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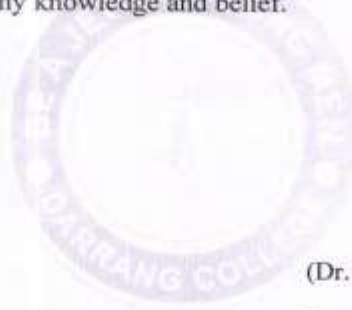
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**DECLARATION**

I hereby declare that the data given and the documents furnished herewith are correct to the best of my knowledge and belief.



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Contents lists available at ScienceDirect

Bioorganic &amp; Medicinal Chemistry

journal homepage: [www.elsevier.com/locate/bmc](http://www.elsevier.com/locate/bmc)

## Efflux pump inhibition by 11H-pyrido[2,1-b]quinazolin-11-one analogues in *Mycobacterium tuberculosis*



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### ARTICLE INFO

#### Keywords:

*Mycobacterium tuberculosis*  
Fluoroquinolone resistance  
Efflux pump  
Quinazolinone  
Efflux pump inhibitor

### ABSTRACT

*Mycobacterium tuberculosis* infection causes 1.8 million deaths worldwide, of which half a million has been diagnosed with resistant tuberculosis (TB). Emergence of multi drug resistant and extensive drug resistant strains has made all the existing anti-TB therapy futile. The major involvement of efflux pump in drug resistance has made it a direct approach for therapeutic exploration against resistant *M. tuberculosis*. This study demarcates the role of 11H-pyrido[2,1-b]quinazolin-11-one (quinazolinone) analogues as efflux pump inhibitor in *Mycobacterium smegmatis*. Sixteen quinazolinone analogues were synthesized by treating 2-aminopyridine and 2-fluorobenzonitrile with K<sup>+</sup>O<sup>-</sup> Bu. Analogues were tested, and **3a**, **3b**, **3c**, **3g**, **3j**, **3l**, **3m**, and **3p** were found to modulate EtBr MIC by > 4 whereas **3a**, **3g**, **3i** and **3o** showed > 4 modulation on norfloxacin MIC. **3i** and **3o** in addition to their very low toxicity they showed high EtBr and norfloxacin accumulation respectively. Time kill curve showed effective log reduction in colony forming unit in presence of these analogues, thus confirming their role as efflux pump inhibitor. Through docking and alignment studies, we have also shown that the LtrA amino acid residues that are interacting with are present in Rv2333c and Rv2846c of *M. tuberculosis*. This study have shown for the first time the possibility of developing the 11H-pyrido[2,1-b]quinazolin-11-one analogues as efflux pump inhibitors for *M. smegmatis* and hence unbolts the scope to advance this study against resistant *M. tuberculosis* as well.

### 1. Introduction

*Mycobacterium tuberculosis* is an etiological agent of tuberculosis (TB), which is responsible for 1.8 million deaths per annum worldwide.<sup>1</sup> The WHO global report showed 460,000 patients suffering from multi-drug resistant TB (MDR-TB) of which 16% died, 8000 patients were reported to have extensive-drug resistant TB (XDR-TB) and 6.2% of people suffering from MDR-TB have XDR-TB.<sup>1</sup> WHO have placed countries like Brazil, India, China, Bangladesh, Indonesia in the top 30 high TB burden countries.<sup>2</sup> *M. tuberculosis* resistant to the first line TB-drugs are responsible for MDR-TB. When the MDR organism become resistant to any fluoroquinolones, and one of the three aminoglycoside antibiotics, it is responsible for XDR-TB.<sup>3</sup> Unlike most of the resistant microorganism *M. tuberculosis* show spontaneous mutation to survive

antibiotic stress instead of horizontal transfer of resistance genes.<sup>4</sup> Although in most of the clinical cases, mutation fails to explain the drug resistance phenomenon.<sup>5</sup> In such cases the prevailing explanation is the over-expression of efflux pump.<sup>6,7</sup> Hence, understanding of efflux pump mechanism and exploration of efflux pump inhibitors (EPIs) are the most direct approach for eradicating the rapidly growing resistance problem. Strategies such as impeding drug binding to the cytoplasmic efflux pumps, constraining the interaction of various components of a multicomponent system, targeting the energy source of efflux pumps and aiming the regulatory component of efflux pump expressions can be opted for counteracting over expression of efflux pump in antibiotic stress.<sup>8</sup> *M. tuberculosis* being highly pathogenic and slow grower consumes more time and requires BSL-3 facility to work; as a result, *Mycobacterium smegmatis* is often used as a research model to explore

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<https://doi.org/10.1016/j.bmc.2018.08.034>

Received 12 July 2018; Received in revised form 9 August 2018; Accepted 27 August 2018

Available online 29 August 2018

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Cite this: *Org. Biomol. Chem.*, 2018, **16**, 3138Received 14th March 2018,  
Accepted 31st March 2018  
DOI: 10.1039/c8ob00631h  
rsc.li/obc

## 2,3-Diaroyl benzofurans from arynes: sequential synthesis of 2-aryl benzofurans followed by benzylation†

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A cascade synthetic strategy for the direct synthesis of 2-aryl benzofurans from aryne precursors has been developed. This reaction proceeds via C–O and C–C bond cleavage as well as C–O and C–C bond formation in a single reaction vessel. The methodology provides good yields of 2-aryl benzofurans and tolerates a variety of functional groups. The synthesized 2-aryl benzofurans were further benzyolated at 3-positions and one of the synthesized 2,3-diaroyl benzofuran structures was confirmed unambiguously by X-ray crystallography.

### Introduction

The benzofuran heterocyclic core is a ubiquitous structural motif found in many natural products and pharmaceuticals.<sup>1</sup> In natural products, it is the “parent” of many related compounds with more complex structures.<sup>2</sup> Psoralen is one of such derivatives which occurs in several plants. A number of benzofuran derivatives exhibit a wide range of activities including antitumour,<sup>3a</sup> antiviral,<sup>3b</sup> antifungal,<sup>3c</sup> anti-inflammatory,<sup>3d,e</sup> antineoplastic,<sup>3f</sup> and antioxidative<sup>3g</sup> properties. They are also used as modulators of androgen biosynthesis (furano steroids),<sup>4a</sup> as antagonists of angiotensin II receptors,<sup>4b</sup> as blood coagulation factor Xa inhibitors,<sup>4c</sup> and as ligands for the adenosine A<sub>1</sub> receptor.<sup>4d</sup> As a consequence, several synthetic methods have been developed and recently there has been growing interest for the synthesis of benzofuran derivatives.<sup>5</sup> Major synthetic strategies include the cyclization of  $\alpha$ -(phenoxy)alkyl ketones, cyclofragmentation of oxiranes, acidic dehydration of *o*-hydroxybenzyl ketones, and base-mediated decarboxylation of *o*-acylphenoxyacetic acids and esters.<sup>6</sup> To improve these traditional multistep reactions, Pd- and Cu-catalyzed cascade processes have been developed.<sup>7</sup> Although these transition metal catalyzed transformations are

efficient and general, harsh reaction conditions, expensive catalyst systems and functional group tolerance are the unavoidable issues associated with them. Therefore, the development of transition-metal-free cascade type synthetic strategies for the synthesis of benzofuran derivatives is important and desirable.<sup>8</sup>

On the other hand, arynes have been continuously used for the development of several useful synthetic methodologies<sup>9</sup> and demonstrated to be versatile intermediates for the synthesis of important compounds and natural products.<sup>10</sup> Although there are several methods for the generation of arynes,<sup>11</sup> *o*-silyl aryl triflates have been extensively used as they are readily available and can be easily converted to the desired arynes. Regarding the synthesis of benzofuran derivatives *via* arynes, Caubere and co-workers have reported a synthetic route to this structural unit by the reactions of dihalogenobenzenes with cyclic ketones, but the use of strong bases (NaNH<sub>2</sub> combined with *t*-BuONa) together with low yields of the product demerits this method.<sup>12</sup> Li and co-workers have also reported a general synthesis of benzofurans by the cycloaddition of arynes with iodonium ylides.<sup>13</sup> The requisite iodonium ylides are unstable and other expensive hypervalent iodine reagents are required for their synthesis. Few years back, Miyabe and co-workers developed few methods for the synthesis of benzofurans using aryne intermediates.<sup>14</sup> In one of their methods, dihydrobenzofurans were synthesized *via* the insertion of arynes into formamide followed by trapping with the zinc enolates of  $\alpha$ -chlorinated methines. Finally, benzofurans were synthesized from dihydrobenzofurans *via* the addition of an ethyl anion. In this synthetic protocol, diethylzinc is predominantly used for the synthesis of zinc enolates of  $\alpha$ -chlorinated methines as well as an ethyl anion, which is expensive and moisture sensitive. Recently, Chandrasekhar

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† Electronic supplementary information (ESI) available: Copies of the <sup>1</sup>H, <sup>13</sup>C NMR and HRMS spectra of all products. CCDC 1823989. For ESI and crystallographic data in CIF or other electronic format see DOI: 10.1039/c8ob00631h



## Investigation of PEG-6000 bridged -N-SO<sub>3</sub>H functionalized geminal dicationic ionic liquids for catalytic conversion of fructose to 5-hydroxymethylfurfural

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MS received 28 April 2018; revised 12 August 2018; accepted 4 October 2018; published online 30 November 2018

**Abstract.** Eight new members of two series of PEG-6000-bridged geminal dicationic ionic liquids based on diphenylammonium/imidazolium cation were synthesized by the change of four anions CF<sub>3</sub>COO<sup>-</sup>, CCl<sub>3</sub>COO<sup>-</sup>, AcO<sup>-</sup> and HSO<sub>4</sub><sup>-</sup>. They were investigated as reusable acidic catalysts for dehydration of fructose to 5-hydroxymethylfurfural in polar aprotic solvent. The characterizations of dicationic ionic liquids were done using <sup>1</sup>H NMR, <sup>13</sup>C NMR, IR and TGA analyses. Irrespective of Hammett acidity strength of the eight ILs, they displayed single peak selectivity for the 5-hydroxymethyl furfural intermediate in HPLC analysis.

**Keywords.** PEG-6000 linker; dicationic ionic liquid; dehydration of fructose; reusable catalyst.

### 1. Introduction

The chemistry of multi-charged ionic liquids has been recognized as a growing field for the generation of structurally diverse organic salts, either by change of charged heads or spacers separating them, with unique physicochemical properties, especially the wide temperature window to exist in liquid state (e.g., -4 °C to 400 °C) and greater thermal stability over monocationic ionic salts.<sup>1-5</sup> Imidazolium and ammonium-based geminal dicationic ionic liquids (DILs) with different bridging groups have been utilized as high-temperature reaction media<sup>1,6</sup> and lubricants,<sup>7</sup> ultrastable separation phases,<sup>8,9</sup> extraction processes<sup>10</sup> and mass spectrometry.<sup>11-13</sup> Polyethylene glycol can be considered as an identical linker for the preparation of geminal DILs with a variety of lengths, polymer architectures and charged groups. The polyethylene glycol (PEG) based materials possess several distinctive properties including temperature dependent phase behavior in solution, environment-friendliness, water miscibility, non-volatility and thermal stability. The various molecular weight PEG backbones are appropriate for immobilization of catalyst and reagents applicable in organic

synthesis.<sup>14,15</sup> The combination of polyethylene glycol spacers and functionalized ionic liquids incorporates various attractive physical properties of the linkers and ionic liquids to the modified supported material.<sup>16-18</sup> The transfer of unique 'critical solution temperature' (CST) of PEG to PEG-functionalized DILs was observed as temperature-dependent biphasic material in an organic solvent and thus further studied as tunable phase separable catalysts in organic reactions.<sup>19-24</sup> As the solvent, they dissolve carbohydrates and polymers,<sup>25</sup> stabilize and activate protein or enzyme,<sup>26</sup> separate inorganic salts from aqueous solutions,<sup>27</sup> function as reductant and stabilizer for nanoparticle synthesis.<sup>28</sup> The attachment of one or more acidic sites to the charged heads may facilitate Brønsted acidic properties to them. The literature search finds some examples of the Brønsted acidic PEG-based DILs with an acidic proton in the anion and also from N-alkylsulfonic group or N-sulfonic group in the cation.<sup>29-31</sup> Eshghi *et al.*,<sup>29</sup> reported only the direct N-sulfonic group containing benzimidazolium DIL as a reusable acidic catalyst for one-pot synthesis of  $\alpha$ -amino phosphonates derivatives in solvent-free condition. Herein, we determined the structure of eight new members of -N-SO<sub>3</sub>H functionalized PEG-6000 linked

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Electronic supplementary material: The online version of this article (<https://doi.org/10.1007/s12039-018-1570-9>) contains supplementary material, which is available to authorized users.

## Catalysis

# Synthesis of Triethylamine-Bridged Basic Tricationic Ionic Liquids and Evaluation of Their Catalytic Efficiencies for Preparation of Arylidene or Alkylidenemalononitrile

Pinky Gogoi,<sup>[b]</sup> Kabita Boruah,<sup>[b]</sup> and Ruli Borah<sup>\*(a)</sup>

Two series of basic triethylamine bridged pyridinium/imidazolium tricationic ionic liquids were synthesized as viscous liquids by ion-pairing with hydroxide, acetate and imidazolide as basic anions. The characterization of tricationic ionic liquids was done using <sup>1</sup>H and <sup>13</sup>CNMR, FT-IR, Thermogravimetric analysis (TGA), Hammett basicity EI-MS and elemental analysis techniques. Thermal stabilities were found within the range of 100–

150 °C for these ionic liquids. They acted as efficient recyclable homogeneous catalysts for the representative Knoevenagel condensation of benzaldehyde and malononitrile at room temperature stirring in neat condition for 10–20 min. The catalytic activity of these ILs was found to be slightly different from each other for the model reaction and did not follow the same sequence of their measured Hammett basicity value.

## 1. Introduction

Functionalized ionic liquids (ILs) especially dicationic and tricationic ionic liquids (TILs) based on ammonium,<sup>[1–3]</sup> imidazolium,<sup>[4]</sup> pyridinium<sup>[5]</sup> and pyrrolidinium<sup>[6]</sup> cations have been synthesized with diverse range of physicochemical properties than most traditional singly charged ILs.<sup>[7]</sup> These tunable physicochemical properties of multicharged ILs facilitate their potential uses as solvent-catalyst systems in organic synthesis,<sup>[8]</sup> electrochemistry,<sup>[9]</sup> high temperature lubricants,<sup>[10]</sup> selective gas chromatographic stationary phases,<sup>[11]</sup> ionic liquid crystals,<sup>[12]</sup> host-guest complexes,<sup>[13]</sup> and gel phases.<sup>[14]</sup>

More numbers of structural variations of ion-pairs are possible with the dicationic or tricationic ILs with varied physicochemical properties. The central structures of TILs have a direct effect on the melting points of ILs. For example, in presence of flexible core units, the TILs display lower melting points as compared to the TILs of rigid core structures.<sup>[15,16]</sup> Such TILs are highly polar at room temperature because of close contact of the three charges of flexible primary structures.<sup>[2]</sup> Moreover, simple basic anions tethered ILs may get several unique behavior of Brønsted basic ILs depending on the nature of ion-pairs like noncorrosive, nonvolatile, robust basic sites, immiscible with selected organic solvents, variable water and air sensitivity, reusable as homogeneous basic catalyst or reaction medium etc. The presence of such inherently safer components of the basic ILs make them as prospective alternative of toxic, corrosive and water miscible

stoichiometric inorganic/organic basic reagents.<sup>[17,18,19]</sup> Various types of base induced condensation reactions like Aldol, Knoevenagel, Claisen-Schmidt reactions have been studied in basic ILs either as reaction medium or as catalyst depending on the strength of Brønsted basic or Lewis basic sites.<sup>[20–22]</sup> The classical Knoevenagel condensation is a well known C–C bond formation reaction for preparation of arylidene or alkylidene intermediates through variation of nucleophilic reagents and aliphatic/aromatic carbonyl compounds.<sup>[23,24]</sup> These intermediates have lots of applications in organic synthesis, biological science, natural product chemistry, polymer chemistry, fine chemicals, medicine, agriculture and light emitting materials.<sup>[6,11,12,25]</sup> This condensation is also catalyzed by Lewis acids,<sup>[26,27]</sup> zeolite,<sup>[28]</sup> neutral silica<sup>[29]</sup> or polymer-supported heterogeneous catalysts.<sup>[30]</sup> Some of the Lewis acid catalyzed reactions utilized 100 °C or 120 °C to get excellent yields of the products with shorter to longer reaction period. The common organic bases such as piperidine, pyridine, amines or their salts were acted as catalyst or reagent in organic solvents for the Knoevenagel condensation at different temperatures.<sup>[31,32]</sup>

A number of mono cationic basic ILs were studied for the Knoevenagel condensation in solution or solvent-free condition at different temperatures to get lower to higher yields of products. They possess variety of organic cations which include tetramethyl guanidine,<sup>[33]</sup> cyclic guanidine,<sup>[34]</sup> alkanolamine,<sup>[35,36]</sup> methoxyl propylamine,<sup>[37]</sup> DABCO,<sup>[38]</sup> DBU,<sup>[39]</sup> N, N, N', N'-tetramethyl-N'-hexyl-ethylenediamine (TMHEDA),<sup>[40]</sup> pyrrolidine,<sup>[41]</sup> piperidine,<sup>[42]</sup> N,N-dimethyl ethanolanminium (DMEA),<sup>[43]</sup> tetrabutylphosphonium,<sup>[44]</sup> hexamethylenetetramine<sup>[45]</sup> and 1-methyl-3-butyl-imidazole<sup>[46]</sup> etc. The reaction parameters of Knoevenagel condensation can be improved under mild conditions using di- or tricationic Brønsted basic ILs as dual specific solvent/catalyst system for rapid abstraction of acidic proton for nucleophilic attack on the carbonyl group.<sup>[39]</sup> Wang *et al.*<sup>[47]</sup> prepared hydrophobic mesoporous poly(ionic liquid)s as heterogeneous basic catalyst via radical copolymerization of

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Supporting information for this article is available on the WWW under  
<https://doi.org/10.1002/slct.201801719>



Cite this: DOI: 10.1039/c7nj03135a

## 1,3-Disulfoimidazolium chloronickellate immobilized HZSM-5 framework as visible-light-induced heterogeneous photocatalyst for advanced oxidation process†

Susmita Saikia,  Pinky Gogoi  and Ruli Borah \*

Ionic solid 1,3-disulfoimidazolium chloronickellate [Dsim]<sub>2</sub>[NiCl<sub>4</sub>] with low band gap value can be modified as a heterogeneous photocatalyst after immobilization on siliceous zeolite **HZSM-5**. In this study, different percentages of [Dsim]<sub>2</sub>[NiCl<sub>4</sub>]/**HZSM-5** supported ionic systems were prepared as acidic solid materials via wet impregnation. The structural changes of the parent **HZSM-5** framework within the heterogenized materials were studied using IR, UV, SEM-EDX, PXRD, Raman, BET, TGA, Hammett acidity, HRTEM and ICP-OES techniques. Assessment of their thermal and water tolerance and intensity of photoluminescence spectra investigate the hybrid samples as possible heterogeneous photocatalysts for oxidative degradation of model dye compound methylene blue (MB) involving H<sub>2</sub>O<sub>2</sub> and sunlight at ambient temperature in aqueous solution. This study may contribute to a new perception for the exploration of halometallate ionic salt systems as potential visible light driven photocatalysts in organic transformation.

Received 22nd August 2017,  
Accepted 23rd January 2018

DOI: 10.1039/c7nj03135a

rsc.li/njc

### Introduction

Halometallate ionic liquids are reviewed as potential functional materials with diverse physicochemical properties that depend on their complex metal anionic speciation and amount of metal present in them in combination with organic cations.<sup>1</sup> Such halometallates are explored as prospective materials in catalysis,<sup>2</sup> electrochemistry,<sup>3</sup> ionothermal synthesis of inorganic semiconductors,<sup>4</sup> gas scrubbing systems,<sup>5</sup> controlled separations/extraction processes,<sup>6</sup> conversion of biomass to energy products<sup>7</sup> and soft composite materials.<sup>8</sup> They show low vapor pressures and high boiling points owing to their strong secondary ionic interactions. It is observed that the use of ionic liquids as a solvent or template has only been studied for the synthesis of TiO<sub>2</sub>-based photocatalysts with high activity and stability in various processes.<sup>9</sup> The semiconductor properties of halometallate ionic salts were first reported by Saikia *et al.* for Brønsted–Lewis acidic 1,3-disulfoimidazolium chlorometallates of Fe(III), Zn(II) and Ni(II) with different band gap values 2.41, 2.55 and 2.30 eV respectively.<sup>10</sup> There has been no mention of semiconductor ionic liquids in recent reviews on acidic and halometallate ionic liquids.<sup>1,11</sup> The lower band gap material 1,3-disulfoimidazolium chlorometallate can be expected

to promote delocalization of imidazolium  $\pi$ -electrons onto empty d-orbitals of the bridging halogens present in tetrahedral chlorometallate anion frame.<sup>12</sup>

The semiconductor properties of 1,3-disulfoimidazolium chlorometallates may introduce them as heterogeneous photocatalysts for the degradation of dyes with UV or visible light initiated advanced oxidation processes (AOPs).<sup>13,14</sup> But these –SO<sub>3</sub>H functionalized chlorometallates are slightly hygroscopic solid materials possessing a lower surface area,<sup>10,15</sup> which limit their use as recyclable heterogeneous photocatalysts for wet hydrogen peroxide catalytic oxidation (WHPCO) of dyes.<sup>14</sup> The immobilization of semiconductor ionic salts on **HZSM-5** zeolite may eliminate the hygroscopic nature of loaded ionic salt materials by distribution of both Brønsted–Lewis acidic sites over a large surface area support with improved thermal stability. This method will produce heterogeneous photocatalyst on a zeolite framework for degradation of organic pollutants involving UV/visible light and H<sub>2</sub>O<sub>2</sub>.<sup>14</sup> The prepared IL/**HZSM-5** catalyst can facilitate simple handling and recycling of catalysts without leaching products as a waste stream to the environment.<sup>16</sup>

Zeolites are crystalline aluminosilicates with well-defined interconnected channels or cavities of nanometer or sub nanometer lengths, termed as micropores (0.5–2 nm).<sup>17</sup> They are characterized by a uniform pore size, polar environment, high surface area, internal active sites and excellent adsorption capability.<sup>18</sup> The structure of zeolite can be modified as selective and efficient photocatalysts either by photoactivation of

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† Electronic supplementary information (ESI) available: Fig. S1–S7 and Tables S1–S5. See DOI: 10.1039/c7nj03135a



## Structural Topology of Weak Non-covalent Interactions in a Layered Supramolecular Coordination Solid of Zinc Involving 3-Aminopyridine and Benzoate: Experimental and Theoretical Studies

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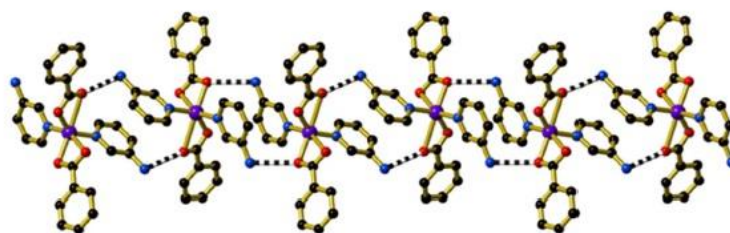
Received: 27 December 2017 / Accepted: 31 July 2018  
© Springer Science+Business Media, LLC, part of Springer Nature 2018

### Abstract

A new Zn(II) coordination solid based on benzoate (Bz) and 3-aminopyridine (3-Apy) viz.,  $[\text{Zn}(3\text{-Apy})_2(\text{Bz})_2]$  (**1**) has been synthesized and its crystal structure has been determined by single crystal X-ray diffraction analysis. The compound is characterized by IR, UV-Vis-NIR, thermal and elemental analysis. X-ray powder diffraction technology has been performed for the complex to investigate whether the analyzed crystal structure is truly representative of the bulk materials. The new compound crystallizes in the triclinic,  $P\bar{1}$  space group with unit cell dimensions:  $a = 10.0848(11)$  Å,  $b = 11.0351(11)$  Å,  $c = 11.4213(13)$  Å.  $V = 1139.1(2)$  and  $Z = 2$ . Intermolecular N–H $\cdots$ O and  $\pi$ – $\pi$  contacts between Zn(II) monomeric units in the crystal structure results in a supramolecular polymeric chain. Further, the extended 1D chain is self assembled via weak intermolecular C–H $\cdots$ O hydrogen bonding interaction to result layered network structure. The interactions have been characterized by analyzing the topology of electron density within the realm of quantum theory of atoms in molecules and non-covalent interaction index calculations.

### Graphical Abstract

A new Zn(II) coordination solid based on 3-aminopyridine and benzoic acid,  $[\text{Zn}(3\text{-Apy})_2(\text{Bz})_2]$  (**1**) has been successfully synthesized. Intermolecular N–H $\cdots$ O and  $\pi$ – $\pi$  contacts between Zn(II) monomeric units in the crystal structure results in a supramolecular polymeric chain. The extended 1D chain is self assembled via intermolecular C–H $\cdots$ O hydrogen bonding interaction to result layered network structure.



**Keywords** Synthesis · X-ray analysis · Crystal structure · Non-covalent interactions · NCI analysis

**Electronic supplementary material** The online version of this article (<https://doi.org/10.1007/s10870-018-0723-5>) contains supplementary material, which is available to authorized users.

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### Introduction

The design and construction of metal–organic supramolecular coordination solids have been widely studied and attracted extensive interest because of their many practical applications such as ion exchange, catalysis, adsorption,





## Supramolecular association involving anion– $\pi$ interactions in Cu(II) coordination solids: Experimental and theoretical studies

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### ARTICLE INFO

Article history:  
Received 22 February 2018  
Accepted 8 May 2018  
Available online 25 May 2018

Keywords:  
Synthesis  
Crystal structure  
Coordination solid  
Hydrogen bonding  
Anion– $\pi$  interaction

### ABSTRACT

Two new coordination solids,  $[\text{Cu}_2(\mu\text{-tp})(\text{phen})_4](\text{NO}_3)_2 \cdot 2\text{H}_2\text{O}$  (**1**) and  $[\text{Cu}(\text{pa})_2(\text{NO}_3)(\text{H}_2\text{O})]\text{NO}_3 \cdot \text{H}_2\text{O}$  (**2**) (*phen* = 1,10-phenanthroline, *tp* = terephthalate, *pa* = picolinamide), were synthesized from purely aqueous media and characterized using elemental analysis, spectroscopic methods (IR, UV–Vis–NIR and ESR) and the single crystal X-ray diffraction technique. In the crystal structures of **1** and **2**, supramolecular networks have been built up involving associations with O–H...O, C–H...O and  $\pi$ – $\pi$  stacking interactions. In addition, both compounds show anion– $\pi$  interactions involving non-coordinated nitrate ions and the aromatic rings of the complexes. The nitrate anions and non-coordinated water molecules in both compounds, with the graph set representation  $R_2^2(8)$ , act as cross-links between symmetry related cationic chains via hydrogen bonding interactions to form 2D layered supramolecular architectures. Theoretical investigations have been carried out on all the supramolecular contacts, including anion– $\pi$  interactions, taking into account the particular position of the anion toward the aromatic ring observed in the crystal structures. Calculations reveal that in addition to the electrostatics, induction and dispersion components are also significant towards the stabilization of the supramolecular interactions. The phase purity and thermal stability of the compounds were verified by powder X-ray diffraction (PXRD) and thermogravimetric (TG) analyses, respectively. The microbial activities have been investigated for compound **1**.

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### 1. Introduction

Supramolecular chemistry elicits considerable attention from chemists due to its function in the design and synthesis of crystalline materials with interesting structures and wide practical utilities in molecular adsorption, catalysis, gas storage, photoluminescence, non-linear optics, multifunctional materials and magnetism [1,2]. In the construction of coordination supramolecular architectures, selection of the appropriate metal ions and organic ligands for the synthesis of coordination solids depends on various factors like pH, solvent, temperature etc. [3–5]. The flexibility of the Cu(II) ion, due to its transition elemental nature, enhances its coordination preferences with aromatic and aliphatic ligands [6]. The crystal structures of copper complexes of mixed N- and O-donor ligands are reported in the literature [7,8]. Depending on the ligand binding sites, some Cu(II) complexes possess a wide

range of biological activity, such as antibacterial, fungicidal, pesticidal and even as tracers [9,10].

The enormous progress achieved in this field of chemistry is evidenced by performing theoretical studies on solid-state structures involving supramolecular interactions [11,12]. Non-covalent interactions form the backbone of supramolecular structures, which include hydrogen bonding, stacking, electrostatic and charge-transfer interactions, as well as metal ion coordination [13]. These interactions have been receiving more attention in recent years with a quest for further experimental and theoretical studies to investigate various processes. Two closely related potential supramolecular interactions involving anionic systems and electron-deficient aromatics, viz. anion– $\pi$  [14] and lone pair (lp)– $\pi$  [15] interactions, also contribute towards the stability of such structures. It has been accepted that electrostatic forces are the main energetic contributions to such weak interactions in supramolecular structures involving electron deficient aromatic molecules, while dispersion forces also play a role in these interactions [16].

In order to realize such systems, we succeeded in synthesizing two new Cu(II) complexes of mixed N- and O-donor ligands, viz.

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## Magneto-optical imaging of stepwise magnetic domain disintegration at characteristic temperatures in $\text{EuB}_6$

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 (Received 1 March 2018; revised manuscript received 16 May 2018; published 27 November 2018)

Prior to the onset of the ferromagnetic transition in semimetallic  $\text{EuB}_6$ , unusual magnetic and electric behavior have been reported. Using a highly sensitive magneto-optical imaging (MOI) technique, we visualize the behavior of magnetic domains in a  $\text{EuB}_6$  single crystal. The transformation from a paramagnetic to a ferromagnetic state is shown to be non-Curie-Weiss-like and proceeds via multiple breaks in the curvature of the temperature-dependent local magnetization. From our experiments, we identify three characteristic boundaries,  $T^*(H)$ ,  $T_{c1}^*(H)$ , and  $T_{c2}(H)$ , in a field-temperature magnetic phase diagram. Using scaling and a modified Arrott's plot analysis of isothermal bulk magnetization data, we determine the critical exponents  $\beta = 0.22 \pm 0.01$ ,  $\gamma = 0.88 \pm 0.05$  and  $\delta = 5.0 \pm 0.1$  and a critical transition temperature =  $12.0 \pm 0.2$  K, which is found to be equal to  $T_{c2}$ . The critical exponents are close to those associated with the universality class of tricritical mean field model. The absence of a model with which the exponents correspond with directly, suggests the presence of large critical fluctuations in this system. The critical fluctuations in this system are sensitive to the applied magnetic field, which leads to field dependence of boundaries in the magnetic phase diagram. Deep inside the ferromagnetic state at  $T$  below  $T_{c2}$ , we observe the presence of large magnetized domains along with the observation of Barkhausen-like jumps in local magnetization. With increasing  $T$  the magnetic domains disintegrate into finger-like patterns before fragmenting into disjoint magnetized puddles at  $T_{c1}^*$  and ultimately disappearing at  $T^*$ . At  $T_{c1}^*$  we observe a significant increase in the spatial inhomogeneity of the local magnetic field distribution associated with the magnetic domain structure disintegrating into smaller magnetized structures. We explain our results via the formation of magnetic polaronic clusters and their coalescing into larger domains.

DOI: 10.1103/PhysRevMaterials.2.113404

### I. INTRODUCTION

In systems with strong electron correlations, there are transformations from a disordered to an ordered spin configuration. The correlations impact not only their magnetic but also electrical properties significantly. A case in point are rare-earth hexaborides ( $\text{RB}_6$ ,  $R = \text{Ca, Sr, Ba, La, Ce, Sm, Eu, and Gd}$ ). These are correlated electron systems which display diverse magnetic and electrical properties [1,2]. This class of materials exhibits strong electron-electron correlations due to narrow, incompletely filled  $d$  or  $f$  bands. The properties of these materials are quite diverse, ranging from superconductivity found in  $\text{YB}_6$  [3] to complex antiferromagnetic phases with Kondo like features in  $\text{CeB}_6$  [4,5] and low carrier density ferromagnetism in semimetallic  $\text{EuB}_6$  [6], as well as an exotic Kondo-like topological insulating state reported

in  $\text{SmB}_6$  [7–9]. Among these materials, in  $\text{EuB}_6$  a complex exchange interaction exists between the itinerant  $d$  electrons and localized  $f$ -electron moments of  $\text{Eu}^{2+}$ , producing a charge localized state with significant local magnetization, viz., magnetic polarons. The formation and size of a magnetic polaron is governed by a balance between kinetic energy of the itinerant  $d$  electrons and exchange interaction between the itinerant electrons and the localized  $f$ -electron moments of  $\text{Eu}$  [10]. Traditionally the concept of magnetic polarons was introduced to study metal-insulator transition in  $\text{EuO}$  [11].  $\text{EuB}_6$  exhibits a transformation from a paramagnet at higher temperatures to a ferromagnetic semimetal at lower temperatures [6]. Electrical transport, specific heat, and optical measurements in  $\text{EuB}_6$  have shown anomalies near  $T_{c1} \sim 16$  K and  $T_{c2} \sim 12$  K [12–17], whereas below  $T_{c2}$  the system is ferromagnetically ordered. At these temperatures, one finds large magnetoresistance, enhanced electronic noise, nonlinear electrical transport properties [18], development of peaks in the Raman spectra [19], and a pronounced lattice distortion

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## Vortex depinning as a nonequilibrium phase transition phenomenon: Scaling of current-voltage curves near the low and the high critical-current states in 2H-NbS<sub>2</sub> single crystals

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 (Received 15 November 2017; revised manuscript received 12 February 2018; published 12 April 2018)

The vortex depinning phenomenon in single crystals of 2H-NbS<sub>2</sub> superconductors is used as a prototype for investigating properties of the nonequilibrium (NEQ) depinning phase transition. The 2H-NbS<sub>2</sub> is a unique system as it exhibits two distinct depinning thresholds, viz., a lower critical current  $I_c^l$  and a higher one  $I_c^h$ . While  $I_c^l$  is related to depinning of a conventional, static (pinned) vortex state, the state with  $I_c^h$  is achieved via a negative differential resistance (NDR) transition where the velocity abruptly drops. Using a generalized finite-temperature scaling ansatz, we study the scaling of current ( $I$ )–voltage ( $V$ ) curves measured across  $I_c^l$  and  $I_c^h$ . Our analysis shows that for  $I > I_c^l$ , the moving vortex state exhibits Arrhenius-like thermally activated flow behavior. This feature persists up to a current value where an inflexion in the  $IV$  curves is encountered. While past measurements have often reported similar inflexion, our analysis shows that the inflexion is a signature of a NEQ phase transformation from a thermally activated moving vortex phase to a free flowing phase. Beyond this inflexion in  $IV$ , a large vortex velocity flow regime is encountered in the 2H-NbS<sub>2</sub> system, wherein the Bardeen-Stephen flux flow limit is crossed. In this regime the NDR transition is encountered, leading to the high  $I_c^h$  state. The  $IV$  curves above  $I_c^h$  we show do not obey the generalized finite-temperature scaling ansatz (as obeyed near  $I_c^l$ ). Instead, they scale according to the Fisher's scaling form [Fisher, *Phys. Rev. B* **31**, 1396 (1985)] where we show thermal fluctuations do not affect the vortex flow, unlike that found for depinning near  $I_c^l$ .

DOI: 10.1103/PhysRevB.97.134510

### I. INTRODUCTION

Equilibrium phase transitions are characterized by breaking of a particular symmetry, for e.g., continuous translational or rotational symmetry, below a critical transition point, like the critical transition temperature [1]. The transition is characterized by an order parameter developing as the control parameter (for example, temperature) is reduced below the critical point (critical transition temperature). Another characteristic of the equilibrium critical phenomenon is scaling of quantities across the critical point [2–4]. Systems driven away from equilibrium exhibit rich features like development of self-organized states, patterns, and unusual dynamics [5–7]. Unlike equilibrium transitions a similar pedagogy isn't well established for studying nonequilibrium (NEQ) phase transitions and therefore is a topic of ongoing research [8,9]. A widely studied NEQ phenomenon is depinning [10] which is seen in diverse systems, like in driven charge density waves (CDWs) [11], Wigner

crystals, magnetic domain-wall motion [12], two-dimensional colloidal systems [13,14] vortices in superconductors [10,15–17], etc. Driven two-dimensional (2D) systems exhibit a variety of out-of-equilibrium phases. Under the influence of periodic shearing forces 2D colloidal systems exhibit irreversible dynamics where the system self-organizes into either fluctuating (with collisions) or quiescent (collisions avoided) phase [18–22]. Further, the driven 2D systems exhibit the plastic depinning phenomenon with channels of mobile particles distributed between regions with localized particles [13,14,23].

We use the vortex depinning phenomenon found in type-II superconductors to study NEQ phase transitions. The vortex state in superconductors is driven from a static to a free flowing phase with a current ( $I$ ) sent across a superconductor due to a Lorentz force ( $\vec{F} = \vec{I} \times \vec{B}$ ) acting on the vortices. However, in realistic superconductors only above a threshold critical current  $I = I_c$ , where the magnitude of  $F$  equals the force with which vortices are pinned, viz., beyond  $F = F_c$ , vortices are depinned. The moving vortices [each possessing magnetic flux quanta ( $\phi_0$ ) =  $2.07 \times 10^{-7}$  G cm<sup>2</sup>] generate a voltage ( $V$ ) drop along the direction of current flow. For an application point of view, it is important to pin these vortices strongly so that superconductors carry current without generating any dissipation due to vortex motion (viz., maintain a  $V = 0$  state in the presence of a current). The vortex velocity ( $u$ ) is proportional to  $V$

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## Research articles

## Magnetostructural properties and electric transport in $Mn_{48+x}Cr_{3-x}Ni_{38}Sn_{11}$ ( $x = 0, 1$ ) ribbons: Mn/Ni ratio versus Cr doping

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## ARTICLE INFO

## Article history:

Received 14 December 2017

Received in revised form 17 January 2018

Accepted 17 January 2018

## Keywords:

Heusler alloys

Cr-doping

Structure property correlation

## ABSTRACT

We report the structural, electrical and magnetic properties of Cr substituted  $Mn_{48+x}Cr_{3-x}Ni_{38}Sn_{11}$  ( $x = 0$  and 1) Heusler ribbons synthesised by melt spinning of the arc-melted bulk alloy. Composition analysis employing EDAX reveals same Ni and Sn concentrations with difference in the Mn/Cr ratio in both the ribbons.  $Mn_{48}Cr_3Ni_{38}Sn_{11}$  ribbons have pure cubic-austenite phase whereas  $Mn_{49}Cr_2Ni_{38}Sn_{11}$  show a mixture of the dominant cubic-austenite with traces of the orthorhombic-martensitic phase as confirmed by X-ray analysis. Ribbons having higher Cr content show (i) pure cubic austenite structure ( $L_2_1$  type) at room temperature (ii) canonical paramagnetic-ferromagnetic transition in the austenite phase and (iii) metallic temperature dependence of resistivity. Small decrease in the Cr content produces dramatic changes in the structure-property profile. Hence ribbons having lower Cr content show (i) a mixture of cubic and orthorhombic phases, (ii) paramagnetic-ferromagnetic transition in the austenite phase above the room temperature which is followed by strongly hysteretic martensitic transition and (iii) metal-like temperature dependence of resistivity followed by typical martensitic resistivity and re-entrant metallic behaviour in the lowest temperature region. AC susceptibility measurements show absence of a spin glass like behaviour in  $Mn_{48}Cr_3Ni_{38}Sn_{11}$ , while the lower Cr variant demonstrates nearly ideal spin glass like characteristics. The high sensitivity of structure-property correlation towards small compositional variations is attributed to the twin effect of Cr substitution at Mn sites and the Mn/Ni ratio.

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## 1. Introduction

Heusler compounds have raised intense research curiosity in recent years due to their rich fundamental physics and extraordinary magnetic properties for potential applications in spintronics, magnetocalorics, shape memory devices and many more [1–7]. These intermetallic compounds when crystallize in the cubic  $L_2_1$  structure represented by the formula  $X_2YZ$  (where X and Y represent transition metals, and Z is a main group element) are called Full Heusler compounds ( $Ni_2MnSn$ ,  $Cu_2MnSi$  etc.), while those with the  $C_1_b$  type crystallographic structure with general formula XYZ ( $NiMnSn$ ,  $TiNiSn$  etc.) are referred as Half Heusler compounds [1–7]. Heusler compounds exhibit simultaneous magnetic transitions coupled with structural transitions from a high symmetry cubic austenite to the lower symmetry martensite phase; the

structure of the martensite is composition dependent and may be orthorhombic or monoclinic [4,5,8]. Both antiferromagnetic (AFM) and ferromagnetic (FM) correlations constitute the martensitic phase that determine its magnetism, whereas the latter kind of magnetic order pervades the austenite [5,8,9]. The strong magneto-structural coupling in the Heusler compounds and their sensitivity to the X/Y ratio gives rise to a plethora of diverse magnetic interactions in the martensite phase which in turn yield exchange bias behaviour, magnetoresistance, magnetic entropy change, etc. [5,9].

Among Heusler compounds, Ni-Mn-Z (Z = Sn, In, and Sb) is of particular interest as the low temperature martensite has a lower magnetization than the high temperature austenite giving rise to an inverse magnetocaloric effect and various other exotic phenomena [8–11]. Sutou et al. [8] extensively investigated the  $Ni_{50}Mn_{50-y}Z_y$  (Z = In, Sn, Sb) and found that in all these compounds (i) paramagnetic (PM)-austenite to ferromagnetic (FM)-austenite phase transition temperature ( $T_C$ ) increases as one substitutes In, Sn and Sb in this order, (ii) cubic-austenite ( $L_2_1$ ) to orthorhombic-martensite phase is observed at further low temperatures, (iii) the magneto-structural transitions are dependent on the

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*A new four-parameter extension of  
Burr-XII distribution: its properties and  
applications*

**Laba Handique & Subrata Chakraborty**

Japanese Journal of Statistics and  
Data Science

ISSN 2520-8756

Jpn J Stat Data Sci  
DOI 10.1007/s42081-018-0016-4



 Springer

## THE ODD MOMENT EXPONENTIAL FAMILY OF DISTRIBUTIONS: ITS PROPERTIES AND APPLICATIONS

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### ABSTRACT

*A new family of continuous distributions called Odd Moment exponential-G family of distributions is proposed. The density and cumulative distribution function are expressed as linear infinite mixtures of exponentiated-G family of the baseline distribution. Some mathematical properties of this new family such as skewness and kurtosis, asymptotes, shapes, moment generating function, distribution of order statistics and power moments are investigated. The model parameter estimation by employing the method of maximum likelihood is discussed. To check the suitability, the proposed model is compared to its submodels and also with useful lifetime models namely the gamma, exponentiated exponential, exponentiated moment exponential and beta exponential distributions by conducting three data fitting experiments with real-life data sets.*

**Keywords:** ME distribution; Power moments; AIC; KS test.

**2000 Mathematics Subject Classification:** 62E15, 60E05.

### 1 Introduction

Statistical distributions are commonly used in describing and predicting real-world phenomena. Numerous extended distributions have been extensively used over the last decades for modelling of data. These days defining new family of distributions has become very popular. So, several classes are developed by adding one or more parameters to bring more flexibility in data modelling. Some well-known generated families are; beta-G (Eugene, Lee and Famoye, 2002), gamma-G (Zografos and Balakrishnan, 2009), kummer beta (Pescim, Cordeiro, Demétrio, Ortega and Nadarajah, 2012), exponentiated generalized class (Cordeiro, Ortega and da Cunha, 2013), Weibull-G (Bourguignon, Silva and Cordeiro, 2014), type I

## PROPERTIES AND DATA MODELLING APPLICATIONS OF THE KUMARASWAMY GENERALIZED MARSHALL-OLKIN-G FAMILY OF DISTRIBUTIONS

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*Abstract:* In this article we propose further extension of the generalized Marshall-Olkin-G (GMO - G ) family of distribution. The density and survival functions are expressed as infinite mixture of the GMO - G distribution. Asymptotes, Rényi entropy, order statistics, probability weighted moments, moment generating function, quantile function, median, random sample generation and parameter estimation are investigated. Selected distributions from the proposed family are compared with those from four sub models of the family as well as with some other recently proposed models by considering real life data fitting applications. In all cases the distributions from the proposed family out on top.

*Key words:* Kw-G family, MO-G family, AIC, KS test, LR test.

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### 1 Introduction

Extension of existing well-known distributions to enhance flexibility in modelling variety of data has attracted attention of researchers recently. Some of the notable new family of distributions proposed of late includes among others the Kumaraswamy Marshall-Olkin-G family by Alizadeh et al. (2015), beta generated Kumaraswamy-G family by Handique et al. (2017a), Marshall-Olkin Kumaraswamy-G family by Handique et al. (2017b), Generalized Marshall-Olkin Kumaraswamy-G family by Chakraborty and Handique (2017), Transmuted Topp-Leone-G family by Haitham et al., 2017, beta generated Kumaraswamy Marshall-Olkin-G family by Handique and Chakraborty (2017a), beta generalized Marshall-Olkin Kumaraswamy-G family by Handique and Chakraborty (2017b), a new generalized family by Tahir et al. (2018) and exponentiated generalized Marshall-Olkin family by Handique et al. (2018) among others.

In this paper we propose another family of continuous probability distributions by integrating the  $GMO - G(\theta, \alpha)$  family of Jayakumar and Mathew (2008) in the  $Kw - G(a, b)$  family of Cordeiro and de Castro (2011) and refer to it as the Kumaraswamy Generalized Marshall-Olkin-G ( $KwGMO - G(a, b, \theta, \alpha)$ ) family. Various mathematical and statistical characteristics along with comparative real data modelling illustration are presented. The probability density function (pdf) of  $KwGMO -$

## **Madrassa and Girls' Education: Reflections from a Muslim Village of Assam**

*Sofica Ahmed\**

*Rabin Deka\*\**

### **Abstract**

*Education is believed to be the best means through which gender discrimination can be eradicated from the society. Historically, Muslims in India have had a lower participation in school education because of social-structural reasons. In their limited choice, a key role is also played by the Madrassa form of education which, in its various forms, includes both secular as well as religious components. The present paper is an attempt to understand the causes behind the differential preference of Muslim parents regarding their children's education. It tries to deal with the issue of why poor working class Muslim parents prefer Madrassa education for their girl child over the secular one. It tries to explore Muslim girl's experiences with education at household and school levels. At the household level, why do they prefer Madrassa kind of education rather than secular? How do different families make gendered choices in terms of educating their child? It is observed that the selection of school depends not just on economy but also on cultural ideas about the good conduct of young men and women. It will also explore a particular madrassa and examine if similar cultural logic functions in Madrassa Schools.*

### **Introduction**

Education is believed to be the best means through which gender discrimination can be eradicated from the society. It is the first step towards establishing equality in a stratified society like India. However, the inherent structural inequalities of Indian society in terms of caste, class, race,



# Morphometric Analysis of Dibru River Basin, Assam using Geo-Spatial Tools

3

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**Abstract:** Quantitative analysis of morphometric parameters helps in understanding the potential of the river basin as it helps in groundwater level management, soil properties and overall management system of the basin. It is necessary to study how fluvial landforms are formed, erosion and depositional works, and soil properties. Present paper deals with the aspects of morphometric parameters like stream order, stream number, basin area, drainage density, drainage frequency, slope with the contour interval of 10 m, basin shape, basin length and long profile etc using Arc GIS 10.1 software. We try to evaluate all the three aspects of the morphometric analysis from the SOT toposheet. Based on all the morphometric analysis progress can make about the understanding of geo-hydrological nature of the natural system and influence on the significance of shaping the basin, their runoff characteristics, infiltration, permeability, erosional power of the river etc.

**Keywords:** morphometry, GIS

## 1. Introduction

Morphometry is define as the measurement and mathematical analysis of the configuration of the earth's surface, shape and dimension of its landforms [1]. Morphometric analysis is important in order to study the nature and behaviour of the drainage basin of the natural system. Hydrologic and geomorphic processes are responsible for the formation and development of morphometric parameters in a drainage basin. Basin is not only control by hydrologic but there is various aspects like climate, geologic, structural control of the lithological and vegetation etc. Various parameters of morphometric analysis are used in order to study the characteristics of the river by following the formula of some illustrious people [9]; [26]; [20]; [12]; [4]; [2]. The study of Quantitative parameters like Linear, Relief and Areal aspects are study with the use of software like Arc GIS 10.1 and try to find its relationship with one another in order to study the nature of drainage system. The relationship between the stream order and number of streams along with stream length just depend on the hydrologic, geologic, slope and vegetation cover. Nowadays GIS plays an important role in analysing the morphometric parameters and also helps in manipulation of spatial information. The techniques of GIS not only help in manipulation of spatial information but also help in

identification of groundwater level potential, soil properties and overall management of the basin.

## 2. Objectives

The main objectives of this paper is-

- 1) To study the three aspects of morphometric parameters.
- 2) To analysis how these parameters helps in shaping a natural system.

## 3. Geographical background of the study area

The Dibru River is a left bank tributary of Brahmaputra River. The basin drain into the plain region of Assam experience the great sub Himalayan terrain and bounded by river Brahmaputra and Lohit in north, Noa Dihing River in the eastern and some tributaries of the Burhi Dihing River in the south and western borders of the basin. Geographically it latitude and longitudinal extension is 27° 25' 30" N - 27° 46' 30" N and 95° 6' 0" E - 95° 58' 30" E covering about 1779 sq km area of Tinsukia, Dibrugarh, Dhemaji district of Assam and part of Arunachal Pradesh with ever-green and semi-deciduous forests and the climatic condition is high humidity and moderate temperature. The slope of the basin varies from gently slope to base level slope (0°-5°).

Volume 8 Issue 8, August 2019

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Paper ID: ART2020273

10.21275/ART2020273

International Journal of Science and Research (IJSR)

ISSN: 2319-7064

ResearchGate Impact Factor (2018): 0.28 | SJIF (2018): 7.426



LOCATION MAP OF DIBRU RIVER BASIN, NORTH-EAST INDIA

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## Global Economic Integration of India's Economy: Trends, Channels and Facilitating Factors

Dilip Saikia<sup>1</sup>  
Nivedita Goswami<sup>2</sup>

### Abstract

It has been a quarter century since India had embarked on the phase of globalisation through a series of macroeconomic reforms started in 1991. In this paper we have analysed the extent and trends of India's economic integration and discussed the channels through which the process of economic integration has been spread and the factors that have facilitated the integration process in the country. The results show that the pace of economic integration in India has accelerated only in the post-2001 period and international trade in goods and services has played a significant role in the integration process. The paper also unveils that India still continues to maintain significant restrictions in international trade and capital flows, which limits its economic integration with the world.

**Keywords:** Economic Reforms, Trade, Capital Flows, Migration and Remittances, Globalisation Index

### Introduction

Globalisation, the process of integration of economies with the world, has become a buzzword nowadays. The process of globalisation is so intense that now almost all countries in the world have been in the phase of globalisation. Today, nations are more integrated and more dependent on the global economy than ever before. Although the process of globalisation started long ago, at least since the industrial revolution, the momentum has unprecedentedly geared up during the last quarter of the twentieth century (Nayyar, 2006), especially since the early 1990s as almost all the developing countries have opened up their economies by that time (McMillan & Rodrik, 2011).

India had embarked on the phase of globalisation through a series of liberalisation policies as a part of its big-bang economic reforms started in 1991. It has been 25 years since India had opened up its economy for the world economy. How globalised is the Indian economy today? How does India compare with her comparators in terms of globalisation? What are the channels of India's integration with the rest of the world? What are the factors that have facilitated India's economic integration? This paper aims to address these questions relating to integration of Indian economy by analysing the trends of economic integration of Indian economy, the channels through which the process of economic integration has been disseminated, and the factors that have facilitated the integration process.

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## Employment in Urban Informal Non-Farm Enterprises in Assam

Dilip Saikia\*, Dr. Debajit Saikia\*\* & Dr. Rupjyoti Borah\*\*\*

The results of the National Sample Survey (NSS) 73rd quinquennial round on unincorporated non-agricultural enterprises show that there has been significant increase in employment in the informal non-farm enterprises (INFEs) in the urban areas in Assam, while that in the rural areas witnessed sharp decline during the first half of the 2010s. Based on the NSS 67th round (NSSO, 2012) and 73rd round (NSSO, 2017) enterprise survey data, this essay presents a brief account of the various facets of employment in the urban INFEs in Assam during the period 2010-11 to 2015-16. Broadly, we analyse the size and trends of employment, employment elasticity, and growth in labour productivity in the urban INFEs across various sectors in Assam.

The informal enterprises, also known as unorganised enterprises, comprise small, private proprietary or partnership enterprises that fall outside the purview of the government regulations, i.e. they need not to register with the government authorities. According to the National Commission for Enterprises in the Unorganised Sector (NCEUS), the informal enterprises are the “unincorporated private enterprises owned by individuals or households engaged in the sale and production of goods and services operated on a proprietary or partnership basis and with less than ten total workers” (NCEUS, 2009). In the NSS framework,

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## Focus

# Rural Unorganised Manufacturing Sector in Assam in the Post-reforms Period

DILIP SAIKIA AND UDDIPANA GOGOI

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*The objective of the present paper is to analyse the performance of the rural unorganised manufacturing sector in Assam in the post-reforms period. Using the National Sample Survey Organisation's (NSSO, 2008 report) 'quinquennial' rounds on unorganised manufacturing sector for the years 1994-95, 2000-01, 2005-06 and 2010-11, we have analysed the growth performance and structural changes in the rural unorganised manufacturing sector in Assam in terms of number of enterprises, employment and output. The analysis showed that in the post-reforms period there has been a deceleration in the growth of output in Assam's rural unorganised manufacturing sector, while the growth of enterprises and employment has been negative. Considerable structural change has been occurring within the rural unorganised manufacturing sector over the years; the share of Own Account Manufacturing Enterprises (OAMEs)– the dominant segment of the rural sector – has been falling, while that of the establishments has been increasing. The establishments' segment has been growing at a faster rate than the OAMEs. Employment elasticity in the overall rural unorganised sector and the OAMEs is negative, whereas that in the establishments' segment has been relatively high. Labour productivity in the rural unorganised sector has been lower than the urban counterpart, however, growth in labour productivity is found to be higher in the rural unorganised sector than urban unorganised sector.*

## Introduction

The unorganised manufacturing sector is an important constituent of the industrial sector in India in general and in Assam in particular. The role of the unorganised sector in an industrially underdeveloped state like Assam is enormous. The strategic role of the sector is perhaps the creation of a wide variety of gainful employment opportunities, together with its contribution in terms of production, income generation, exports and capital accumulation (Subrahmanya, 2004). Since the unorganised sector is highly labour intensive and also quite diversified including a wide range of manufacturing enterprises dispersed all over the rural and urban areas, the sector can generate large employment opportunities to the surplus agricultural labourers and landless labourers in the rural areas and to the unemployed migrant workers in urban areas. The sector also plays a vital role in industrialisation in rural and backward areas through creating new small-scale enterprises, since large-scale industries can't grow in rural and backward areas where basic infrastructure facilities are not available. Since the enterprises consisting the unorganised sector are small-scale enterprises and require comparatively lower capital cost than large industries to start-up, they can grow anywhere especially in rural and backward areas with small amount of investments, and provide substantial employment opportunities, and thereby holds the promise to enhance the economic condition of the backward states like Assam (Saikia, 2014).

The size of the unorganised manufacturing sector in Assam is huge in terms of number of enterprises and employment. The unorganised sector accounted for about 99.5% of manufacturing units, over 80% of manufacturing employment and about one-fourth of value added of the manufacturing sector in the state during

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# GROWTH OF URBAN NON-FARM INFORMAL ENTERPRISES IN ASSAM

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Dilip Saikia \*

## ABSTRACT

*The aim of this paper is to examine the growth of urban non-farm informal enterprises (NFIEs) in Assam during the first half of the 2010s. Based on the NSS 67th and 73rd quinquennial rounds of enterprise survey data, the paper analyses the size, structure and growth of the urban NFIEs in terms of number of enterprises, employment and output by various sectors such as manufacturing, trade and services over the period 2010-11 to 2015-16. The paper also examines the growth in number of urban NFIEs by operational characteristics of the enterprises such as nature of operation, type of ownership and location. Finally, the employment elasticity and growth of labour productivity in the urban NFIEs across the sectors have been analysed in order to examine the employment potentiality of the various sectors within the urban NFIEs. The specificity of this study is that it may be the first scientific attempt to analyse the entire urban NFIEs across various sectors in the state.*

**Keywords:** Urban informal sector, non-farm enterprises, labour productivity, employment elasticity, employment growth, output growth, Assam

## Introduction

The informal sector constitutes an important part of the urban economy especially in developing countries like India. The emergence of urban informal sector is an inevitable phenomenon in the face of growing urban labour force resulting from large-scale rural-urban migration and a rapid natural growth of population in developing economies (Chaudhuri 2000; Gupta 1993). The rural migrants who could

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March 2018

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# EMPLOYMENT DECELERATION IN THE UNORGANISED RURAL NON-FARM ENTERPRISES IN ASSAM

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Dilip Saikia\*  
Rupjyoti Borah

## ABSTRACT

*Unorganised non-farm enterprises play a significant role in employment and income generation in the rural areas in many developing countries. This paper aims at examining recent employment trends in the rural unorganised non-farm enterprises (UNFEs) in Assam. The NSS 67th and 73rd rounds of enterprise survey data has been explored to estimate employment growth rate, employment elasticity, and labour productivity in the rural UNFEs across the sectors - manufacturing, trading, and services - in Assam for the period 2010-11 to 2015-16. The findings reveal that there has been an absolute decline in employment in rural UNFEs in Assam during 2010-11 to 2015-16, and the services enterprises were the major loser, though manufacturing and trading enterprises also suffered job loss. The growth rate of real labour productivity has been very low and employment elasticity turned out to be highly negative in all but services enterprises, suggesting the failure of the rural UNFEs, despite having immense potential, to create employment opportunities in the state.*

**Keywords:** Unorganised sector, rural non-farm sector, employment, employment elasticity

## Introduction

The agricultural sector in India is still virtually, to a large extent, continued to play a central role in the rural economy, but in recent years, because of stagnation of the sector and its inability to generate productive employment, the rural non-farm enterprise (NFE) has gained significant importance for rural development, especially from the point of view of employment generation. The rural NFEs comprising a wide range of activities including manufacturing, construction, trade, and a variety of services activities can create large numbers of employment opportunities - both self-

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## Nursing Shortages in the Rural Public Health Sector of India

Dilip Saikia<sup>1</sup>

### Abstract

*The objective of this article is to examine the situation of the nursing workforce and the shortage of nurses in the public health sector in rural India. Using secondary data from various publications of government agencies of India, an assessment of the size, distribution, adequacy, and shortfall of the nursing workforce in the rural public health sector in India is presented for the period of 2005–2017. The paper also examines the impact of nursing shortages and discusses the causes of nursing shortages in India, and shows that although the numbers of nurses in the rural public health sector have been rising incrementally in both absolute terms and in relation to the population being served in the period from 2005 to 2017, the sector is still suffering from acute nurse shortages. The densities of nurses as well as the ratio of nurses to doctors is abysmally low compared to global norms, and these figures vary considerably across states and union territories. This study has found significant adverse effects of these nursing shortages on critical health outcomes such as the infant mortality rate (IMR) and the under-five mortality rate (U-5MR). It is suggested that sufficient staffing of nurses in rural health centers should be enacted to eradicate this nursing shortage and to enhance public health care services in rural areas.*

### Keywords

*Nurse staffing; nurse workforce; nurse shortages; skill mix; staffing levels*

### Introduction

Nurses represent an important segment of health care providers and constitute almost half of the total health workforce in most countries (Buchan & Calman, 2004; Malik, 2008). They generally practice in a wide range of health care settings and can be considered “front-line” staff in most situations as they are the initial point of patient contact in any health system (Buchan & Calman, 2004; Naylor & Kurtzman, 2010). Spending more time caring for the patient than any other health care provider, they play a crucial role in the safety and recovery of the patient (Garretson, 2004). Thus, a sufficient supply of nurses is deemed to be crucial in order to maintain a satisfactory standard of health care.

The significance of sufficient nursing staff and the adverse effects of nursing shortages are well documented in the literature (Buchan & Calman, 2004; Blegen, Goode, & Reed, 1998; Aiken, Clarke, Sloane, Sochalski, & Silber, 2002; Needleman, Buerhaus, Mattke, Stewart, & Zelevinsky, 2002; Subirana, Long, Greenhalgh, & Firth, 2014). Nursing shortages impact various factors, such as health care delivery processes, the capacity of health facilities, the quantity and quality of health care services, the nurses themselves (as the role becomes more stressful and taxing during such shortages), and, ultimately, the health outcomes of the

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## India's struggle with manpower shortages in the primary healthcare sector

*Dilip Saikia*

India, after failing to achieve most of the health-related targets of the Millennium Development Goals (MDGs) by 2015, has made a commitment to achieve another set of health-related targets (a total of nine targets under Goal 3) including 'universal health coverage' (UHC) laid down by the sustainable development goals (SDGs) to be achieved by 2030. The achievement of the UHC and other health-related SDG targets is contingent on the availability and quality of public health services at primary, secondary and tertiary care levels. However, all is not well with the public health sector in India, especially at the primary care level. Despite the huge investments made in the National Rural Health Mission (NRHM) over the period 2005–2015 to strengthen the primary healthcare in rural areas of the country, there is still a shortfall in the required number of sub-centres, primary health centres (PHCs) and community health centres (CHCs) as well as health manpower, especially specialist doctors. The health manpower – 'the stock of all individuals engaged in the promotion, protection or improvement of population health'<sup>1</sup> – is the backbone of the health system and without them the health system can never function. Acknowledging the role of health manpower for enabling UHC, the High Level Expert Group on UHC for India emphasizes that 'India's mandate for UHC depends, to a great extent, on adequate and effective Human Resources for Health (HRH) providing care at primary, secondary and tertiary levels in both the public and private sectors'<sup>2</sup>.

India's health manpower crisis was reported way back in 2004 by the Joint Learning Initiative (JLI)<sup>3</sup> – a network of global health leaders. The JLI's report on human resources for health highlights that India had about 11.3 health manpower (doctors, nurses and midwives) per 10,000 people in 1998, and thus, was among the low-health manpower density countries. Similarly, the World Health Report 2006 (ref. 4) estimated the density of health manpower (doctors, nurses and midwives) in India at 18.7 per 10,000 people in 2004 and placed India

among the 57 countries having a critical shortage of health manpower.

The estimates of health manpower density, however, vary based on the sources of data. While the above estimates are based on the official data from the professional councils of doctors and nurses, estimates based on the Population Census and National Sample Survey (NSS) data show even a lower health manpower density in India. Based on Census 2001 data, a recent study<sup>5</sup> estimates that India had approximately 20.12 total health manpower and 12.28 doctors, nurses and midwives per 10,000 people respectively in 2001. Another study<sup>6</sup> based on the NSS 61st round (July 2004–June 2005) on 'employment and unemployment' estimates the densities of all health manpower and doctors, nurses and midwives at 20 and 11.9 respectively, per 10,000 people. Estimates based on NSS 68th round (July 2011–June 2012) data show that the situation is unchanged even in 2011–12; the densities of all health manpower and doctors, nurses and midwives were about 20.9 and 13.4 per 10,000 people respectively<sup>7</sup>. Further, after adjusting for educational qualification, the densities fall to 9.1 and 6.4 per 10,000 people respectively<sup>7</sup>. Thus, in comparison to the international health manpower norms, the total number of doctors, nurses and midwives in India is approximately half of the WHO's benchmark of 25.4 per 10,000 people and after adjusting for educational qualification, the numbers fall to just a quarter of the WHO benchmark.

The situation is even critical in the rural areas as the distribution of health manpower is overwhelmingly skewed in favour of the urban areas. Only about 40.8% of all health workers are in the rural areas, where about 70% of the population resides. The percentage of health manpower residing in the rural areas by cadres are: 39.6% for doctors, 43% for AYUSH doctors, 39.6% for nurses and midwives, 20.4% for dentists, and 45% for pharmacists<sup>8</sup>. As a result, the density of health manpower in rural areas is just a quarter of that in urban areas<sup>5,6</sup>. Even those who serve in rural areas are mostly

(over 70%) engaged in the private sector<sup>5</sup>, leaving the healthcare services inaccessible to a large section of the rural people, since about one-fourth of the rural population are poor, for whom the private medical facility is economically beyond reach.

Although the NRHM mission (now National Health Mission) has made substantive efforts to augment the health manpower in rural public health sector, the sector continues to suffer from persistent shortage of qualified health manpower. As per data available from the Ministry of Health and Family Welfare, Government of India (Rural Health Statistics 2016–17)<sup>8</sup> there were, as on 31 March 2017, about 156,231 sub-centres (a shortfall of 34,946 from the required numbers), 25,650 PHCs (a shortfall of 6409 PHCs) and 5624 CHCs (a shortfall of 2168 CHCs) in rural India.

The total number of health manpower, as on 31 March 2017 at various health facilities by cadres were: 14,350 medical officers, 4156 specialist doctors, and 2129 radiographers at CHCs; 27,124 doctors, 22,351 auxiliary nurse midwives (ANMs), 14,267 lady health visitors (LHVs), and 12,288 male health assistants at PHCs; 70,738 nurses, 25,193 pharmacists, and 18,952 laboratory technicians at the combined PHC and CHC levels; and 198,356 ANMs and 56,263 male health workers at sub-centres. This adds up to a total of 466,167 healthcare personnel in the public health sector in rural India, which translates into a density of 5.3 healthcare personnel per 10,000 people or one healthcare personnel for every 1890 people in 2017 compared with the density of 4 per 10,000 people or one healthcare personnel for every 2473 people in 2005. The combined density of doctors, nurses and midwives improved from 3.6 to 4.8 per 10,000 people over 2005 to 2017, but it still remains less than one-fifth of the WHO's benchmark of 25.4 per 10,000 people. Going by this benchmark, there was a deficit of 20.6 doctors, nurses and midwives per 10,000 people in rural India, leaving around 80% of rural population without access to public healthcare services.



Available online on 15.06.2019 at <http://jddtonline.info>

## Journal of Drug Delivery and Therapeutics

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Review Article

### Cancer Cell Metabolism: A Review

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#### ABSTRACT

It has been known for decades that cancer cells exhibit enhanced rates of Glucose uptake and glycolysis. Rapidly growing Tumor cells display remarkably different metabolic autonomy from the tissues which they are derived. Tumor cells alter their metabolism to support growth and proliferation. In this study, we have re-examined the metabolism in tumor cells and have made an attempt to bring together the major contributions made to this topic till date. This review in particular highlights the altered metabolism in the high energy demanding tumour cells, genetic changes that alter tumour cell metabolism and the role of metabolic microenvironments that may promote malignant progression.

**Keywords:** Crabtree, Warburg, Metabolic microenvironments, Hypoxia, pH,

**Article Info:** Received 02 May 2019; Review Completed 01 June 2019; Accepted 06 June 2019; Available online 15 June 2019



Cite this article as:

Bordoloi R, Bhuyan S, Das A, Cancer Cell Metabolism: A Review, Journal of Drug Delivery and Therapeutics. 2019; 9(3-s):939-946 <http://dx.doi.org/10.22270/jddt.v9i3-s.2865>

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#### INTRODUCTION

Over the past few decades, increased researches related to the metabolic adaptations of the cancer cells has resulted in the augmentation of evidences that suggest an association of the several pathways of human metabolism with the cancer cells<sup>1,2,3</sup>. Tumour cells are less specialised than the normal cells<sup>4</sup> which help them ignore signals to sustain an uncontrolled division<sup>5</sup> and defy apoptosis mediated particularly by oxidative damage<sup>6</sup>. For a cell to divide rapidly, it must be nutrient hungry of the major metabolically demanding macromolecules viz. carbohydrates, proteins, lipids and nucleic acids. However, these essential nutrients are only present in concentrations that are spatially and temporarily heterogenous<sup>7</sup>. Therefore, it is required that the cancer cells adapt to this stressful microenvironment of the growing tumour. It is this anabolic drive that redesigns the tumour cell's metabolic pathway for its better survival and growth.

Carbohydrate come from nearly all food sources in our diet and is eventually broken down into glucose by enzymes in the small intestine; which are later absorbed into the blood stream through the intestinal walls by the villi. Glucose being the body's main energy source, most of the calories are derived from the carbohydrates. The catabolism

carbohydrates to yield ATP in a normal cell is associated with pathways such as Glycolysis or Embden-Meyerhoff Pathway, Oxidation of pyruvate, the Citric acid cycle or the Korb's Cycle, Pentose Phosphate Pathway, Glycogenolysis, Glycogenesis and Gluconeogenesis.

The application of computer-aided tomography (CAT) in combination with positronemission tomography (PET) imaging technique using the glucose analogue tracer fluorodeoxyglucose (FdG) has demonstrated that most cancer cells show significantly increased glucose uptake<sup>8-13</sup>. This is because anabolic pathways branching off from glycolysis produces some biosynthetic intermediates such as amino acids, lipids and nucleotide precursors<sup>14</sup>. In a cancer cell, the demand for these products is relatively high owing to its nature of rapid growth. When glycolytic flux through these pathways increases, glucose uptake must also increase alongside to maintain normal ATP levels. As per reports, by the time a normal cell would take to produce 36 ATP from per glucose, the normoxic cancer cell would utilize 11 molecules of glucose to produce 56 ATP from it, whereas the anoxic cancer cell would generate 26 ATP from 13 glucose molecules<sup>15</sup>.

This review aims to describe the role of altered glucose metabolic pathway in the high energy demanding tumour cells as described by the Warburg effect with a particular

ISSN: 2250-1177

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CODEN (USA): JDDTAO



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## Martensitic ferromagnetism and spin glass behaviour in $\text{Ni}_{47}\text{Mn}_{36}\text{Cr}_4\text{Sn}_{13}$ ribbons

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### ARTICLE INFO

#### Keywords:

Functional alloys  
 Electrical and magnetic properties  
 Glass transition  
 Martensitic transformation

### ABSTRACT

$\text{Ni}_{47}\text{Mn}_{36}\text{Cr}_4\text{Sn}_{13}$  ribbons were prepared by melt-spinning of the as synthesised bulk alloy. The room temperature structure of the ribbon is dominantly cubic  $L2_1$  with small admixture of the martensitic orthorhombic phase. The dominance of odd superlattice peak (111) over (200) peak suggests noticeable presence of chemical disorder and hence antisite defects. The temperature dependent resistivity and magnetization measurements unravel the martensitic phase (MP) around  $\sim 360$  K in the high temperature austenite phase (AP), while the AP-MP transition occurs at 307 K during cooling and the reverse appears at 328 K in warming cycle. The low field magnetoresistance is rather small and exhibits nonlinear temperature dependence in the low field region. A robust re-entrant ferromagnetic transition whose magnetic moment is almost thrice that of the austenite phase occurs in the martensitic phase. At further lower temperatures, the ferromagnetic transition is succeeded by a re-entrant spin glass (RSG). The analysis of the frequency dispersion of the spin freezing temperature within the Vogel-Fulcher law yields a high value of activation energy ( $E_a \approx 50.8$  meV) and smaller time constant ( $\tau = 3.28 \times 10^{-12}$  s) as compared to usual SG behaviour generally observed in Heusler ribbons. However, alternative analysis in terms of the dynamic scaling law validates the canonical nature of the spin glass and hence appears to be better option for analysing the spin glass states associated with the re-entrant ferromagnetism.

### 1. Introduction

Heusler alloys [1] have attracted immense research interest due to their tuneable multifunctional properties for applications in magnetocalorics, thermoelectrics, spintronics, etc. These materials exhibit host of technologically useful physical properties as a function of thermomagnetic coordinates, temperature (T) and magnetic field (H) [2–6]. When these intermetallic compounds adopt the formula  $T_2T'\Gamma$  (T and T' represent transition metals, and  $\Gamma$  belongs to a main group element) and crystallizes in  $L2_1$  type cubic structure, are called Full Heusler alloys (e.g.,  $\text{Ni}_2\text{MnSn}$ ,  $\text{Cu}_2\text{MnSi}$  etc.), while those with the  $C1_b$  type crystallographic structure having general formula TTT (NiMnSn, TiNiSn, etc.) are referred as Half Heusler alloys [2–6]. Both of these Heusler alloy families exhibit cubic structures with four interpenetrating FCC sublattices. In the Full Heusler alloys the T atoms occupy the Wyckoff positions 4a (0 0 0) and 4b ( $\frac{1}{2}$   $\frac{1}{2}$   $\frac{1}{2}$ ), while the T' and  $\Gamma$  atoms occupy 4c ( $\frac{1}{4}$   $\frac{1}{4}$   $\frac{1}{4}$ ) and 4d ( $\frac{3}{4}$   $\frac{3}{4}$   $\frac{3}{4}$ ) positions, respectively while in the half Heusler type systems one T-atom sublattice remains unoccupied [7,8].

With the lowering of temperature many of these full Heusler alloys such as NiMn based systems undergo a first order structural phase transformation from the higher symmetry cubic austenite phase (AP) to a lower symmetry structurally modulated martensite phase (MP). The reorientation of the martensitic phase can be induced by external agents like temperature, stress or magnetic field [9]. The austenite phase exhibits paramagnetic (PM) state at higher temperatures and ferromagnetic (FM) correlations appear on lowering temperature and under special cases like the Mn rich alloys the FM and antiferromagnetic (AFM) coexist [10,11]. Compositional variation or doping with a fourth element have been observed to bring about a change in the austenite-martensitic transition temperature ( $T_{AM}$ ) as it is very sensitive to the valence electron concentration per atom (e/a) [10–12]. A rich variety of technologically important properties like large magnetocaloric effects, magnetoresistance, shape memory effect, exchange bias are observed in the vicinity of the martensitic transition (MT) temperature [5–7] and so efforts are being made to bring the martensitic transition in the proximity of the Curie temperature and especially in the room

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<https://doi.org/10.1016/j.intermet.2019.106492>

Received 12 July 2018; Received in revised form 16 January 2019; Accepted 26 April 2019  
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## Magnetic and Magnetotransport Characteristics of Cr-Substituted $\text{Ni}_{55}\text{Mn}_{34}\text{Sn}_{11}$ Thin Films Grown by Magnetron Sputtering

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Received: 12 December 2018 / Accepted: 27 March 2019  
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### Abstract

Highly oriented Cr-substituted  $\text{Ni}_{55}\text{Mn}_{34}\text{Sn}_{11}$  Heusler thin films having thickness ~400 nm were deposited by Ultrahigh vacuum dc magnetron sputtering on MgO (100) substrates. At room temperature, the films exhibit a mixture of dominant  $L2_1$  cubic austenite phase, as revealed by the intense (002) and (004) peaks, along with small fraction of the orthorhombic–martensitic phase. Surface morphology of the thin films showed distribution of Cr-rich and Cr-deficit regions together with patterned and aligned magnetic domains, thus bringing out the inherent room temperature ferromagnetism of the film. At temperatures above the Curie temperature,  $T_C \sim 321$  K, the magnetic behaviour of the films is seen to follow the Curie law rather than the Curie–Weiss law. Ferromagnetic to antiferromagnetic transition appears at  $T_N \sim 247$  K, which gives rise to exchange bias at low temperatures due to the coexistence of the two magnetic orders. This phase coexistence also leads to the formation of a spin glass state deep into the martensitic region. The film exhibits metal-like nature at high temperature and semiconductor-like behaviour with the lowering of temperature. A reentrant metallic state is observed at  $T \leq 38$  K during cooling that persists up to  $\leq 62$  K in warming cycle. The hysteresis in the  $\rho$ – $T$  curve spread over a very wide temperature range confirms the magnetic phase coexistence in the martensitic state in the present thin films. The magnetoresistance (MR) first increases (2.4% at 300 K and  $H = 50$  kOe) with temperature and maximizes to around ~3.25% at  $T = 150$  K and then starts decreasing. Its value in the glassy state is very small. This shows that a magnetic liquid like state is more conducive to larger MR.

**Keywords** Sputtering · Heusler alloys · Thin films · Austenite–martensite transformation

### 1 Introduction

In recent times, off-stoichiometric Ni–Mn–Sn Heusler compounds exhibiting martensitic transformation (MT) have drawn immense research interest due to their intrinsic multifunctional properties like magnetoresistance (MR), magnetic shape memory effect (MSME), magnetocaloric effect (MCE), exchange bias (EB), and spin glass (SG) behaviour [1–7]. Ever since

Sutou et al. [8] first reported MT, this family of compounds has been centre of extensive investigations as their functional properties offer great potential for applications in diverse areas like spintronics, magnetic refrigeration technology, and magnetic actuation [5–7, 9, 10]. These compounds exhibit austenite phase (AP) with cubic  $L2_1$  structure at high temperature which transforms to a modulated orthogonal or tetragonal martensite phase (MP) with the lowering of temperature. The austenite phase may be a pure paramagnetic (PM) phase or it can show a mixed paramagnetic–ferromagnetic (PM–FM) phase around the Curie temperature  $T_C$ . In contrast, the modulated martensite phase in general has coexistence of ferromagnetism and anti-ferromagnetism (AFM) and hence the formation of a spin glass state with the glass transition depending on the chemical composition [1–7, 11, 12].

In Ni–Mn–Sn full Heusler systems, the excess Mn atoms occupy the Ni or Sn sites and the hybridization between the Ni atoms and the Mn atoms on the Sn sites is an important driving force for the occurrence of MT [13, 14]. A first-order magnetocoupled structural phase transition in these compounds

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# Sperimagnetism in Perpendicularly Magnetized Co-Tb Alloy-Based Thin Films

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Received: 15 March 2019 / Accepted: 3 June 2019  
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## Abstract

Thin films of  $\text{Co}_{1-x}\text{Tb}_x$  ( $x = 0.10, 0.12, \text{ and } 0.15$ ) alloy have been prepared by a co-sputtering process using dc magnetron sputtering. The measurement of temperature variation of magnetization indicates that these films exhibit ferrimagnetism with Curie temperature ( $T_C$ ) much above the room temperature. The  $M-T$  curves under zero-field-cooled and field-cooled conditions indicate that  $\text{Co}_{0.85}\text{Tb}_{0.15}$  film exhibits non-collinear sperimagnetic ordering due to competition between exchange interaction and perpendicular magnetic anisotropy. An increase of coercivity, squareness, and change of magnetic isotropy to magnetic anisotropy behavior with the increase of Tb composition was observed. Particularly,  $\text{Co}_{0.85}\text{Tb}_{0.15}$  is found to exhibit perpendicular magnetic anisotropy. The relative reversal in these films follows the Kondorsky model. The post-annealing of the films helps to improve the squareness of the hysteresis curve, but it reduces the coercivity.

**Keywords** Co-Tb thin film · Magnetic anisotropy · Sperimagnetism · Annealing effect

## 1 Introduction

The amorphous films of rare earth-transition metal (RE-TM) alloys have been extensively studied due to their various potential applications in micro-actuators, micro-sensors, and magnetic recording media [1]. In such amorphous materials, a wide variety of magnetic order, such as ferrimagnetism exists even in the presence of various kinds of disorder [2, 3]. In addition to this collinear magnetic order, non-collinear magnetic structures such as speromagnetism, asperomagnetism, and sperimagnetism are known to occur due to competition between random local anisotropy and exchange interaction [2–4]. Particularly, sperimagnetic structure, which is usually observed in ferrimagnetic amorphous materials, comprises two (or more) magnetic species with the moments of at least one species frozen in random orientations below ordering

temperature [2, 4]. Among various amorphous RE-TM alloys, the Co-Tb alloy is one of the potential candidates for application in magnetic recording media and spin transfer torque [5]. Usually, the amorphous Co-Tb alloys are ferrimagnetic/sperimagnetic [6, 7] and the ferrimagnetism arises due to the antiferromagnetic exchange-coupling of the magnetic moment of Tb sublattice with that of ferromagnetically aligned Co sublattice [6]. One of the very important and rather surprising property of amorphous Co-Tb thin films is the presence of strong perpendicular magnetic anisotropy (PMA), which is often attributed to variation of the intrinsic microstructure linked to the growth condition [8]. Usually, the strength of PMA in Co-Tb alloys have a strong dependence on composition [9], film thickness [10], sputtering condition [9], underlayer/adjacent layer [11], post-annealing [9, 12], and measurement temperature as well [8–12]. The aim of the present work is to study the magnetic properties of as-prepared films of Co-Tb amorphous alloys with different composition and to study the effect of post-annealing upon magnetic properties.

## 2 Experimental Details

$\text{Co}_{1-x}\text{Tb}_x$  ( $x = 0.10, 0.12, \text{ and } 0.15$ ) alloys were grown by a co-sputtering process using DC magnetron sputtering. Pure

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# *Olkin Family of Distribution: Its Properties and Applications*

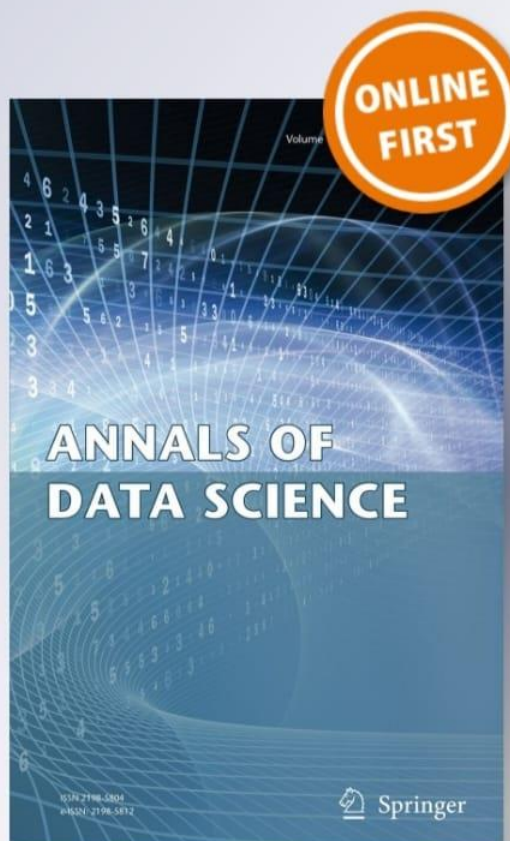
**Laba Handique, Subrata Chakraborty & Thiago A. N. de Andrade**

**Annals of Data Science**

ISSN 2198-5804

Ann. Data. Sci.

DOI 10.1007/s40745-018-0166-z



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# International Journal of Applied Mathematics and Statistics™

ISSN: 0973-7545 (Online), ISSN 0973-1377 (Print)

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## Some Aspects of the Odd Log-Logistic Burr X Distribution with Applications in Reliability Data Modeling

*Rana Muhammad Usman, Laba Handique, Subrata Chakraborty*

### Abstract

A new extension of Burr type X distribution named as the odd log-logistic Burr X distribution is proposed. Explicit expressions for important properties such as quantile function, moments, entropy, stress-strength reliability, moment of order statistics, stochastic ordering and shapes of this distribution are provided to enable mathematical treatment. Performance of estimation technique used for model parameters estimation is numerically investigated employing Monte Carlo simulation with different sample sizes and parameter combinations. To justify the usefulness of the proposed distribution in real life reliability engineering examples two data modeling are presented. Findings from these applications has clearly suggested the enhanced ability of the proposed model in adjustment of the considered data sets.

### Keywords

Burr X; Log-logistic Burr X; Stress-strength reliability; stochastic ordering, Order statistics; Maximum likelihood estimation

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## A new class of distributions based on the zero truncated Poisson distribution with properties and applications



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### Abstract

We study a new family of distributions defined by the minimum of the Poisson random number of independent and identically distributed random variables having the Topp Leone-G distribution. Some mathematical properties of the new family are derived. Maximum likelihood estimation of the model parameters is investigated. Two special models of the new family are discussed. We perform three applications to real data sets to show the potentiality of the proposed family. In order to test the validity of the new family, a modified Chi-squared goodness-of-fit test based on Nikulin-Rao-Robson statistics is proposed theoretically.

**Keywords:** Topp Leone-G family, order statistics, maximum likelihood estimation, quantile function, generating function, moments.

**2010 MSC:** 60E05, 62F10.

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### 1. Introduction

In the statistical literature, several G classes of distributions have been constructed using zero truncated Poisson (ZTP) distribution such as the complementary generalized transmuted Poisson G family by Alizadeh et al. [1], the exponentiated generalized G Poisson family of distributions by Aryal and Yousof [3], the odd log-logistic Poisson G family of distributions by Alizadeh et al. [2], among others. On this

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doi: [10.22436/jnsa.012.03.03](https://doi.org/10.22436/jnsa.012.03.03)

Received: 2018-08-29 Revised: 2018-09-05 Accepted: 2018-09-19

## **A New Statistical Model for Extreme Values: Properties and Applications**

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Received 10 September 2018; Accepted 5 January 2019

(Communicated by Haneen A. Al-Khawaja)

### **Abstract**

*In this work, a new three parameter extreme value model is defined and studied. Various structural properties of the proposed model are investigated. The new density is expressed as a linear mixture of the Fréchet density. Method of the maximum likelihood is implemented to estimate the model parameters. Simulations are conducted for different sample sizes to examine the performance of the maximum likelihood estimators for the model parameters. The new model is applied to*



## THE EXPONENTIATED GENERALIZED EXTENDED GOMPERTZ DISTRIBUTION

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### ABSTRACT

This paper presents a new generalization of the extended Gompertz distribution. We defined the so-called exponentiated generalized extended Gompertz distribution, which has at least three important advantages: (i) Includes the exponential, Gompertz, extended exponential and extended Gompertz distributions as special cases; (ii) adds two parameters to the base distribution, but does not use any complicated functions to that end; and (iii) its hazard function includes inverted bathtub and bathtub shapes, which are particularly important because of its broad applicability in real-life situations. The work derives several mathematical properties for the new model and discusses a maximum likelihood estimation method. For the main formulas related to our model, we present numerical studies that demonstrate the practicality of computational implementation using statistical software. We also present a Monte Carlo simulation study to evaluate the performance of the maximum likelihood estimators for the EGEG model. Three real-world data sets were used for applications in order to illustrate the usefulness of our proposal.

**Keywords:** Applied results, exponentiated generalized class, Gompertz distribution, probability models with applications, real data sets.



Open Access

Review Article

**Cancer Cell Metabolism: A Review**Rajashree Bordoloi<sup>1\*</sup>, Shuvam Bhuyan<sup>2</sup> and Abhijit Das<sup>3</sup><sup>1</sup>Assistant Professor, Department of Botany, Darrang College, Tezpur, Assam.<sup>2</sup>Department of Botany, Darrang College, Tezpur, Assam.<sup>3</sup>Associate Professor, Department of Zoology, Darrang College, Tezpur, Assam.**ABSTRACT**

It has been known for decades that cancer cells exhibit enhanced rates of Glucose uptake and glycolysis. Rapidly growing Tumor cells display remarkably different metabolic autonomy from the tissues which they are derived. Tumor cells alter their metabolism to support growth and proliferation. In this study, we have re-examined the metabolism in tumor cells and have made an attempt to bring together the major contributions made to this topic till date. This review in particular highlights the altered metabolism in the high energy demanding tumour cells, genetic changes that alter tumour cell metabolism and the role of metabolic microenvironments that may promote malignant progression.

**Keywords:** Crabtree, Warburg, Metabolic microenvironments, Hypoxia, pH,

**Article Info:** Received 02 May 2019; Review Completed 01 June 2019; Accepted 06 June 2019; Available online 15 June 2019



Cite this article as:

Bordoloi R, Bhuyan S, Das A, Cancer Cell Metabolism: A Review, Journal of Drug Delivery and Therapeutics. 2019; 9(3-s):939-946 <http://dx.doi.org/10.22270/jddt.v9i3-s.2865>

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**INTRODUCTION**

Over the past few decades, increased researches related to the metabolic adaptations of the cancer cells has resulted in the augmentation of evidences that suggest an association of the several pathways of human metabolism with the cancer cells<sup>1,2,3</sup>. Tumour cells are less specialised than the normal cells<sup>4</sup> which help them ignore signals to sustain an uncontrolled division<sup>5</sup> and defy apoptosis mediated particularly by oxidative damage<sup>6</sup>. For a cell to divide rapidly, it must be nutrient hungry of the major metabolically demanding macromolecules viz. carbohydrates, proteins, lipids and nucleic acids. However, these essential nutrients are only present in concentrations that are spatially and temporarily heterogenous<sup>7</sup>. Therefore, it is required that the cancer cells adapt to this stressful microenvironment of the growing tumour. It is this anabolic drive that redesigns the tumour cell's metabolic pathway for its better survival and growth.

Carbohydrate come from nearly all food sources in our diet and is eventually broken down into glucose by enzymes in the small intestine; which are later absorbed into the blood stream through the intestinal walls by the villi. Glucose being the body's main energy source, most of the calories are derived from the carbohydrates. The catabolism

carbohydrates to yield ATP in a normal cell is associated with pathways such as Glycolysis or Embden-Meyerhoff Pathway, Oxidation of pyruvate, the Citric acid cycle or the Korb's Cycle, Pentose Phosphate Pathway, Glycogenolysis, Glycogenesis and Gluconeogenesis.

The application of computer-aided tomography (CAT) in combination with positronemission tomography (PET) imaging technique using the glucose analogue tracer fluorodeoxyglucose (FdG) has demonstrated that most cancer cells show significantly increased glucose uptake<sup>8-13</sup>. This is because anabolic pathways branching off from glycolysis produces some biosynthetic intermediates such as amino acids, lipids and nucleotide precursors<sup>14</sup>. In a cancer cell, the demand for these products is relatively high owing to its nature of rapid growth. When glycolytic flux through these pathways increases, glucose uptake must also increase alongside to maintain normal ATP levels. As per reports, by the time a normal cell would take to produce 36 ATP from per glucose, the normoxic cancer cell would utilize 11 molecules of glucose to produce 56 ATP from it, whereas the anoxic cancer cell would generate 26 ATP from 13 glucose molecules<sup>15</sup>.

This review aims to describe the role of altered glucose metabolic pathway in the high energy demanding tumour cells as described by the Warburg effect with a particular

ISSN: 2250-1177

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DR GYANESHWARI DEVI MEMORIAL PRIZE PAPER

**THE SOCIO-CULTURAL AND POLITICAL  
SITUATION IN THE EASTERNMOST PART OF  
THE GUPTA REALM: EMERGENT SAMATAṬA**

**Devdutta Kakati  
JNU**

The area known as Bengal has a rich historiography of being studied as a region.<sup>1</sup> The most compelling reasons for identifying Bengal as a valid regional unit for historical studies are its location in the Ganga delta – the largest delta in the world – and its being the only one and unique *a-samudrahimācala* (stretching from the Himalayas to the sea) region in the entire Indian subcontinent. The Bay of Bengal provides the only outlet to the sea for the land-locked Ganga plains. In terms of distinct geological, political and cultural formations; Bengal has been divided into five principal sub-regions- Puṇḍravardhana (the northern part of Bengal), Rāḍha (the west of Bhagirathi), Vaṅga (embracing Dhaka), Samataṭa (Comilla) and Harikela (Chittagong)<sup>2</sup> with Samataṭa and Harikela lying in the trans-Meghna zone within the active delta in the eastern/south-eastern sector of the Ganga delta.

As for Samataṭa, this sub-region lies on the trans-Meghna tract of the Comilla-Noakhali plains with the Tripura hills bordering the east, the Bay of Bengal flanking its southern territory and the Meghna bordering it in the north and the west (joined by the Padma in the west). The following pages attempt to trace the emergence of Samataṭa during the 5th and 6th centuries, CE the formative period which gave a distinct sub-regional identity to Samataṭa. On a sub-continental level, this period from around 400-700 CE has been designated by Romila Thapar as ‘threshold times’ which marked the emergence of new political and social formations; from granting revenue-free landed property to religious donees (individual or institutional) to the emergence of the underlords (*śāmantas*). We shall see that Samataṭa too witnessed some of these features.<sup>3</sup>

Samataṭa appeared in the 4th century CE in the Allahabad pillar inscription of Samudragupta as a frontier (*pratyanta*) state, obviously from the point of the Gupta realm, with its stronghold in the Ganga plains. The rulers of this area are referred to as simply *ṅṅpatis* of a particular region without even having their names mentioned. This points to the fact that these rulers were perhaps merely chiefs who were tributaries of the Gupta sovereign.

# Women Empowerment through Women Entrepreneurship: A Study of Home Based Enterprises run by Women in Sonitpur District of Assam

Dr. Manoj Kumar Hazarika

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*"There is no chance for the welfare of the world unless the condition of women is improved",* Thoughts on  
Women – Swami Vivekananda

**Abstract:** The concept and philosophical basis of "Women Empowerment" in social policy is of recent origin, but the meaning, theme and the struggle are not new for the society. Women empowerment was first brought to limelight at the International Women's Conference in 1985 in Nairobi to focus on the redistribution of power and control of resources in favour of women through positive intervention. The Programme of Action 1992 gave comprehensive parameters like enhancement of self-esteem and self-confidence, health, education, economic independences etc. for empowering women. According to the Census of India 2011, women constitute nearly 50 percent of population, perform two-thirds of the work and produce 50 percent of food commodities of our country. But they earn one-thirds of remuneration and own only 10 percent of property or wealth of the country and are still dominated by male in the society. It is general believed that one can tell the condition of a nation by looking at the status of its women. Economic dependence upon males is the one of the main reason for the exploitation of the females. Women empowerment and women entrepreneurship are closely associated with each other. Women entrepreneurship comes to be the best alternative for women empowerment due to lack of guaranteed employment. All women have some unrecognized skills which can be easily transformed in to earning sources. Economic empowerment increases women's access to economic resources and opportunities including jobs, financial services, property and other productive assets, skills development, decision making and market information. Most of the women are associated with home based enterprises due to the ability of a home based enterprise is to attract young women/mothers to work with the family and create a new concept of entrepreneurs, 'mompreneurs'. The enterprise enables them to keep up their professional, intellectual or artistic interest and earn income for the family without compromising the needs of the family. A home based enterprise is a modern form of cottage and village industry with new definition. Only difference of cottage industries and home-based enterprises is that the location of cottage industries is restricted in villages whereas the home-based enterprises are also located in urban and semi-urban areas. In this regard, a study was conducted in Sonitpur

## **RURAL UNORGANISED MANUFACTURING INDUSTRIES IN ASSAM: SOME ASPECTS OF GROWTH, STRUCTURAL CHANGE AND PRODUCTIVITY**

*Dilip Saikia\**  
and  
*Rupjyoti Borah\*\**

### **ABSTRACT**

*The present paper aims to analyse the performance of the rural unorganised manufacturing industries in Assam in the post-reform period. The analysis has brought out that the rural unorganised manufacturing industries in Assam have been undergoing considerable structural changes over time; the most domineering household-based enterprise segment, i.e., OAMEs, has been losing its share, in favour of the establishments. At the industry level, however, the preponderance of the agro-based group of industries such as food and beverages, textiles, and wood products remained untouched. Over time, the rural unorganised manufacturing industries have been deteriorating; output growth has been decelerating, while growth in the number of enterprises and employment has been negative during 1994-95/2010-11. The setback in the rural OAMEs has the onus of this deceleration; otherwise, the rural establishments witnessed a decent growth. Across industry groups, most of the industries have achieved a decent output growth at varying rates, whereas majority of the industries witnessed a considerable decline in the number of enterprises and employment. The consequences of such a pattern of job-loss growth are quite high growth in labour productivity and negative employment elasticity across industry groups. The paper emphasises the need for provisioning of training facilities leading to skill development, access to credit and market facilities, uninterrupted power supply, technology support, agricultural growth, and strong linkages between unorganised and organised enterprises, among others, for the growth of rural unorganised manufacturing in the State.*

**Keywords:** *Unorganised Manufacturing, Growth, Employment Elasticity, Structural Change.*

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# Women Empowerment through Women Entrepreneurship: A Study of Home Based Enterprises run by Women in Sonitpur District of Assam

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## Traditional Foods of Assam and its Commercialization

Pallabika Sarmah, Samutjal Saikia, Ashim Saikia

**Abstract:** All the people round the Globe have their local traditional food. The taste of the local traditional food differs according to one's social and cultural structure. The source of ingredients of every local traditional food is the nature and they prepare them according to their tradition and custom. The North-East of India, Assam, is full of variety of castes and creeds. And every caste has their own traditional food and a special traditional way of preparation. But, the local people of Assam use only certain specific ingredients to prepare their traditional dishes, of which 'Pork', Pastes prepared from mustard-oil seeds, pickles prepared from various fruits are the main or can be taken into accounts. These traditional foods of Dibrugarh District are also sent for marketing. Study on the use, preparation and popularization of such traditional food is observed in five different villages and sub-urban areas of Dibrugarh District. The fact and data on preparation and conservation of the local traditional foods have been collected through conversation with the needs of the families, shop-keepers, and other such people related with the process. The financial aspect covered provides financial support; scientific process of preparation of the traditional food is also included in this course of study

**Keywords:** Traditional foods, Commercialization, Dibrugarh, Assam.

### I. INTRODUCTION

Assam and the people of Assam are rich in traditional food. The variety in traditional food among the locals exists since old days. These traditional foods are collected, prepared and preserved in different scientific ways. The tasty traditional foods usually are collected from nature and they come under both the category of vegetarian and non-vegetarian. People collect these resources from nature, naturally or through systematic cultivation or through farming of cattle's or through fisheries. People prepare the traditional food both for personal and commercial purposes. The commercial aspect of the traditional food fetch them money for their livelihood. This becomes a major source of income mainly for the economically backward people. Market or marketing system existed in Assam since ages, where variety of material was also marketed along with varied food stuff. And these marketing, at last now have developed and these the shape of fall phased market. The world today has turned

into a global village. Improvement of transportation system, popularization of internet service, has much contribution to the world Globalization. This improvement has facilitated the traders to trade round the Globe, and the people all around also have got introduced to the different culture and traditions and their typical traditional food. People have started to adopt various scientific process in preparing various traditional foods like various cakes from rice powder, local dry fishes, pickle of various seasonal fruits, bamboo shoot Pickle, Pickles prepared from pork and duck meat, various dishes prepared from mustard-oil seeds and many such more. How these local traditional foods have been marketed is the study matter of this research (paper). Preparation, Presentation and commercialization in the subject-matter of this study with reference to social aspects.

### II. METHODOLOGY

This paper is basically prepared on analytical method based on primary sources and secondary sources of data such as books, journals, magazine, newspaper and internet. The following tools and methods are used for the purpose of the study and data collection: Unstructured Interview, Personal Interview, Group Interview, Observations method, Conversation, discussion.

### III. PROCESS OF DATA COLLECTION

The period study constituted from October 2017 to December 2018 covering 25 families from the five villages and in 20 commercial outlets. The study data's are purely based on the basis of verbal communication. The study is based on the source and naming of the local food products, its uses and food value, sale of such local production-preservation-packing system, evaluation of costing, popularizations of such local products. The data's and information's are formally noted for followed research work. Local beliefs on such products and its impact on sale and profit made out of it are also an area of this study.

### IV. AREA OF THE STUDY

Dibrugarh is one of the major and important District of North-East, India. The District is 27° 5'38" to North, 27° 42'30" to the Northern part, 94° 33'46" to East to 95° 29'8" is expanded. Dibrugarh has it area of 1,305.3 sq. Km with a population of 13,26,335 according to 2011 (year) census. Dibrugarh has it Geographical structure with Dhemaji Dist. To its North, Charaidew District and Arunachal Pradesh to its

Revised Version Manuscript Received on 16 September, 2019.  
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Retrieval Number: B154609K2S11192019QREJESP  
DOI: 10.35940/ijrte.B1546.09R2S1119

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Published By:  
Blue Eyes Intelligence Engineering  
& Sciences Publication







## THE ACADEMIC PRACTICE OF COMPARATIVE LITERATURE IN ASSAM: THE ROLE OF DIBRUGARH AND GAUHATI UNIVERSITY

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Article History: Received on 24<sup>th</sup> August 2019, Revised on 25<sup>th</sup> September 2019, Published on 30<sup>th</sup> October 2019

### Abstract

**Purpose:** This paper aims to present a picture of the evolution, present condition and the prospect of Comparative Literature in the academic world of Assam by mainly giving example of the numerous works done on the discipline in Assam, the syllabus of Dibrugarh and Gauhati University and the research works and projects done in these respective universities.

**Methodology:** The research methods mainly used in this study are analytical and survey methods. The necessary materials are collected from library and used, with proper observation and analysis, to justify the proposed ideas.

**Main Findings:** This paper, with clear data, seems to cast light on the trajectory of Comparative Literature in Assam, especially of the present situation and with the observation of these data, an effort is made to get a view of its prospect.

**Application:** Besides getting acquainted with the evolution of the discipline of Comparative Literature in Assam, this paper seems to be beneficial in comprehending the required adaptation and changes for the discipline in the current situation.

**Novelty/Originality:** The significance of this paper lies in its effort to give a critical look at the discipline from its beginning to the present situation and most importantly, the discussion of the lacks and faults of its practice and of various steps for the development of the discipline in the state will be very relevant and instrumental in the context of Assam.

**Keywords:** Academic Practice, Comparative Literature, Assam, School, University, Syllabus.

### INTRODUCTION

The discussion about the theory of Comparative Literature was started in the mid 20<sup>th</sup> century. The person who paved the way for the academic study of the subject is Jogeswar Sharma who in the journal of the Assam Sahitya Sabha of 1977, wrote an essay titled *Tulanamulak Sahitya* (Comparative Literature) where he discusses the theory of Comparative Literature and shows its importance. Another major development comes in the hands of a scholar named Prafulla kataki who wrote the first book about Comparative Literature titled *Tulanmulok Sahitya* (Comparative Literature) in the year 1989 (Bezborah, 2009). It is noteworthy to mention that it is Prafulla kataki who is considered, as supported by many books, the first person to bring out the subject of Comparative Literature. But it is Jogeswar Sharma who first brought the subject to the realm of literary discussion eleven years before Prafulla kataki. Nirajona Mahanta Bezborah in her book *Tulanamulok Sahitya Aru Sahityik Gobekhona* (Comparative Literature and Literary Research), published in 1994, writes "Comparative Literature in Assam is in a very nascent condition. In Assamese language, the subject had its beginning in Dr. Prafulla Kataki's book *Tulanamulok Sahitya* (1989)" (Bezborah, 1999). But we would like to inform, along with Nirajona, all the learned society of Assam that instead of Prafulla kataki's book, it is the article titled *Tulanamulak Sahitya* by Jogeswar Sharma written 11 years before Prafulla's book is the first essay written on Comparative Literature. But, unfortunately, the name of Jogeswar Sharma cannot be seen in the books pertaining to Comparative Literature written till today.

In the second half of the twentieth century, there were very few literary works produced that dealt with Comparative literature and only a handful of people were involved in bringing the subject into the academic world among which Jogeswar Sharma is the first who gave a clear idea about the subject. He published an article in the first volume of 'Asom Sahitya Sabha Patrika' of the 14<sup>th</sup> year in 1977 (Sharma, 1977) where he explains, in a very lucid manner, the nature of Comparative literature. In the article, he gives a brief description of the idea, purpose, scope, and discussion of Comparative Literature done in Western countries (Saikia, 2018; Bezborah, 2019). The idea that had its beginning in Sharma's article was strongly established by Prafulla Kataki in his book *Tulanamulok Sahitya* where he gives an idea about the definition, significance, scope, purpose, usefulness of Comparative Literature, World Literature, etc. Gradually, Comparative Literature drew the attention of the learned society and they started considering it as a subject of profound discussion. In the year 1992, a seminar was held at Dibrugarh University on Comparative Literature where eminent scholars like Mahendra Borah, Amresh Dutta, etc. put forwarded a very good discussion on Comparative Literature (Bezborah, 2013). By realizing the significance of the subject, the Assamese Department of Dibrugarh University, established in 1965, included three comparative Indian literature papers in its syllabus. But to have a clear and broad understanding of the subject, there was a lack of books apart from Prafulla Kataki's book. In order to make the subject clearer, other writers also tried to write books on the topic. For instance, Nirajona Mahanta Bezborah published a book titled *Tulanamulak Sahitya*

## Analysis of strength and threat of golden silk industry in Dhakuakhana, Assam

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### Abstract

Assam is one of the largest silk producing states in the country and having potential for production of three varieties of silk (mulberry, eri and muga or golden silk). Golden silk is one of the rarest silk in the world. Muga Silk of Assam was protected as a Geographical Indication (GI) from Assam in 2007. The Ahom rulers of Assam patronized the growth of muga silk as an industry in Assam. Assam alone produces 95% of the total golden silk of the world and Dhakuakhana produces around 40% of the total golden silk production of the Assam. Dhakuakhana is a place for pure and original muga silk. The agro climatic condition of Dhakuakhana is very suitable to increase productivity, quality and profitability of muga culture. Activities like cultivating muga worm and weaving high quality muga silk products are intimately linked with the culture and tradition of the people of Dhakuakhana since long past. Muga as a developmental enterprise is capable of generating potential employment in its various stages. Dhakuakhana is a hub of silkworm cultivation and muga production and the farmers, who face floods and erosion almost every year, depends on muga cultivation for livelihood. Golden silk production is not only considered as a tradition but also a living culture of Dhakuakhana as almost in every household of the villages of Dhakuakhana use to produce golden silk. The paper is mainly based on interaction with the people associated with research substation and departmental official of muga farm. Field visit to the various muga farm owned by individual along with the household visit to interact with the weavers are also considered. The study attempts to describe and analyse the present scenario of golden silk industry of Dhakuakhana.

**Keywords:** 1.Muga, 2.Tradition, 3.Employment, 4.Potential.

### Introduction:

Assam enjoys irrefutable reputation for its exquisite silk product and the silk industry of Assam mainly comprises the culture of eri, muga, and mulberry silk. Golden silk popularly known as 'Muga silk' of Assam is one of the rarest and expensive silks in the world. Golden silk is only produced in Assam and some parts of Garo hills all over the world. Assam produces 95 % of the total golden silk production of the world. The fact that sets this Silk apart from all other versions of silk is that it is totally golden yellow in colour. The word 'Muga' derived from the Assamese word which means yellowish therefore its known as muga silk. The Muga Silkworm exists from Mesozoic Era and cannot tolerate even the minimum pollution levels as it is very sensitive in nature. Golden silk is prepared from the semi-cultivated silkworm named '*Antheraea Assamensis*'. It is organic and natural and has the strongest natural fiber where the golden luster increases with age and any type of embroidery can be done on it. Golden silk is also known for its extreme longevity and durability. The Ahom rulers of Assam patronized the growth of Muga Silk as an industry of Assam, therefore the period between 1228-1828 during the reign of the Ahom rulers considered as the golden age of Muga Silk. The production of golden silk are mainly concentrated in Upper Assam and is predominant in the areas of Lakhimpur, Dimaaji, Sivasagar, Golaghat and Dibrugarh districts. Dhakuakhana of Lakhimpur district in upper Assam is known as 'Golden silk focus area of Assam. Dhakuakhana is one of largest producer of golden silk of Assam and high quality golden silk in Assam boasts here. Muga, 'the golden fibre' is produced in Dhakuakhana has also tremendous export potentiality because of its quality. Activities like cultivating muga worm and weaving high quality muga silk products are intimately linked with the culture and tradition of the people of Dhakuakhana since long past.

# INTEGRATED COMMUNITY BASED GOVERNMENTAL POLICIES FOR CONSERVATION OF WETLAND ECOSYSTEM WITH SPECIAL REFERENCE TO MAGURI- MOTAPUNG WETLAND OF TINSUKIA DISTRICT, ASSAM

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*Abstract:* Wetland is the home of many species and also support livelihood of many people. It is a transitional area between terrestrial and open water system. It is a crucial resource of income generation. In this paper we emphasise on the government policies

**International Journal of Civil Engineering and Technology (IJCIET)**

Volume 10, Issue 11, November 2019, pp. 229-234, Article ID: IJCIET\_10\_11\_023

Available online at <http://www.iaeme.com/ijciyet/issues.asp?JType=IJCIET&VType=10&IType=11>

ISSN Print: 0976-6308 and ISSN Online: 0976-6316

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# **FLOOD FREQUENCY ANALYSIS USING GUMBEL'S DISTRIBUTION METHOD: A LOWER DOWNSTREAM OF LOHIT RIVER (DANGORI RIVER), ASSAM (INDIA)**

**Sonowal Gulap**

Research Scholar, Geography Department, Cotton University, Guwahati, India

**Thakuriah Gitika**

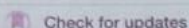
Assistant Professor, Geography Department, Cotton University, Guwahati, India

**ABSTRACT**

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*Flood frequency analysis is a statistical analysis in hydrology. It is used to estimate the magnitude of floods at a particular location for a given return period. The Gumbel distribution method is one of the most widely used methods for flood frequency analysis. In this study, the Gumbel distribution method is used to estimate the magnitude of floods at the lower downstream of the Lohit River (Dangori River), Assam (India). The results of the analysis show that the magnitude of floods at the lower downstream of the Lohit River (Dangori River), Assam (India) is estimated to be 1000 cumecs for a return period of 100 years.*

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Cite this: *Org. Biomol. Chem.*, 2019, **17**, 6450Received 17th May 2019.  
Accepted 14th June 2019  
DOI: 10.1039/c9ob01157a  
rsc.li/obc

## Aryne insertion into the P=O bond: one-pot synthesis of quaternary phosphonium triflates†

Kashmiri Neog,<sup>a,b</sup> Dhiraj Dutta,<sup>a,b</sup> Babulal Das<sup>c</sup> and Pranjal Gogoi<sup>\*a,b</sup>

A novel transition-metal free synthetic strategy has been developed for the direct synthesis of quaternary phosphonium triflates *via* insertion of aryne into phosphine oxide. This methodology provides good yields of quaternary phosphonium salts and one of the synthesized phosphonium salts has been unambiguously established by single crystal XRD study. Preliminary mechanistic studies suggest that the reaction proceeds *via* a sequential [2 + 2] cycloaddition followed by the *o*-arylation and protonation pathway.

## Introduction

Organophosphorus compounds are an important class of organic compounds that have gained much attention among chemists due to their broad spectrum of applications in various promising areas, such as medicinal chemistry,<sup>1</sup> organic synthesis,<sup>2</sup> natural products,<sup>3</sup> materials chemistry,<sup>4</sup> catalysis and coordination chemistry.<sup>5</sup> Aryl substituted organophosphorus compounds and their derivatives have particularly gained importance as targets for synthesis due to their unique physicochemical and biological properties, which are influenced by the C(sp<sup>2</sup>)-P bond between the phosphorus and the arene. Therefore, the construction of the C(sp<sup>2</sup>)-P bond is one of the most important and fundamental methods to synthesize organophosphorus compounds in organic synthesis. The classical synthetic methods for the construction of the C-P bond rely on the transition-metal-catalyzed cross-coupling reactions as well as reactions of phosphine reagents with C(sp<sup>2</sup>)-halides or pseudo halides.<sup>6</sup> Later on, various Cu,<sup>7</sup> Ni<sup>8</sup> and Mn<sup>9</sup> catalyzed or mediated synthetic strategies have been developed for the synthesis of aryl substituted organophosphorus compounds. Among organophosphorus compounds, quaternary aryl phosphonium salts are also promising compounds,<sup>10</sup> which are extensively used as Lewis acid reagents,<sup>11</sup> phase-transfer catalysts,<sup>12</sup> ionic liquids,<sup>13</sup> and anti-cancer agents<sup>14</sup> as well as in drug delivery.<sup>15</sup> Although there are several methods

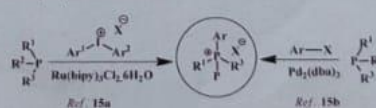
for the synthesis of organophosphorus compounds, synthetic methods for quaternary phosphonium salts are very rare (Scheme 1).<sup>16</sup> In this regard, metal-catalyzed coupling of phosphines with aryl halides and hypervalent iodine is known but it requires high reaction temperatures and expensive reagents. Therefore, the development of a reliable synthetic strategy for the synthesis of quaternary phosphonium salts *via* the construction of the C(sp<sup>2</sup>)-P bond from readily available starting materials under mild reaction conditions is still a challenge for chemists.

On the other hand, arynes are highly reactive transient intermediates, which have emerged as powerful synthons for various carbocycles,<sup>17</sup> heterocycles<sup>18</sup> and natural products.<sup>19</sup> Although there are several synthetic protocols for the generation of arynes, the use of 2-(trimethylsilyl) aryltriflates<sup>20</sup> as mild aryne precursors has led to the rapid growth of this field. Due to their high reactivity, arynes undergo various interesting reactions including nucleophilic addition,<sup>21</sup> [2 + 2] cycloaddition and Diels-Alder reactions.<sup>22</sup> Additionally, this intermediate could be used for the direct *ortho*-functionalization of

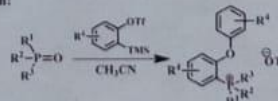
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† Electronic supplementary information (ESI) available. CCDC 1888261. For ESI and crystallographic data in CIF or other electronic format see DOI: 10.1039/c9ob01157a

## (a) Previously reported methods:



## (b) Our approach:



Scheme 1 Reported and our approach for the quaternary phosphonium salt.

## Three-Component Coupling Reactions of Aryne, DMSO, and Activated Alkyne: Stereoselective Synthesis of 2-[(*o*-Methylthio)aryloxy]-Substituted Dialkyl Maleates

Hemanta Hazarika,<sup>†,‡</sup> Kashmiri Neog,<sup>†,‡</sup> Abhilash Sharma,<sup>†,‡</sup> Babulal Das,<sup>§</sup> and Pranjal Gogoi<sup>\*,†,‡,§</sup><sup>†</sup>Applied Organic Chemistry Group, Chemical Science and Technology Division, CSIR-North East Institute of Science and Technology, Jorhat 785006, India<sup>‡</sup>Academy of Scientific and Innovative Research (AcSIR), CSIR-NEIST Campus, Jorhat 785006, India<sup>§</sup>Department of Chemistry, Indian Institute of Technology Guwahati, Guwahati 781039, India

### Supporting Information



**ABSTRACT:** A transition-metal-free coupling reaction of aryne, DMSO, and activated alkyne for the synthesis of 2-[(*o*-methylthio)aryloxy]-substituted dialkyl maleates is reported. This cascade process is associated with several bond cleavage as well as bond formation reactions in one pot. One of our synthesized maleates has been unambiguously established by single-crystal XRD studies. This methodology allows preparation of trisubstituted vinyl ethers with excellent stereospecificity.

Arynes are one of the most important classes of transient species that have emerged as powerful synthons and widely used in the synthesis of various functionalized arenes,<sup>1</sup> heterocycles,<sup>2</sup> and complex natural products.<sup>3</sup> This versatile reactive intermediate could be achieved in situ from its corresponding precursors using appropriate reagents and conditions. However, fluoride-induced generation of aryne using readily available Kobayashi's aryne precursor<sup>4</sup> is broadly accepted and frequently used for aryne-based synthetic methodologies. In aryne chemistry, the synthesis of functionalized arenes, particularly *ortho*-functionalized arenes, by nucleophilic additions followed by trapping of electrophiles is the fundamental reaction mode. Additionally, multicomponent reactions<sup>5</sup> and dipolar cycloaddition<sup>6</sup> strategies have also been developed for difunctionalization of arenes with two important functional groups into adjacent positions of aromatic framework through the formation of carbon–carbon and carbon–heteroatom bonds. Insertion of aryne into  $\sigma$ -bonds and  $\pi$ -bonds has gained more preference over others for the synthesis of *ortho*-functionalized arenes. Aryne insertion into the methylene–carbonyl  $\sigma$ -bond,<sup>7</sup> C=C bond,<sup>8</sup> C=O,<sup>9</sup> various amides including DMF,<sup>9*a*,10</sup> P–O,<sup>11</sup> and I–I<sup>12</sup> bonds for the synthesis of 1,2-disubstituted arenes has been reported. This synthetic protocol offers a potent and valuable tool for the rapid construction of complex molecules in a highly atom-economic way.

On the other hand, aryl sulfides are important structural units present in pharmaceuticals and materials.<sup>13</sup> They have been used as synthetic intermediates and also as chiral ligands

in organic synthesis.<sup>14</sup> Additionally, the oxidized forms of aryl sulfide such as sulfoxide and sulfone are also important functional groups present in pharmaceuticals.<sup>15</sup> Thus, the construction of the Csp<sup>2</sup>–S bond is an important and challenging task for chemists. Traditionally, this relied on transition-metal-catalyzed coupling reactions between organic halide and sulfur nucleophile, which are air-sensitive and odorous.<sup>15</sup> Therefore, development of transition-metal-free synthetic strategies for the synthesis of aryl sulfides is highly desirable. Synthesis of aryl sulfides via aryne has received tremendous attention as this strategy could be designed for the installation of other important functional groups along with the sulfide moiety. Nucleophilic addition or insertion into aryne followed by electrophilic trapping cascade reactions made it feasible in a single operation. Therefore, several transition-metal-catalyzed as well as transition-metal-free synthetic routes for the synthesis of functionalized aryl sulfides from aryne have been developed. Transition-metal-free synthesis of functionalized aryl sulfides from arynes proceeds via [2 + 2] or [3 + 2] cycloaddition of aryne with thioethers, sulfoxide, or vinyl sulfoxides. The reaction of arynes with thioethers bearing  $\alpha$ -CH protons<sup>16</sup> or lacking  $\alpha$ -CH protons<sup>17</sup> were well studied and used for the synthesis of various sulfur-containing valuable products. Surprisingly, the insertion of arynes into the S–O bond of sulfoxides is rare, which proceeds via four-membered cycloadduct product followed by cleavage of the S–O bond,

Received: January 10, 2019

Published: April 3, 2019

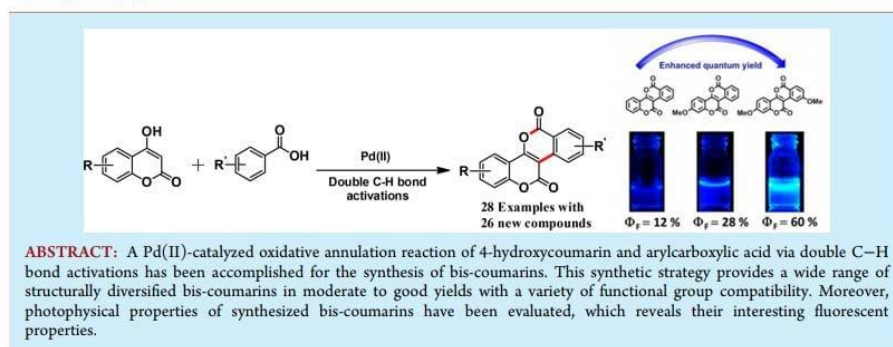
## Pd(II)-Catalyzed Oxidative Annulation via Double C–H Activations: Synthesis and Photophysical Properties of Bis-Coumarins

Kumud Sharma,<sup>†,‡</sup> Kashmiri Neog,<sup>†,‡</sup> and Pranjal Gogoi<sup>\*,†,‡</sup>

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### Supporting Information

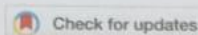


Coumarin is one of the most widely found skeletons in nature.<sup>1</sup> It constitutes the central core unit of many natural products and exhibits interesting biological properties, including antioxidant, anti-inflammatory, anticancer, and antimicrobial activities.<sup>2</sup> Due to its wide availability and unique properties, the  $\pi$ -extended version of it has become an area of interest and several such compounds have been developed for photonic applications.<sup>3</sup> Coumarin compounds exhibit interesting photophysical properties, including strong light absorption,<sup>4a,b</sup> high fluorescence quantum yields,<sup>4c</sup> and large Stokes shifts.<sup>5</sup> As a result, they have been widely used in fluorescent probes,<sup>6a,b</sup> two-photon fluorescence microscopes,<sup>6c,d</sup> OLEDs,<sup>7a,b</sup> dye-sensitized solar cells,<sup>7c</sup> photolabile materials,<sup>7d,e</sup> and other electronic devices. With regard to  $\pi$ -extended coumarins, benzocoumarins are common and were initially synthesized by Pechmann in 1984.<sup>8a</sup> Later, various synthetic protocols such as Knoevenagel condensation followed by intramolecular cyclization,<sup>8c,8b</sup> electrophilic substitution of naphthols with  $\beta$ -keto esters followed by cyclization,<sup>8c,d</sup> and metal-catalyzed reactions<sup>8e,f</sup> have been developed for the synthesis of benzocoumarins.

On the other hand, heterocycle-fused coumarin derivatives make up another important and emerging subarea of  $\pi$ -extended coumarins, where various heterocycle units are annulated to coumarin to enhance photophysical properties. Additionally, the introduction of a heterocycle to coumarin is a powerful approach for controlling the photophysical properties

of coumarins for photonic applications. With regard to the synthesis of coumarin-fused heterocycles, several such compounds have been synthesized and their photophysical properties were evaluated. Among coumarin-fused heterocycles, bis-coumarins are highly targeted and have been synthesized using diverse synthetic methods. Taniguchi and co-workers synthesized some S-shaped bis-coumarins using double Pechmann reactions.<sup>9a</sup> Kim and co-workers developed some high-planarity bis-coumarins using  $BBr_3$ -promoted lactonization of *p*-terphenyldicarboxylic acid derivatives.<sup>9b</sup> Some novel types of bis-coumarins were synthesized by Gryko and co-workers using modified Knoevenagel bis-condensation followed by oxidative aromatic coupling reactions.<sup>9c,d</sup> Another interesting bis-coumarin fused in the pyran-2-one ring, i.e., chromeno[3,4-*c*]chromene-6,7-diones, could be synthesized using two different ways by heating 3-methoxyphenol with diethyl ethoxymethylenemalonate or 2-oxo-2*H*-chromene-3-carboxylate derivatives in the presence of a Lewis acid.<sup>10</sup> A similar bis-coumarin, isochromeno[4,3-*c*]chromene-6,11-dione, is also known; however, a few studies have been devoted to their synthesis. Pechmann condensation of 4-hydroxycoumarin with ethyl 2-oxocyclohexane-carboxylate followed by dehydrogenation,<sup>11a</sup> reaction of 4-hydroxycoumar-

Received: November 4, 2019

Cite this: *Org. Biomol. Chem.*, 2020, **18**, 9549

## Recent advances in the synthesis of organophosphorus compounds via Kobayashi's aryne precursor: a review

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Organophosphorus compounds are important structural motifs that unveil enormous applications, particularly in the field of organic synthesis, agriculture, materials science and medicinal chemistry. Additionally, ortho-substituted arylphosphorus compounds have played an important role in homogeneous catalysis. Though there are several synthetic pathways for the synthesis of organophosphorus compounds, this review is particularly focused on aryne-based methodologies reported in the literature to date.

Received 29th September 2020.

Accepted 9th November 2020

DOI: 10.1039/d0ob01988g

rsc.li/obc

## 1. Introduction

Phosphorus-based compounds are important scaffolds that have gained tremendous attention owing to their profound prevalence in various promising areas, such as organic synthesis,<sup>1</sup> agriculture, medicinal chemistry,<sup>2</sup> materials chemistry,<sup>3</sup> natural products,<sup>4</sup> catalysis and coordination chem-

istry.<sup>5</sup> Some important bioactive organophosphorus compounds are shown in Fig. 1.

Among the rich array of organophosphorus compounds, particularly arylphosphorus and their derivatives are of growing importance for specific targets due to their fascinating biological and physicochemical properties. The unique C–P bond between phosphorus and arene plays a crucial role in achieving such properties. In view of their applications, various approaches have been made during the past few decades towards the synthesis of this structural motif. A literature study reveals that the classical method of C–P bond formation usually depends on transition-metal instigated coup-

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Pranjal Gogoi

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## ৰামধেনুত প্ৰকাশিত নৱকান্ত বৰুৱাৰ কবিতা আৰু ইয়াৰ ভাষাশৈলী

ড° পল্লাবিকা শৰ্মা

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### সংক্ষিপ্ত-সাৰ :

ৰামধেনুৱে অসমীয়া কাব্য সাহিত্যত যুগ পৰিৱৰ্তনৰ আগলি বতৰা ঘোষণা কৰিলে। নতুন ভাব, ভাষা আৰু আংগিকৰ সম্পৰ্কৰে ৰামধেনু আলোচনীয়ে যি ধাৰাৰ সৃষ্টি কৰিলে পৰৱৰ্তী সময়তো সেই ধাৰা প্ৰৱাহিত হৈয়ে থাকিল। ৰামধেনুৰ কবিতা নতুন ছন্দ-ইডিয়ম আৰু ভাষাৰ অন্নিৱৰ্ত্তৰে আধুনিক মানুহৰ অৰ্ন্তজগতৰ অভীপ্সা-অভিজ্ঞতা আদিৰ বিচিত্ৰ প্ৰকাশেৰে সাৱলীল ৰূপত প্ৰাণ পাই উঠিল। ৰামধেনুৰ পাতত কবিতা ৰচনা কৰি প্ৰসিদ্ধি লাভ কৰা নৱকান্ত বৰুৱা আধুনিক অসমীয়া কাব্য-কাননৰ এক উল্লেখযোগ্য নাম। নতুন ভাব, বিষয়বস্তু আৰু আংগিকেৰে নৱকান্ত বৰুৱাৰ কাব্য-ভাগীমাই আধুনিক অসমীয়া কবিতাক সমৃদ্ধিশালী ৰূপত গঢ়ি তুলিলে। নৱকান্ত বৰুৱাৰ কবিতাৰ বিষয়বস্তুত দৈনন্দিন বাস্তৱতাৰ ছবিহে প্ৰকটিত হৈ উঠিছে। এক গভীৰ ভাববোধৰ বিশ্লেষণ, গতানুগতিক জীৱন চিত্ৰ, সমসাময়িক ঘটনা প্ৰৱাহৰ প্ৰদাহ, প্ৰতীক-চিত্ৰকল্প আৰু সাংগীতিক লয়যুক্ত ভাষাৰ সাৱলীল বিচৰণে তেওঁৰ কবিতাত নতুনত্বৰ সূচনা কৰিছে। ৰামধেনুৰ বিভিন্ন সংখ্যাত প্ৰকাশিত নৱকান্ত বৰুৱাৰ কবিতাৰ সংখ্যা হৈছে ১৪ টা আৰু সেইকেইটা হ'ল : 'মহাকাব্যৰ পাণ্ডুলিপি', 'নিদান', 'পঁচিশ ডিচেম্বৰ', 'সন্ধি তোমাৰ স'তে', 'এটি প্ৰেমৰ পদ্য', 'বোধিক্ৰমৰ খৰি', 'প্ৰাৰ্থনাঃ আকাশৰ প্ৰতি খিৰিকীৰে', 'অৰ্জুন', 'বশিষ্ঠত পিকনিক', 'আধা ডজন কবিতা', 'চকুপানীঃ ফাণ্ডনৰ' আৰু 'আইলৈ চিঠি : নৱকৰ পৰা' আৰু 'জোখ'। প্ৰস্তাৱিত গৱেষণা পত্ৰৰ বিষয়ৰ পৰিসৰত নৱকান্ত বৰুৱাৰ দ্বাৰা ৰচিত ৰামধেনুত প্ৰকাশিত কবিতাসমূহৰ আধাৰতেই তেওঁৰ কবিতাৰ বিষয়বস্তুৰ আৰু ভাষাশৈলীৰ বিশ্লেষণ কৰা হ'ব। এই বিষয়ৰ বিশ্লেষণে নৱকান্ত বৰুৱাৰ কাব্যালোচনাৰ ক্ষেত্ৰত এক নতুন দিশৰ উন্মোচন ঘটাব বুলি

আশা প্ৰকাশ কৰিয়েই এই গৱেষণা পত্ৰখন যুগত কবি উলিওৱা হৈছে। গৱেষণা পত্ৰখন প্ৰস্তুতকৰণৰ ক্ষেত্ৰত বিশ্লেষণাত্মক পদ্ধতিৰ অৱলম্বন কৰা হৈছে।

সূচক শব্দ : ৰামধেনু, নৱকান্ত বৰুৱা, কবিতা, ভাষাশৈলী।

### ০.০ প্ৰস্তাৱনা :

অসমীয়া সাহিত্যৰ প্ৰতিটো আন্দোলন বা যুগান্তৰ একোখন আলোচনীক কেন্দ্ৰ কৰি গঢ় লৈ উঠিছে। অসমীয়া সাহিত্য ইতিহাসৰ বিশাল আৰু বৰ্ণাঢ্য পাত লুটিয়ালে বিভিন্ন আলোচনীৰ মাজত বিশেষ লক্ষণাক্ৰান্ত সাহিত্যিক আন্দোলনে আত্মপ্ৰকাশ কৰা পৰিলক্ষিত হয়। জোনাকী যুগ (১৮৮৯-১৯০০), আৱাহন যুগ (১৯২৯-১৯৩৯) আৰু ৰামধেনু যুগ (১৯৫২-১৯৬২)ত ৰচিত নানাৰঙী সুষমাৰে মণ্ডিত ভিন্ন স্বাদৰ নতুন লেখকৰ সাহিত্যৰাজিয়ে অসমীয়া সাহিত্যক নতুনত্বৰ লগতে পৰিপুষ্টি প্ৰদান কৰিছে। ৰামধেনু যুগটিক অসমীয়া সাহিত্যৰ স্বৰ্ণযুগ বুলি ক'লেও হয়তো অতুক্তি কৰা নহ'ব। নতুন লেখক সৃষ্টি আৰু ভিন্ন স্বাদধৰ্মী সাহিত্য সৃষ্টিৰে ৰামধেনু যুগৰ সাহিত্যই অসমীয়া সাহিত্যত এক নতুন ধাৰাৰ সংযোজন ঘটালে। "ৰামধেনুও ওলাই আহিছিল আৱাহনৰ পেটৰ পৰাই; কিন্তু যি স্থলত আৱাহনে আত্মসাৎ কৰিছিল কুৰি শতিকাৰ প্ৰথম তিনিটা দশকৰ অভিজ্ঞতা আৰু ভাবাদৰ্শক সেই স্থলত ৰামধেনুৰ উত্তৰাধিকাৰৰ লগত যুক্ত হৈছিল তাৰ পৰৱৰ্তী দুটা দশকৰ ঐতিহাসিক অভিজ্ঞতা, সামাজিক চিন্তা আৰু সাহিত্যিক প্ৰভাৱ। ঐতিহাসিক অভিজ্ঞতা, সামাজিক চিন্তা আৰু মানুহৰ চিত্তভূমিক দ্বিতীয় বিশ্বযুদ্ধই পৃথিবীখনক আৰু মানুহৰ চিত্তভূমিক প্ৰচণ্ডভাৱে জোকাৰি পেলোৱা যি ভূমিকম্পৰ সৃষ্টি কৰিছিল সি কঁপাই তুলিছিল অসমীয়া লেখকসকলৰ চিত্তভূমিকো।" (বৰগোহাঞি উঃ নাই)

## PalArch's Journal of Archaeology of Egypt / Egyptology

### The Study Of The Ancient Temples Of Tezpur

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**Boby Kalita, Rudrakshi Saikia, The Study Of The Ancient Temples Of Tezpur- Palarch's Journal Of Archaeology Of Egypt/Egyptology 18(4). ISSN 1567-214x, Key words : Tezpur, Shiva, Sakta, Ganpatya, Vishnu.**

#### Abstract

Assam, one of the seven sisters of North-East India, is a collage of various cultural factors, which makes it special in the entire peninsula. Sonitpur, which is a historical district of Assam, plays an important role in the cultural background of Assam. It is located in central Assam and is a combination of numerous cultural as well as religious tribes. The Shaiva-Sakta temples, Namghars, Vaishnav Satras etc. provide a vivid picture of the rituals, traditions, beliefs and magnificent architecture of ancient Assam.

The whole Sonitpur district is evenly distributed with Shaiva, Sakta, Vishnu, Gauriya and Ganpatya temples. These religious institutions have witnessed daily worshippings of innumerable devotees from time immemorial. These temples have, both directly and indirectly, helped in establishing and strengthening the morality as well as spirituality of the population.

**Key words :** Tezpur, Shiva, Sakta, Ganpatya, Vishnu.

#### INTRODUCTION

Likewise India, Assam is also a rainbow land of different religions. Religion is undoubtedly an important fertilizer in the evolution of mankind. Proper analysis of the entire process of evolution of human beings shows that a society cannot exist without any religion. Thus, we can say that it is religion that holds our existence as well as the existence of the society. Religion, however, has different meanings. The dictionary says that 'religion is good company.' According to the rationalist philosophers, 'religion is that part of human psychology which gives birth to complete devotion towards the supreme power, i.e. God.' According to Sarvapalli Radhakrishnan, 'religion is the intro spection of truth.'

We cannot, and must not, ignore religion in the current age of scientific development. In fact, science and religion are the two sides of the same coin. Religion has many rituals, traditions and beliefs attached to it. This results in the formation of many temples, Devalayas, Satras, Church, Mosques, Gurudwaras etc. all these institutions bind the population with an invisible thread of unity and system.

## Analysis of the element of Confession in Kamala Das' poetry.

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### Abstract

Kamala Das is a modern Indian poet who emphasises on various issues relating to modern society and its impacts on her life. This paper will try to shed light on how Kamala Das made the use of confessional technique in her poems to express her personal experiences to offer a critique of the contemporary society. This paper will attempt to show Kamala Das frankness and candor in the treatment of a subject, with reference to some of her poems like; An Introduction, My Grandmother's House, The Suicide and The Old Play House.

**Keywords:** Confession, Criticism, Oppression, Marriage

The confessionalism is a poetic device, used by poets to reveal extremely confidential and private matters of their lives. In the second half of the twentieth century, a group of American poets started writing on a highly subjective matter. This group of poets includes Robert Lowell, John Barryman, W.D Snodgrass, Theodore Roethke, Sylvia Plath, and Anne Sexton, who gives expression of personality without any escape in their poems. This group establishes the confessional pattern in poetry.

There were poets from India like Mamta Kalia, Eunice de Souza, Malanie Silgado etc, who took up this confessional pattern of poetry. Among these writers Kamala Das excels the position. She started writing in open form and in open language. Her poetry displays her courage to criticize the traditional bound conservative society which was harsh on her unconventional life style. She is a confessional writer also in the sense that she brings awareness to her female counterparts about their dormant sexual desires and their unfulfilled sexual relation with their husbands which they try to suppress for fear of societal censure. As a good confessional writer, she writes about subjects which are considered as a taboo for a woman, like speaking about sexual acts, sexual desires, description of private body parts, extramarital affairs and the like.

She confesses a lot of things about herself. She celebrates the body and is not ashamed of its needs. She is not comfortable with the patriarchal system, which refuses to give women space and fixes to roles of a good daughter or a good wife or a good mother.

What leads Kamala Das to adopt the confessional mode of writing? She thought herself to be a victim of male dominated society. Having personally experienced husband's ill treatment of her, she could not help giving vent to her grievances in her poems. Her confessional writing has a therapeutic effect on her as it is written when the writer undergoes intense grief or resentment from which she would like to get relief. Her poetry is largely confessional and autobiographical in that the most important concern of her as a poet is sexual frustration and



A STYLISTIC STUDY OF LAKSHMINATH BEZBARUAH'S BURHI  
AAIR XADHU (GRANDMA'S TALE)

Dr. Dulal Chandra Das\*

ABSTRACT

Since its first publication, Lakshminath Bezbaruah's '*Burhi Aair Xadhu*' has already passed more than a century. It was the first compilation of folk tales published in Assamese language. The tradition of telling folk tales present in almost in every society of the world. India is no exception of that tradition. In the glorious tradition of storytelling, since the *Panchatantra*, the earliest example of the tradition in the Indo-European languages followed by Arabian Nights, the *Pentameran*, etc., we can mention the Grimm brothers' fairy tale book "*Kinder Und Haus*" published in 1812, which was the first modern compilation of folk tales. Similarly, '*Burhi Aair Xadhu*' the first compilation or collection of Assamese folk tales published in the year 1911.

**Keywords :** Style, prose, Burhi Aair xadhu, Assamese.

**Introduction :**

The language of folk tales compiled in '*Burhi Aair Xadhu*' differs in various ways from the language of other literary works of Lakshminath Bezbaruah. The language of '*Burhi Aair Xadhu*' has its own style. Folk tales are mainly didactic and child-centred. Therefore, in folk tales' simple language is used to attract children. Lakshminath Bezbaruah also changed the linguistic style of tales which were collected by him. After collecting the stories, he had rewritten the tales in a new style changing the language and structure of the stories suitable for the simple psychological framework of the child.

Apparently, the language used in the folk tales is usually the language used by the people in general conversation or colloquial language or may be termed as the folk language. In the introduction of the '*Burhi Aair Xadhu*' Bezbaruah clearly stated that, "Language and folk tales are the backbones of a nation. The Assamese regard their language as their mother and folk tales as the noble speech".

Apart from the substantial application of the colloquial words and phrases, we get the genuine taste of

the peculiar literary and linguistic style of Lakshminath Bezbaruah in '*Burhi Aair Xadhu*'. His unique style of expression, narrative technique and selection and application of words contributed in enhancing its beauty and rich character. Therefore, it is very important to study the prose style of '*Burhi Aair Xadhu*'.

**Content Analysis**

Through the literary analysis of the works of a writer his personality, his ideals and his outlook towards the contemporary issues can be appreciated. Stylistics explores the wisdom of a writer's linguistic ability through a discussion of his linguistic essence. This linguistic ability of the author is complemented by grammatical aspects and skill in the use of words and this is considered to be the style of a writer. For example, syntax, direct speech, dramatic dialogue, idioms, adjectives, adverbs, conjunctive adverbs, use of quotations from the canons, use of figurative expressions, proverbs, use of standard and dialectal vocabulary, etc. as well as rhetorical elements are some of such linguistic tools. Literary quality of a text is enhanced by the clever use of rhyme, metaphor, essence, pun, syntax, distortion,

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## The Journey Of “Dalits” From Dalit Writing To Visual Art: An Illustration

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**ABSTRACT:** The paper deals with the exploration of Dalit writing to the aesthetics of film culture. It is a study on the journey from the Dalit literary genre to the cinematic creation of the Dalit exponent. Dalit literature of today tends to be more realistic as it is the expression of first hand experiences, which the Dalit had been confronting in their life. This paper aims to throw light on the presence of Dalit realities which is not only restraint to movement but also to literature and visual arts. But it is believed that the upper caste Brahmanical society has been dealing with the Dalits inferiorly, and their representation of Dalits in the art and culture is misinterpreted. Because of their preconceived notion about Dalits, the upper castes writers and directors from the big cities often portrays Dalit issues in a biased way for which the actual display of Dalit injustice remains always blur. Therefore, this paper is an attempt to showcase the vulnerability of the representation of Dalits in the society through art and literature.

**Keywords:** Dalits, untouchable, film, Dalit literature.

### INTRODUCTION

The term ‘Dalit’ literally means ‘oppressed’ and is considered to be a class subjected to untouchables, downtrodden and discriminated from the mainstream society of India. Etymologically, the word ‘dalit’ comes from the Sanskrit which means ‘crushed’ or ‘broken of pieces’. In society, Dalits have been designated to a certain class of work which is inferior to the others, such as manual laborers, butcher, animal carcasses and waste and sewers, by the upper class Hindu society. There are many different names proposed for defining this group of people like ‘Ashprosh’ (Untouchable), ‘Harijans’ (Children of God) ‘Dalits, (Broken People) etc.


The origin of caste system is in India. The caste system divides Hindus into four groups based on their karma which means works and dharma. These four main categories are –Brahmins (teachers and intellectuals), Kshatriyas(rulers and fighters), Vaishyas(traders), Shudras(low graded workers).Beside these four categories there is one more category which is known as

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Visual Art: An Illustration

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Scopus Indexed

**International Journal of Advanced Research in Engineering and Technology (IJARET)**  
Volume 11, Issue 12, December 2020, pp. 2358-2367, Article ID: IJARET\_11\_12\_223  
Available online at <http://www.iaeme.com/ijaret/issues.asp?JType=IJARET&VType=11&IType=12>  
ISSN Print: 0976-6480 and ISSN Online: 0976-6499  
DOI: 10.34218/IJARET.11.12.2020.223

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## **A STUDY ON THE BANK EROSION BY THE RIVER JIA BHARALI AND ITS IMPACT ON THE PANCHMILE AREA OF TEZPUR TOWN, ASSAM (INDIA)**

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### **ABSTRACT**

*The problem of bank erosion by the river is becoming very serious day by day. The state of Assam in India is such a flood affected region which bears the brunt of bank erosion by the mighty river Brahmaputra and its tributaries in every rainy season. The flood and bank erosion by the river Jia Bharali, a right bank tributary of the Brahmaputra, have been creating havoc in the Panchmile area of Tezpur town for the last few decades. Due to its increasing erosive intensity day by day the Panchmie area is now under severe threat of erosion and the river start to shift towards north-west, if it's shifting continues then it will be a thinkable matter for the people of Tezpur town in near future. Keeping this in mind, an attempt to study about the bank erosion problem of Panchmile area and its consequent impact in details with the help of geo-spatial tools is made.*

**Keywords:** Bank erosion, flood, geo-spatial tools, mighty river.

**Cite this Article:** Niha Dutta, Gulap Sonowal and Gitika Thakuriah, A Study on the Bank Erosion by the River Jia Bharali and its Impact on the Panchmile Area of Tezpur Town, Assam (India). *International Journal of Advanced Research in Engineering and Technology*, 11(12), 2020, pp. 2358-2367.  
<http://www.iaeme.com/IJARET/issues.asp?JType=IJARET&VType=11&IType=12>

### **1. INTRODUCTION**

'Erosion, transportation and deposition are the key functions of a river through which it creates different landforms and brings about changes in its course. When the river overflows its banks, it creates natural calamities including flood, erosion and sedimentation' (Baishya,

## Shortage of Food and Water! Man-Elephant Conflict in the Boraligaon Village of Kaliabor Sub-Division of Nagaon District, Assam (India)

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Received November 12, 2020; Revised December 13, 2020; Accepted December 20, 2020

**Abstract** Man-elephant conflict is not a new topic in today's world as it becomes a universal problem due to its frequent occurrence in many parts of the world. The damages and destructions caused by wild elephants is real and significant danger to human life as well as their properties. Most of the elephants often venture into villages during night time in the search of food, water and living space. The herd of wild elephants always trigger panic among the local people of Boraligaon village of Nagaon district (Assam) during harvesting season which have remained unaddressed for the people of Assam due to lack of proper communication. Thus, this paper is an attempt to assess the nature of man elephant conflict with its impact in the study area of Boraligaon village. Keeping this in mind, it has been tried to highlight the key issues using primary information as well as secondary collected from various sources. The continuing man-elephant conflict during winter season has taken a serious turn in the study region damaging most of the paddy fields in the time of harvesting which is an outcome of habitat loss and food and water shortage of wild elephants. This conflict may be a never-ending process, but its risk can be lowered down by adopting some scientific and systematic initiatives as well as their proper monitoring in timely.

**Keywords:** conflict, habitat loss, harvesting, paddy field

**Cite This Article:** Niha Dutta, "Shortage of Food and Water! Man-Elephant Conflict in the Boraligaon Village of Kaliabor Sub-Division of Nagaon District, Assam (India)." *Applied Ecology and Environmental Sciences*, vol. 9, no. 1 (2021): 86-91, doi: 10.12691/aees-9-1-14.

### 1. Introduction

Man elephant conflict is a serious concern in most of the world's countries and becomes a universal problem. 'Each year, man-elephant conflict results in approximately 100 to more than 500 human deaths and damage to 10,000-15,000 houses and 8-10 million hectares of crops, while over 200 elephants die due to human-related activities including poaching for ivory or meat, poisoning, cattle-borne diseases, electrocution and collision with trains' [1]. In simple words, man-elephant conflict refers to the interactions between humans and elephants that often resulting in detrimental impacts for both species. But now question is that why does this conflict occur again and again? What are the main reasons behind this conflict? Basically, national parks, wildlife sanctuaries, safari parks, protected areas are the actual habitat and ideal environmental conditions for elephants which are now very close to or adjoining human settlements in most parts of the world. As a result, whenever this beautiful creature of nature comes into contact with landscapes dominated by human in search of living space and food they pose a great threat to human beings and their properties. 'But now varieties of management strategies have been


developed and are practiced at different scales for preventing and mitigating man-elephant conflict.' [2].

According to the 2017 census by Project Elephant, India has the largest number of wild Asian elephants, estimated at 29,964 representing about 60 per cent of the species' global population as India is the home of around 30 notified Elephant Reserves by covering an area of about 69,582.80 km<sup>2</sup>. But rapidly expansion of human settlements and agricultural fields has resulted in widespread loss of elephant habitat which is progressively forced them to closer contact with people, sparking more frequent and severe human-elephant conflicts over space, resulting in most dangerous effects ranging from crop raiding to reciprocal loss of life. In India, over 500 people and 100 elephants die every year due to conflict with each other, while properties worth millions are damaged [3]. 'Such conflicts affect not only the population of elephant but broaden environment impacts on ecosystem equilibrium and biodiversity conservation also' [4]. As a great threat to biodiversity conservation, the management of this conflict is must by adopting a wide variety of prevention and mitigation approaches.

Conflict between man and elephant is not a new topic for Assam as this greenery land of Northeast India is one of the most important strongholds for the survival of the Asian elephants. According to Synchronized Elephant

Scopus Indexed

International Journal of Advanced Research in Engineering and Technology (IJARET)  
Volume 11, Issue 12, December 2020, pp. 2358-2367, Article ID: IJARET\_11\_12\_223  
Available online at <http://www.iaeme.com/ijaret/issues.asp?JType=IJARET&VType=11&IType=12>  
ISSN Print: 0976-6480 and ISSN Online: 0976-6499  
DOI: 10.34218/IJARET.11.12.2020.223

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## A STUDY ON THE BANK EROSION BY THE RIVER JIA BHARALI AND ITS IMPACT ON THE PANCHMILE AREA OF TEZPUR TOWN, ASSAM (INDIA)

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### ABSTRACT

*The problem of bank erosion by the river is becoming very serious day by day. The state of Assam in India is such a flood affected region which bears the brunt of bank erosion by the mighty river Brahmaputra and its tributaries in every rainy season. The flood and bank erosion by the river Jia Bharali, a right bank tributary of the Brahmaputra, have been creating havoc in the Panchmile area of Tezpur town for the last few decades. Due to its increasing erosive intensity day by day the Panchmie area is now under severe threat of erosion and the river start to shift towards north-west, if it's shifting continues then it will be a thinkable matter for the people of Tezpur town in near future. Keeping this in mind, an attempt to study about the bank erosion problem of Panchmile area and its consequent impact in details with the help of geo-spatial tools is made.*

**Keywords:** Bank erosion, flood, geo-spatial tools, mighty river.

**Cite this Article:** Niha Dutta, Gulap Sonowal and Gitika Thakuriah, A Study on the Bank Erosion by the River Jia Bharali and its Impact on the Panchmile Area of Tezpur Town, Assam (India). *International Journal of Advanced Research in Engineering and Technology*, 11(12), 2020, pp. 2358-2367.

<http://www.iaeme.com/IJARET/issues.asp?JType=IJARET&VType=11&IType=12>

### 1. INTRODUCTION

'Erosion, transportation and deposition are the key functions of a river through which it creates different landforms and brings about changes in its course. When the river overflows its banks, it creates natural calamities including flood, erosion and sedimentation' (Baishya,



## “असम के आदिवासी लोकगीत : एक परिचयात्मक अध्ययन”

मिजानुर हुमेन मण्डल

तदर्थ प्रवक्ता, हिन्दी विभाग, दरंग कॉलेज, तेजपुर, असम

असम में लोकगीतों का प्रचलन प्राचीन काल से ही विद्यमान रही है। लोकगीत का संबंध सामान्य लोकजीवन से है। लोकगीतों की परंपरा उतना ही प्राचीन है जितने की मानव जाति। अतः लोकगीत अत्यंत प्राचीन एवं मानवियों संवेदनाओं के सहजतम उद्गार है। लोकगीत का रूप सामूहिक होता है, इसलिए लोकगीत की उत्पत्ति को किसी एक व्यक्ति से जोड़ा नहीं जा सकता है। लोक शब्द का सामान्य अर्थ है- जन, जनता, लोग, मनुष्य, और आम-जन आदि। बृहत् हिन्दी कोश के अनुसार लोक का अर्थ-संसार, पृथ्वी, मानवजीवन, समूह, भूभाग, प्रांत आदि से होता है। हिन्दी साहित्य कोश भाग-1 में लोकगीतों के तीन अर्थ दिये हैं- (1) लोक में प्रचलित गीत (II) लोक निर्मित गीत (III) लोक विषयक गीत 2। कोश के अनुसार लोकगीत गीत या देहातो में गाए जाने वाले जनसाधारण के वे गीत हैं जो परंपरागत रूप से किसी जन-समाज में प्रचलित रहते हैं। 3 प्रसिद्ध लोक चिन्तक ग्रीम महोदय के अनुसार- लोकगीत आपने-आपमें बनते हैं-१। विसा' वदह बवउचवेमे पजेमसा' 4 इसी प्रकार भारतीय चिन्तक आचार्य हजारी प्रसाद दिवेदी के अनुसार-“लोकगीत की एक-एक बहू का चित्रण पर रीतिकाल की सौ-सौ मुगधाएँ और खडिताएँ न्यौछावर की जा सकती है, क्योंकि ये निरलंकार होने पर भी प्राणमयी हैं और वे अलंकारों से विभूषित होने पर भी निष्प्राण हैं। ये अपने जीवन के लिए किसी शास्त्र विशेष की मुखापेक्षी नहीं हैं। ये अपने आपमें परिपूर्ण हैं।” 5

सामान्यतः यह कहा जा सकता है कि लोकगीत किसी समुदाय द्वारा विकसित वह गीत है जो प्राचीन काल से विभिन्न उत्सवों, पर्व के अवसरों पर जनमानस की अभिव्यक्ति के लिए गयी जाती है। लोकगीत लिखित न होने के कारण इनके संकलन का कार्य अत्यंत कष्ट साध्य एवं कठिन है। विभिन्न विधानों ने यद्यपि इन लोकगीतों के संकलन का महत्वपूर्ण प्रयास किया है, परन्तु अभी भी लोकगीतों का का बड़ा हिस्सा अलिखित या बिखरा पड़ा है। असम एक बहुभाषी प्रदेश है। यहाँ अनेक जनजाति एक साथ मिलजुलकर निवास करते हैं। असम के विभिन्न भागों में रहने वाले लोग अनेक बातों में अलग-अलग होते हुए सांस्कृतिक दृष्टि से एक ही हैं। आदिवासी चाय-जनगोष्ठी इसका उदाहरण है। चाय-जनगोष्ठी के लोगों को भले ही बाहर से लाया गया हो, लेकिन इनके खान-पान, रहन-सहन, वेश-भूषा, आचार-व्यवहार आदि के दृष्टि से एक ही हैं। इन लोगों का न कोई जाति है, न एक ही धर्म का है। इसलिए चाय खेत या उद्योग में काम करने वाले लोगों को चाय-जनगोष्ठी(आदिवासी) के नाम से नामाकरण किया है। आदिवासी चाय-जनगोष्ठी को भाषा असमिया से भिन्न और बंगला, उड़िया, भोजपुरी के करीब है। आदिवासी चाय-जनगोष्ठी के कुछ उपजाति भी हैं, जैसे चाउताल, असुर, उराव, काँध, कामार, क्विचान, खारिया, बराईक, नायक, पानिका, पुर्जा, भील, मुइयाँ, भूमिज, माझी, माली, महली, मिरधा, मुंडा, राजबर, लोहार, लोधा, हो, लिमडु, तामा, डुकपा आदि।

आदिवासी चाय-जनगोष्ठी में प्रचलित गीतों को 'बागानी' गीत भी कहते हैं। इन गीतों का वर्णन हम इस प्रकार देख सकते हैं-

1. संस्कार परक लोकगीत।
2. अनुष्ठान एवं उत्सव परक लोकगीत।
3. प्रेमपरक लोकगीत।
4. श्रमपरक लोकगीत आदि।

1. संस्कार परक लोकगीत :- 'संस्कार एक प्रकार गुण है जिसके कारण एक व्यक्ति दूसरे व्यक्ति से सम्मान प्राप्त कर सकता है। संस्कार शब्द 'सम' उपसर्ग 'कृ' धातु और 'धज' प्रत्यय के योग से बना है। जिसका अर्थ है जिसके होने से कोई भी यज्ञोत्ता होती है। 6

संस्कार भारतीय सामाजिक जीवन की नींव है। संस्कार मनुष्य के शरीर और मन दोनों को पवित्र करवाता है। जन्म से लेकर मृत्यु तक का सम्बन्ध संस्कार से है। संस्कार हमारे जीवन को उज्वलता की ओर ले जाते हैं। जिसमें संस्कार नहीं उसको उस समाज से बहिष्कृत माना जाता है।

आदिवासी चाय-जनगोष्ठी के सामाजिक जीवन प्रारम्भ से संगीतमय रहा है। इस समाज में विभिन्न प्रकार के संस्कार परक गीत मिलते हैं। एक सोहर गीत में इसका उदाहरण मिलता है। पुत्र-जन्म के अवसर पर गाये जाने वाले गीतों को 'सोहर' कहते हैं। संस्कृत के 'शोभ' शब्द से इनका सम्बन्ध जोड़ा जा सकता है। हिन्दी के तदभव रूप बनते हैं इसी कारण सोहर को 'शुभ' तथा सुहावना माना जाता है। इस अवसर पर गाये जाने वाले गीतों को 'सोहर' कहना सर्वथा समीचीन है। सभी स्त्री-पुरुषों में संतान की लालसा होती है। इसके लिए देवी-देवताओं की पुजा की जाती है। स्त्री-पुरुष दोनों संतान के लिए उपवास भी रखते हैं। एक आदिवासी चाय-जनगोष्ठी के गीतों में टुचू देवी की पूजा करके संतान प्राप्ति का वर्णन मिलता है। एक टुचू गीत में इसका उदाहरण द्रष्टव्य है-

तेल विलास शलिता विलास

स्वर्गे विलास बाती ग

सकल देवी सईन शा लोउवा

घरेर कुलवती ग

गाई आइल बहुर आइल

## असम में कोरोना महामारी : साहित्य और सोशल मीडिया

मिजानुर हुसैन मण्डल

शोधार्थी, हिन्दी विभाग, असम विश्वविद्यालय, असम

कोरोना को बवअपक-19 के नाम से जाना जाता है। कोरोना की शुरुआत मध्य चीन के वुहान शहर में सन 2019 के मध्य दिसंबर में हुई। चीन ने ही इसे '2019 नोबेल कोरोनावायरस' नाम दिया। जिसे 'वुहान कोरोनावायरस' और सार्स-कोव 2 भी कहते हैं। यह एक ऐसा रोग है जो श्वसन तंत्र में रोग उत्पन्न करता है और मानव से मानव में फैलता है। इसके कई लक्षण हैं जैसे-सिरदर्द, बंद नाक, गले में खरश, थूक के साथ खासी, साँस की तकलीफ, तेज बुखार आदि। भारत में कोरोना संक्रमण का पहला मामला केरल में 30 जनवरी को मिला। 3 फरवरी तक बढ़कर इसकी संख्या तीन हो गयी जो चीन के वुहान से लौटे थे। वे तीनों ही छात्र थे। इसके पश्चात भारत में तेजी से कोरोना फैल गयी।

असम में कोविड-19 महामारी का पहला मामला करीमगंज जिले के बदरपुर में 31 मार्च को पाया गया, जो कि दिल्ली के निजामुद्दीन मरकज में शामिल हुए थे। इसके पश्चात अजमेर शरीफ दरगाह (राजस्थान) के कुछ तीर्थयात्री भी कोरोना संक्रमित हुए। जो बस द्वारा 6 मई को कछार जिले के सिलचर शहर पहुँचे। इसके बाद असम कोरोना महामारी की ओर अग्रसर होते गए क्योंकि देश के अन्य हिस्सों में फँसे असम के कई लोग असम लौट आए। जिनमें से कुछ लोगों ने कोरोना टेस्ट कराया और कुछ लोग डर के बजह से इधर-उधर भागते भी रहे। कुछ दिन पश्चात असम सरकार ने राज्य के बाहर से आने वाले लोगों को 14 दिनों का अनिवार्य संगरोध (Quarantine) करती है। जिसके लिए सरुसजाइ स्पॉट्स कॉम्प्लेक्स में संगरोध केंद्र स्थापित किया गया और सरकार द्वारा पास में ही एक अपार्टमेंट किराए पर लिया गया था। जहाँ कम से कम 200 डॉक्टर रहने की सुविधा थी। धीरे-धीरे सभी जिलों के स्कूल, कॉलेज तथा विश्वविद्यालय में फनंलंदजपदम सेंटर स्थापित किया गया। हालांकि राज्य में कई लोगों को COVID-19 पॉजिटिव पाया गया है, परंतु घबराने की जरूरत नहीं है क्योंकि स्थिति से निपटने के लिए स्वास्थ्य विभाग तैयार है और सभी मरीजों को बेहतर चिकित्सा मुहैया कराई जा रही है। चूँकि मेरा विषय साहित्य और सोशल मीडिया से है इसलिए आगे में इसी विषय पर चर्चा करूँगा।

असम में कोरोना की शुरुआत से ही साहित्य, जीवन, अर्थ, समाज आदि पर गहरा प्रभाव पड़ा है। इस दौरान बहुत सी विषय पूरी तरह से बादल चुके हैं। लोग भूखा मर रहे हैं, बेपारी अपने धंधे के लिए परेशान हैं, कृषक अपने उत्पादन के लिए परेशान हैं, लेखक तथा साहित्यकार अपनी रचना के लिए आशंकित हैं। कोरोना महामारी के संकट ने बाकी चीजों की तरह साहित्य को भी प्रभावित किया है। बहुत सारे लेखक की रचना अप्रकाशित है क्योंकि मार्च के महीने से ही प्रकाशन बंद पड़े हैं। कॉलेज, विश्वविद्यालय तथा साहित्यिक मंच खोलने की प्रतीक्षा में है तथा लाइब्रेरी धूल खा रही है। साथ ही कोरोना के इस महामारी ने लेखक तथा साहित्यकार के सोच में भी परिवर्तन लाया है। इस महामारी में बहुत सारे लेखक तथा सामान्य जन भी कविता, कथा, तथा कहानी लिख रहे हैं। इसके साथ-साथ बहुत सारे गायक-गायिका भी कोरोना की जागरूकता पर गीत गा रहे हैं। कोरोना की जागरूकता संबंधी एक असमिया गीत इस प्रकार है-

चौदिसो मृत्यु किरिली,  
नहय बनु एया धेमाली।  
काँदिसे आजी मानव जाति,  
कोरोना की जे एक महामारी।  
ए हाजू हुआ बंधु बाचिबले,  
हाजू हुआ बंधु बाचिबले।

अर्थात् चारो तरफ मृत्यु की कहर है ये कोई मजाक नहीं है। आज पूरी मानव जाति रो रही है। कोरोना ही एक महामारी है। हे दोस्त इससे बचने के लिए तैयार हो जाओ।

आज साहित्य में महामारी एक नया विषय बनकर उभरा है। जैसा कि साहित्य समाज का दर्पण है, समाज का प्रतिबिम्ब है, समाज का मार्कदर्शक है इसलिए शायद अब यह साहित्य का केंद्र बिन्दु होगा। क्योंकि कोरोना महामारी का समाज पर असर पड़ा है। किसी भी काल के साहित्य से उस समय की परिस्थिति, जनमानस के रहन-सहन, खान-पान, व अन्य गतिविधियों का पता चलता है। मानव को जन्म से लेकर मृत्यु तक, जीवन के हर क्षेत्र में समाज की आवश्यकता पड़ती है। मानव समाज का एक अभिन्न अंग है। जीवन मंद मानव के साथ क्या चटित होता है उसे साहित्यकार शब्द में रचकर साहित्य की रचना करता है। चूँकि अभी कोरोना महामारी का समय है इसलिए सभी लेखक समाज में हो रहे घटनाओं को लिपिबद्ध करने का प्रयास कर रहे हैं। कोरोना महामारी में मानव जीवन की सुरक्षा में डॉक्टर, नर्स, तथा सफाई कर्मचारियों की अहम भूमिका है। जिस तरह डॉक्टर मानव को बचाने के लिए दिन-रात कोशिश कर रहे हैं, इसी प्रकार विभिन्न साहित्यकार या लेखक भी कोरोना में जुड़ा रहे लोगों के मानसिक स्वास्थ्य के लिए भी प्रयत्नरत हैं। इस संदर्भ में जय प्रकाश पाण्डेय

(603)

नवम्बर-दिसम्बर, 2020

## असम के चाय-जनगोष्ठी : समाज और संस्कृति

मिजानुर हुसैन मण्डल\*

### शोध सारांश

असम पूर्वोत्तर भारत के आठ राज्यों में से एक है। असम एक बहुभाषी प्रदेश है। यहाँ अनेक जनजाति एक साथ मिलजुलकर निवास करते हैं। असम के विभिन्न भागों में रहने वाले लोग अनेक बातों में अलग-अलग होते हुए सांस्कृतिक दृष्टि से एक ही हैं। आदिवासी चाय-जनगोष्ठी इसका उदाहरण है। चाय-जनगोष्ठी के लोगों को भले ही बाहर से लाया गया हो, लेकिन इनके खान-पान, रहन-सहन, वेश-भूषा, आचार-व्यवहार आदि के दृष्टि से एक ही हैं। इन लोगों का न कोई जाति है, न एक ही धर्म का है। इसलिए चाय खेत या उद्योग में काम करने वाले लोगों को चाय-जनगोष्ठी(आदिवासी) के नाम से नामाकरण किया है। आदिवासी चाय-जनगोष्ठी की भाषा असमिया से भिन्न और बंगला, उड़िया, भोजपुरी के करीब है।

**Keywords:** केयवर्ड : संस्कृति, समाज, चाय-जनगोष्ठी, बोली, उत्सव, अनुष्ठान आदि।

#### भूमिका -

असम को संस्कृति और प्राकृतिक संसाधनों के मामले में सबसे अमीर राज्यों में से एक माना जाता है। असम में सबसे अधिक चाय का उत्पादन होता है। चाय-बगीचों में काम करने के लिए उन्हें कई राज्य से लाया गया है। 1 जैसे- झारखंड, ओडिशा, छत्तीसगढ़, पश्चिम बंगाल और आंध्र प्रदेश आदि बाद में उन्हें चाय-जनगोष्ठी का प्रमाण पत्र दिया गया है। वे ब्रिटिश औपनिवेशिक द्वारा लाए गए आदिवासियों और पिछड़ी जातियों के वंशज हैं जो वर्तमान चाय बागानों के उद्योग में मजदूरों के रूप में काम कर रहे हैं। वे विषम, बहु-जातीय हैं जिनमें कई आदिवासी और जाति समूह शामिल हैं।

चाय बागान के मजदूर उन गरीब प्रवासियों के वंशज हैं, जिनके भाग्य ने उन्हें चाय बागानों में आने के लिए मजबूर किया। उन्हें रिश्वत, जबरदस्ती और धोखे का शिकार होना पड़ा। 2 जब चाय-जनगोष्ठी के लोगों को असम में लाया गया तब वर्तमान असम की सीमा से बहुत अलग थे। उस समय नेपाल और भुटान असम के अंतर्गत थे। जॉन पेंटर के अनुसार 'भूटान और नेपाल के राज्य असम के भीतर शामिल हैं और साथ ही त्रिपुरा, कोचबिहार और कोरतोया भी असम के राजनीति सीमा के अंतर्गत आते हैं। 3

उस समय कमता या कोच राज्य भी असम के अंतर्गत शामिल थे। वर्तमान चाय जनगोष्ठी मुख्य रूप से ऊपरी असम

और उत्तरी ब्रह्मपुत्र घाटी के उन जिलों में पाए जाते हैं जहाँ कोकराझार, उदलगुरी, सोनितपुर, नागांव, गोलाघाट, जोरहाट, शिवनगर, चरैदेव, उदालगुरी, डिब्रूगढ़, तिनसुकिया जैसे चाय बागानों मौजूद हैं। असम के बराक घाटी क्षेत्र के साथ-साथ कछार, करीमगंज और हाईलाकांदी जिलों में समुदाय की एक बड़ी आबादी है।

असम के चाय जनगोष्ठियों में मूलतः अफ्रिक, द्राविड और मंगोलिय लोग देखने को मिलता है। इन जनगोष्ठी के अपना एक अलग सा पहचान है। जिसके कारण इनमें रहन-सहन, खान-पान, नीति-नियमों में भिन्नता देखने को मिलते हैं। मुंडारी, चाओताल, उड़िया, तेलुगु, कुरमाली और खरटा आदि भाषा-भाषी लोगों के विभिन्न जाति-जनजाती के सम्मिश्रित समाज है। इन सम्मिश्रित समाज जब असम में स्थायी रूप से रहने लगे तब वे असमिया समाज के रीति-नीति, रहन-सहन, खान-पान, संस्कार आदि को अपनाते लगी। आज एक वृद्ध असमिया समाज का हिस्सा बन गया। चाय-जनगोष्ठी के लोग एक साथ रहना पसंद करते हैं। इसलिए वे जहाँ रहते हैं उस क्षेत्र का नामकरण उसके जाति के आधार करते हैं। जैसे-उड़िया सम्प्रदाय जिस बस्ति या क्षेत्र में रहते हैं उसे उड़िया बस्ति या उड़िया गाँव कहते हैं। इसी प्रकार मुण्डा जाति के लोग जिस बस्ति या गाँव में रहते हैं उसे मुण्डा बस्ति या मुण्डा गाँव कहते हैं। भले ही इनके पूर्वजों में उच्च नीच की भावना रही होगी परंतु असम आने के पश्चात इनके बीच उच्च नीच की भावना लुप्त हो

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## असम में प्रचलित ग्वालपड़िया लोकगीत एक परिचयात्मक अध्ययन

□ मिजानुर हुसैन मण्डल\*

### शोध सारांश

भारत प्राचीन काल से ही विभिन्न संस्कृतियों का देश रहा है। यह वैविध्य ही भारतीय संस्कृति का सौंदर्य है। संस्कृति का निर्माण विभिन्न तत्वों जैसे—कला, संस्कार, उत्सव, त्यौहार, खान-पान, वस्त्र, गीत, संगीत आदि से मिलकर होता है। इसमें लोक और शास्त्र का परस्पर समन्वय एवं आदान-प्रदान भी अपनी महत्त्वपूर्ण भूमिका निभाता है। लोकगीत किसी संस्कृति की प्रकृति को अभिव्यक्त करने वाला प्रधान उपकरण माना जाता रहा है। सामान्यतः यह कहा जा सकता है, कि लोकगीत किसी समुदाय द्वारा विकसित वे गीत हैं जो प्राचीन काल से विभिन्न उत्सवों, पर्वों, अवसरों पर आनंद की अभिव्यक्ति के लिए सृजित होते हैं। इनका निरंतर विकास होता है और समय के साथ इनकी लयात्मकता की अभिव्यक्ति होती है। असम पूर्वोत्तर भारत पर स्थित वह राज्य है जो चतुर्दिक सुरम्य पर्वतश्रृणियों तथा नदियों से घिरा है। इस राज्य के उत्तर में अरुणाचल प्रदेश, पूर्व में नागालैंड तथा मणिपुर, दक्षिण में मिजोरम तथा मेघालय एवं पश्चिम में बांग्लादेश तथा पश्चिम बंगाल स्थित है। यह एक बहुभाषी प्रदेश है। यहाँ अनेक जाति-जनजाति के लोग एक साथ घुलमिलकर निवास करते हैं। असम के विभिन्न भागों में रहने वाले लोग अनेक बातों में अलग होते हुए भी सांस्कृतिक दृष्टि से एक ही हैं। यदि किसी समूची संस्कृति का अध्ययन करना हो तो वहाँ के लोक साहित्य अर्थात् लोकगीत, लोक-कथा, लोक-गाथा आदि का विशेष अवलोकन करना पड़ेगा।

**Keywords :** असम, ग्वालपड़िया, बोली, भाषा, लोकगीत, संस्कृति, लोकसाहित्य आदि

**भूमिका—** लोक-साहित्य शब्द सामान्यतः दो शब्दों के मेल से बना है 'लोक' और 'साहित्य'। श्लोक शब्द संस्कृत के श्लोक दर्शन धातु से 'ध' प्रत्यय लगाने पर निष्पन्न हुआ है। इस धातु का अर्थ देखना होता है। अर्थात् इस जगत में जो दिखाई देता है वह श्लोक है। लोक शब्द का सामान्य अर्थ है— जन, जनता, समूह, लोग, मनुष्य, और आम जन आदि। हिन्दी शब्द कोष में लोक शब्द का भिन्न-भिन्न अर्थ दिया गया है— बृहत् हिन्दी कोष के अनुसार लोक का अर्थ—संसार, पृथ्वी, मानवजाति, समूह, भू-भाग, प्रांत आदि Student favorite dictionary में लोक का अर्थ—folk, people, general people, public etc माना गया है 2 उपनिषद में लोक के दो परिकल्पना की गयी है— इहलोक और परलोक। लोक का संबंध कुछ विद्वान यहलोक और परलोक से करते हैं 3

लोकगीत लोक-साहित्य का ही एक अभिन्न अंग है। लोक साहित्य के अंतर्गत लोकगीतों का स्थान सर्वोपरि है। लोकगीत जनता की हार्दिक भावनाओं के सच्चे प्रतीक हैं। यह एक ऐसा अमूल्य अमानत है जिसमें सदियों से चली आ रही पीढ़ी का लोकानुभव संचित होता है। लोकगीत में जन-समाज का हृदय लिपटा रहता है। इस साहित्य का न कोई रचयिता होती है

और न ही इस साहित्य के सृजन का कोई समय निर्धारित होता है बल्कि इसे मनुष्य अपने भावनाओं से व्यक्त करते हैं। हजारी प्रसाद द्विवेदी जी ने लोकगीतों की परिभाषा देते हुए कहे हैं— "लोकगीत की एक-एक बहू के चित्रण पर रीतिकाल की सौ-सौ मुग्धाएँ और खंडिताएँ न्यौछावर की जा सकती हैं, क्योंकि ये निरलंकार होने पर भी प्राणमयी हैं और वे अलंकारों से विभूषित होने पर भी निष्प्राण हैं। ये अपने जीवन के लिए किसी शास्त्र विशेष की मुखापेक्षी नहीं हैं। ये अपने आप में परिपूर्ण हैं।"<sup>4</sup>

ग्वालपाड़ा क्षेत्र में बोली जाने वाली गीतों को ग्वालपड़िया लोकगीत कहते हैं। ग्वालपड़िया समाज में हिन्दू, मुस्लिम, क्रिस्ताइन, सिख, बौद्ध, जैन आदि अनेक सम्प्रदायों के लोग रहते हैं। इसके साथ ही कोच— राजबंशी, बोड़ो, रामा, मेस आदि जनजातियाँ भी ग्वालपड़िया समाज के अंग हैं। इन सभी सम्प्रदायों एवं जनजातियों की एक मिली-जुली सामान्य संस्कृति है, जिसे 'ग्वालपड़िया लोक-संस्कृति' कहते हैं। ग्वालपड़िया लोक-संस्कृति मुखतः कृषि प्रधान लोक-संस्कृति है। संसार की अन्य लोक-संस्कृतियों की तरह ग्वालपड़िया लोक-संस्कृति में

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New Mathematics and Natural Computation  
| Vol. 16, No. 01, pp. 177-193 (2020)

# Fuzzy Bounded Linear Operator in Fuzzy Normed Linear Spaces and its Fuzzy Compactness

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Mami Sharma and Debajit Hazarika

<https://doi.org/10.1142/S1793005720500118> |  
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## Abstract

In this paper, we first investigate the relationship between various notions of fuzzy boundedness of linear operators in fuzzy normed linear spaces. We also discuss the fuzzy boundedness of fuzzy compact operators. Furthermore, the spaces of fuzzy compact operators have been studied.

**Keywords:** Fuzzy number - fuzzy norm - fuzzy bounded linear operator - fuzzy compact operator



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## History

## Keywords

Fuzzy number

fuzzy norm

fuzzy bounded linear operator

fuzzy compact operator

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## Comparative Analysis of Genetic Diversity in Some Non-commercial Cultivars of *Musa* L. from Assam, India, Using Morphometric and ISSR Markers

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### ABSTRACT



Northeast India is known for its diverse nature of soil, climate, and topography that supports rich banana diversity. Banana (*Musa* sp.) is the second most important fruit crop in India due to its availability throughout the year, taste along with the nutritive and medicinal value. Thus, the genetic diversity of banana resources is essential for present and future food. This study aimed to determine the comparative genetic variation among 14 non-commercial edible banana cultivars of Assam, India, by using 50 different morphological characters with ISSR markers. Morphological data were analyzed hierarchical clusters and principal coordinates which showed to cluster all the accessions into two distinct groups and subsequently into four subgroups. Furthermore, ISSR markers revealed the average percentage of polymorphism. A total of 62 bands were detected of which 56 bands showed polymorphism using seven primers. The highest number of the band was detected with the primer UBC-843 and the lowest number of the band was observed with UBC-848. The genetic similarity index was prepared using Jaccard's similarity coefficient and the range of genetic similarity was from 0.28 to 0.77 with 0.51 of average. Dendrogram produced from the cluster analysis showed the clear division of the genotypes into two distinct clusters. Seven accessions of viz. *Bharatmoni*, *Assamiya-malbhog*, *Gobin tulashi*, *Bokmoni*, *Bangali-malbhog*, *Katiya-jahaji*, and *Abor-malbhog* were clustered in the first group. The second group included the accessions viz. *Jatikol*, *Adeel*, *Guwahatia-kol*, *Fessa-monohar*, *Athiya kol*, *Ximalu-monohar*, and *Bogi-monohar*. The Mantel test analysis also showed positive relationships between morphological traits and ISSR markers.

### KEYWORDS

Mental test; morphological descriptors; phylogenetic analysis; underutilized banana resources

### Introduction

The genus *Musa* L. embraces of all the cultivated bananas which are consumed by human and animals as a nutritious fruit since centuries. Present day's cultivated edible bananas are mostly triploids that are originated from two wild diploid forms of *Musa* viz. *Musa acuminata* Colla (AA) and *M. balbisiana*

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## SEED MYCOFLORA OF FENUGREEK (*TRIGONELLA FOENUM- GRAECUM* L.) AND ITS MANAGEMENT

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(Assam), India.

### Abstract

Seeds of fenugreek (*Trigonella foenum-graecum* L.) are infected during storage condition, which affect the germination percentage. Seeds were evaluated using blotter test and agar plate method to determine the fungal association. Seven fungal species were isolated from the internal and external seed surfaces of fenugreek, viz., *Aspergillus flavus*, *Aspergillus niger*, *Cladosporium*, *Penicillium italicum*, *Mucor*, *Fusarium solani* and *Rhizopus stolonifer*. Out of five fungitoxicants used, Carbendazim and Indofil M-45 were found effective to control seed mycoflora of fenugreek. Treated seeds showed better germination percentage as well as root and shoot length than control.

**Key words :** Management, mycoflora, *Trigonella foenum-graecum*.



## THE POLYMERASE CHAIN REACTION (PCR) AND PLANT DISEASE DIAGNOSIS : A REVIEW

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### Abstract

Polymerase chain reaction (PCR) is a powerful scientific technique in molecular biology that amplifies genes or any fragment of DNA, making thousands to millions of copies of particular DNA sequence or from one molecule. With this system, minute amounts of DNA are often replicated very rapidly and thereby amplified to such an extent that the DNA becomes easy to detect, study and use for any given purpose. Three essential steps to PCR include (a) melting of the target (b) annealing of two oligonucleotide primers to the denatured DNA strands, and (c) primer extension by a thermostable DNA polymerase. Newly synthesized DNA strands serve as targets for subsequent DNA synthesis as the three steps are repeated up to 35-50 times. The specificity of the tactic derives from the synthetic oligonucleotide primers, which base-pair to and define each end of the target sequence to be amplified. The use of PCR grew rapidly in plant pathology, as in other disciplines, with the introduction in 1988 of *Thermus aquaticus* (Taq) DNA polymerase. This enzyme exhibits relative stability at DNA-melting temperatures, which eliminates the need for enzyme replenishment after each cycle of synthesis, reduces PCR costs and allows automated thermal cycling.

**Key words :** Polymerase chain reaction, Plant Disease Diagnosis, *Thermus aquaticus*





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## Habitat distribution mapping of *Musa flaviflora* Simmonds - a wild banana in Assam, India



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### ARTICLE INFO

**Article history:**  
Received 4 August 2018  
Accepted 3 February 2020  
Available online 6 February 2020

**Keywords:**  
*Musa flaviflora*  
Taxonomy  
Distribution  
Ecological niche modelling (ENM)

### ABSTRACT

*Musa flaviflora* Simmonds, a kind of typical species of banana grows wildly in North East Region of Assam. This species of *Musa* is confined only a few pockets of North East Region of India including Eastern part of Assam with a poor population size. Therefore, conservation of this plant through proper scientific investigation is urgently needed. The present study was conducted to find out the habited status of this species through ecological niche modelling (ENM), which helps to conserve this plant with proper scientific investigation in future. On the other hand, though earlier worker does the taxonomy of this species, it is not clear. So, in this present investigation a detailed taxonomic description of *Musa flaviflora* with its predicted location was find out through ecological niche modelling (ENM) for improving the conservation status of the species.

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### 1. Introduction

The territory of Assam is rich in having a good number of wild spe-

(GIS) databases ([www.worldclim.org](http://www.worldclim.org) and [www.diva-gis.org](http://www.diva-gis.org)). High resolution satellite imageries coupled with environmental variables and spatial datasets on climate and vegetation enhance models accuracy.



## Studies on coordination environment of transition metal chloride anionic speciation of N, N-disulfodiisopropylammonium ionic salts and assessment of their Brønsted-Lewis acidic properties

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Received 23 December 2019; revised and accepted 22 July 2020

Four ionic salts of N, N-disulfodiisopropylammonium cation with complex anionic speciation of metal chlorides such as  $[\text{FeCl}_4]$ ,  $[\text{NiCl}_4]^{2-}$ ,  $[\text{Zn}_2\text{Cl}_6]^{2-}/[\text{Zn}_4\text{Cl}_{10}]^{2-}$ ,  $[\text{CoCl}_4]^{2-}/[\text{CoCl}_3]^-$  have been synthesized and characterized with FTIR, NMR, TGA, Raman and electronic spectra. Comparative Brønsted and Lewis acidic strength of the salts have been assessed for catalytic uses in organic reactions *via* UV-visible Hammett plot and FTIR spectra using pyridine as probe molecule. Band gap values obtained from Tauc plot present their semiconductor behavior to design ionic liquid-based photo catalysts in future.

**Keywords:** Brønsted-Lewis acidic, Chlorometallates, Anionic speciation, Transition metal cation, Ammonium cation

Ionic liquids of chlorometallates are considered as important class of acidic/basic/neutral material

The water tolerant capacity of chloroferrate (III) ionic liquids gives lots of scope for development of strong







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# Unconventional formation of a 1D-chain of H-bonded water molecules in bipyridine-based supramolecular hexameric hosts of isostructural coordination compounds of Co(II) and Zn(II): Antiproliferative evaluation and theoretical studies

[Sanjib Chetry](#)<sup>a</sup>, [Pranay Sharma](#)<sup>a</sup>, [Antonio Frontera](#)<sup>b</sup>  , [Debajit Dutta](#)<sup>a</sup>,  
[Akalesh K. Verma](#)<sup>c</sup>  , [Manjit K. Bhattacharyya](#)<sup>a</sup>  

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*A Simple Extension of Burr-III Distribution  
and Its Advantages over Existing Ones in  
Modelling Failure Time Data*

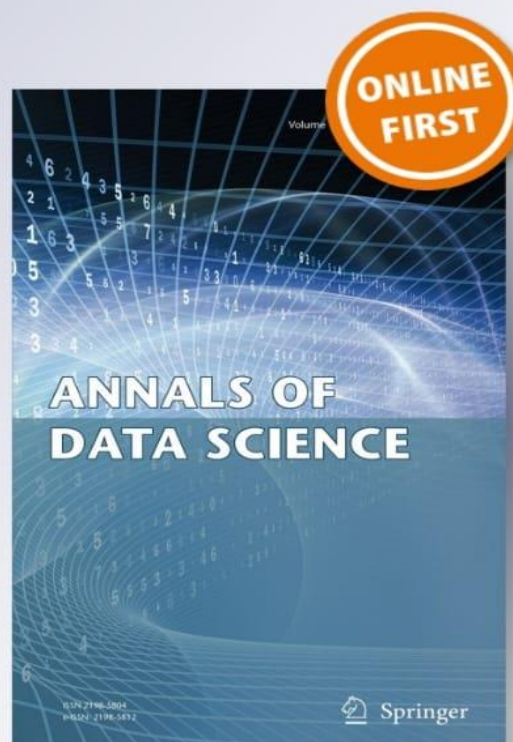
**Subrata Chakraborty, Laba Handique &  
Rana Muhammad Usman**

**Annals of Data Science**

ISSN 2198-5804

Ann. Data. Sci.

DOI 10.1007/s40745-019-00227-2



 Springer



Thailand Statistician  
July 2020; 18(3): 267-280  
<http://statassoc.or.th>  
Contributed paper

## New Extended Burr-III Distribution: Its Properties and Applications

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Received: 18 September 2018

Revised: 18 February 2019

Accepted: 17 June 2019

### Abstract

In this article, we consider a three parameter extended Burr-III distribution and study some distributional, reliability properties and parameter estimation. Performance of estimation technique used for model parameters estimation is numerically investigated employing Monte Carlo simulation with different sample sizes and parameter values. Efficacy of this distribution in modeling from two real life data is evaluated in comparison to some existing extensions of Burr-III distribution employing well known goodness of fit tests and model selection criteria. Our findings show the proposed distribution as the best among the all the other extensions of Burr-III distribution considered in this study.

**Keywords:** Log-logistic-X, stress-strength reliability, stochastic ordering, Akaike information criterion.

### 1. Introduction

Burr (1942) defined the cumulative distribution function (cdf) and probability density function (pdf) (for  $x > 0$ ) of the Burr-III (BIII) distribution respectively by

$$G^{\text{BIII}}(x; \beta, \delta) = (1 + x^{-\delta})^{-\beta}, \quad (1)$$

$$f^{\text{BIII}}(x; \beta, \delta) = \beta \delta x^{-\delta-1} (1 + x^{-\delta})^{-\beta-1}, \quad (2)$$

where  $\beta > 0$  and  $\delta > 0$  are both shape parameters.

In 2006, Gleaton and Lynch developed a new family of distribution named as generalized log-logistic family of distribution. Later on, this family was called as odd log-logistic family of distribution. The cdf of the odd log-logistic (OLL-X) family of distribution was given as

$$F(x; \alpha, \xi) = \frac{G(x, \xi)^\alpha}{[G(x, \xi)^\alpha + (1 - G(x, \xi))^\alpha]}, \quad (3)$$

where  $\alpha > 0$  is an additional shape parameter.  $G(x, \xi)$  is the cdf of the parent distribution and  $\xi$  denotes the parameters of the parent distribution. The corresponding pdf of the OLL-X family is given as

## Generalized Modified Exponential-G Family of Distributions: Its Properties and Applications

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### ABSTRACT

*A new family of continuous distributions called generalized modified exponential-G family is proposed. The probability density and cumulative distribution function are expressed as infinite linear mixtures of exponentiated-G distribution. Important statistical properties such as moment generating function, distribution of order statistics, power moments, asymptotes and shapes of the proposed family are investigated. The maximum likelihood estimation of the parameters is presented. To check the suitability the proposed model is compared with its submodels and also with a few useful lifetime models by conducting three data fitting experiments with real-life data sets.*

**Keywords:** ME distribution, power moments, AIC, KS test

**Mathematics Subject Classification:** 62E15, 60E05.

### 1. INTRODUCTION

Of late, there has been an extraordinary eagerness for introducing more flexible distributions via extension of the classical distributions by inducting additional shape parameter(s) in the baseline distribution. In the process many generalized families of distributions have been proposed and studied in the last two decades for modeling data arising in applied areas such as economics, engineering, biological studies, environmental sciences and medical sciences among others. These generalized distributions are shown to have more flexibility compared to the baseline ones.

Some well-known generalized families are: Generalized Marshall-Olkin Kumaraswamy-G family (Chakraborty and Handique, 2017), Marshall-Olkin Kumaraswamy-G by Handique *et al.*, (2017a), Beta generated Kumaraswamy-G by Handique *et al.*, (2017b), beta generated Kumaraswamy Marshall-Olkin-G by Handique and Chakraborty (2017a), beta generalized Marshall-Olkin-Kumaraswamy G by Handique and Chakraborty (2017b), Odd moment exponential family (Haq *et al.*, 2018), Odd Frechet-G family (Haq and Elgarhy, 2018), Kumaraswamy generalized Marshall-Olkin-G family (Chakraborty and Handique, 2018), exponentiated generalized Marshall-Olkin-G family (Handique *et al.*, 2018) and Zografos-Balakrishnan Burr XII (Haitham *et al.*, 2018) among others.

In the present study, we derive the *generalized modified exponential-G family of distributions* (GME-G) using the generalized moment exponential distribution and study its properties and applications.

ISSN 0974-7117 (Print); ISSN 0973-8347 (Online)  
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## Analyzing Impatience in Multiserver Markovian Queues

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### Abstract

Reneging and Balking are two facts of customer impatience. In traditional queuing literature, customer impatience was not often considered. However, for the last few decades, queuing theorists have been trying to integrate aspect of balking and reneging into modeling of queues in a holistic way. This paper is an extension of the work in the same direction. We consider a multiserver Markovian queuing model under the assumption that customers are state aware so that their impatience is state dependent. We derive the generating function of the stationary system size distribution and obtain mean system size along with other performance measures.

**Keywords:** Balking; Impatience; Queuing; Reneging; Performance measures; Multiserver queue.

### 1. Introduction

Queues are a very common day phenomenon which is present almost. Because of constraints with service delivery mechanism, queues or waiting lines arise when the customers does not get service immediately i.e. when the demand for a service facility goes beyond the capacity of that facility. Waiting is disliked as customers are hard pressed for time. The act of having to wait in a line or queue often induces impatience in arriving customers. In queuing systems, such impatience can be of two types – balking and reneging. If an arriving customer finds the service facility to be non-empty and leaves without joining the queue, then such a phenomenon is called balking. Haight (1957) was possibly the first to introduce the concept of balking.

Reneging is the other commonly observed impatient customer behavior. It occurs when arriving customers join the queuing system, get impatient and leave before completion of service. Barrer (1957) has outlined two types of reneging - viz. reneging till beginning of service (R\_BOS) and reneging till end of service (R\_EOS). Additionally, depending on the nature of the reneging rate, queuing literature provides for splitting reneging into two types viz. position independent reneging (PIR) and position dependent reneging (PDR). Choudhury and Medhi (2011B) have illustrated these two types of reneging. Similar to reneging, the balking can also be classified into two parts viz. state independent balking (SIB) and state dependent balking (SDB). (Choudhury and Medhi, 2012).

In this paper, we analyze a multiserver Markovian queuing system under the assumption that customers may balk as well as renege. We consider a specific balking rule where the balking probability of the customer decreases as the state of the system goes up i.e. balking is state dependent (SDB). We also assume position dependent reneging (PDR) which is very relevant from practical point of view. Here the reneging rate is a function of the position of the customer. For example, in case of life insurance business where the purchase of a policy refers to the arrival of a customer into the queuing system (insurance firm), the processed application can be called the departure from the queuing system, the claim processing department is considered as a server and the system capacity (the number of policies it can accommodate) is taken as infinite. The claims are processed in order of their arrival (i.e. the queue discipline is FCFS). Jain et al., (2014) have assumed that the probability of joining the firm (i.e. chances of purchasing a policy) is higher when it has more number

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## Exploring the non-equilibrium fluctuation relation for quantum mechanical tunneling of electrons across a modulating barrier

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(Received 31 January 2020; accepted 13 October 2020; published 16 November 2020)

We study the validity of the fluctuation relation for a non-equilibrium quantum mechanical system, viz., electrons quantum mechanically tunneling across a periodically modulating barrier. Experimentally this system is realized by measuring the fluctuation in the tunneling current between an STM tip and a vibrating gold film deposited on a piezo crystal. The long time series of tunneling signal shows large positive and negative fluctuations. The analysis shows that over finite observation time intervals, the probability distribution of the average rate of work done has a positive mean. About this mean, the distribution is broad and it is spread over not only positive but also negative values. These positive and negative values correspond to work done either on the electron by the external drive or work done by the electron against the drive, as it tunnels across the modulating barrier, respectively. For different driving frequencies, we show that the probability distribution satisfies the non-equilibrium fluctuation relation (NEFR). Thus, we prove that the NEFR is valid for a driven quantum mechanical system. For this tunneling process, we determine the large deviation function (LDF), which is related to NEFR. We see changes in the shape of the LDF as a function of the drive frequency, although NEFR is valid at all these frequencies. Measuring dissipation associated with microscopic irreversible trajectories in non-equilibrium quantum mechanical systems is a challenging task. Here we use NEFR also to obtain a measure of the dissipation associated with the electron tunneling across the modulated barrier.

DOI: 10.1103/PhysRevResearch.2.043237

### I. INTRODUCTION

For systems in equilibrium, there is no net heat exchanged between the system and the environment. However, for driven non-equilibrium (NEQ) steady-state systems, the applied drive helps to overcome the energy lost from the system as the dissipated energy flows to the surrounding environment. However, unlike macroscopic systems, small-sized driven systems show unusual features, due to their high susceptibility to fluctuation effects which can irreversibly modify the trajectories along which the system evolves. For example, consider a small particle being driven through a viscous medium. Within a finite time window, heat dissipated from the driven system is transferred to the surrounding environment (medium). However, occasionally, this particle can also capture some heat from the environment [1,2], which irreversibly modifies the trajectory of the small particle. Consequently, for such systems, repeated measurements on an NEQ system prepared with identical protocol over a finite observation time window shows a probability distribution of the heat exchanged between the system and the environment. The heat exchanged can be both positive and negative, de-

scribing the two-way flow leading to irreversible trajectories. For describing the behavior of such NEQ systems, one defines the average entropy production or consumption rate ( $s_\tau$ ), in a time interval ( $\tau$ ) as  $s_\tau = \frac{1}{\tau} \int_t^{t+\tau} s(t') dt'$ . The probability distribution of  $s_\tau$ , viz.,  $P(s_\tau)$ , is spread over  $s_\tau$  values which are both positive (entropy increasing events) as well as negative (entropy consuming events). The  $P(s_\tau)$ , satisfies some useful mathematical relations, viz., the non-equilibrium fluctuation relations (NEFRs). The NEFR, seen in simulations by Evans and Searles [3] and then proved by Gallavotti and Cohen [4], is for non-equilibrium steady-state systems with time-independent driving forces. Subsequently, Shragel and Chou [5] derived a general form of NEFR for situations involving time-dependent driving forces to account for forward ( $f$ ) and reverse ( $r$ ) paths of the system. This general form of NEFRs is

$$\lim_{\tau \rightarrow \infty} \frac{P^f(+s_\tau)}{P^r(-s_\tau)} = e^{\tau s_\tau}. \quad (1)$$

Equation (1) states that within a duration  $\tau$ , the probability of the positive time-averaged entropy production rate for the forward path [ $P^f(+s_\tau)$ ] is exponentially larger than the probability of entropy consumption rate for the reverse path [ $P^r(-s_\tau)$ ]. Typically, for macroscopic systems  $P^f(+s_\tau)$  dominates. However, in different NEQ situations, like for driven small-sized systems, the  $P^r(-s_\tau)$  is also significant. For a system with symmetric forward and reverse drive, the  $f$  and  $r$  superscripts in Eq. (1) are dropped.

The Gallavotti-Cohen non-equilibrium fluctuation relation (NEFR) has been verified for a diverse variety of driven

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*Magnetic Property of CoTbNi Ternary Alloy Thin Films*

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**Journal of Superconductivity and  
Novel Magnetism**

ISSN 1557-1939  
Volume 33  
Number 10

J Supercond Nov Magn (2020)  
33:3165-3170  
DOI 10.1007/s10948-020-05574-3



## Influence of Cu Insertion Layer on Magnetic Properties of Co-Tb/Cu/Co-Tb Thin Films

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Received: 26 April 2020 / Accepted: 27 May 2020  
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### Abstract

This work focuses on the study of the influence of the insertion layer (IL) on the magnetic properties of thin films of Co-Tb. Thin films of Ta (5 nm)/Co<sub>1-x</sub>Tb<sub>x</sub> (20 nm)/Cu (3 nm)/Co<sub>1-x</sub>Tb<sub>x</sub> (20 nm)/Ta (5 nm) as well as Ta (5 nm)/Co<sub>1-x</sub>Tb<sub>x</sub> (40 nm)/Ta (5 nm) with  $x = 0.10$  and  $0.15$  were grown on a silicon substrate using DC magnetron sputtering. The X-ray diffraction patterns indicate the amorphous nature of all prepared films. The measurement of surface roughness of Ta (5 nm)/Co<sub>1-x</sub>Tb<sub>x</sub> (20 nm) and Co<sub>0.85</sub>Tb<sub>0.15</sub> (20 nm)/Cu (3 nm)/Co<sub>0.85</sub>Tb<sub>0.15</sub> (20 nm) films using 3D optical profilometer indicates a high surface roughness. The measured out-plane and in-plane magnetic hysteresis (M-H) curves indicate that Ta/Co<sub>1-x</sub>Tb<sub>x</sub> (40 nm)/Ta films (i.e., without any IL) exhibit nearly magnetic isotropic behavior. However, Ta/Co<sub>1-x</sub>Tb<sub>x</sub> (20 nm)/Cu (3 nm)/Co<sub>1-x</sub>Tb<sub>x</sub> (20 nm)/Ta films exhibit in-plane magnetic anisotropy. The in-plane anisotropy was found to be significant for the case of  $x = 0.10$  film with larger effective anisotropy constant ( $K_{eff}$ ). The values of saturation magnetization and squareness (Sq) of films are found to decrease with Cu insertion layer and it is likely due to the worsening of the Co-Tb/Cu interface. The post-annealing of the Co-Tb films with Cu IL helps to improve the value of  $M_S$  and  $K_{eff}$  but it reduces the  $H_C$  and the squareness of the hysteresis curve.

**Keywords** Thin film · Co-Tb alloys · Ferrimagnetism · Magnetic anisotropy · Cu insertion layer

### 1 Introduction

Recently, rare earth-transition metal (RE-TM) alloys have been revisited extensively due to their various potential applications in magnetic recording media and spin-transfer torque [1–4]. The magnetism of RE-TM alloys arises due to the moments of TM elements (such as Co, Fe, Ni) and the RE elements (e.g., Gd, Tb, Ho), which have antiparallel orientations due to the exchange interaction between the f and d electrons [1]. Among various amorphous RE-TM alloys, the Co-Tb alloy is one of the extensively studied RE-TM alloys due to its various potential applications [3, 4]. Co-Tb alloys exhibit ferrimagnetic/sperimagnetic behavior, and their magnetic

properties have been studied in detail by Hansen et al. [5, 6]. The non-collinear magnetic ordering in Co-Tb arises from the competition between the local magnetic anisotropies and exchange interactions [1, 5]. This competition leads to the local distribution of the Tb and the Co magnetic moments in the Tb and Co sublattices, known as sperimagnetism [7]. By varying the relative concentrations of the two species, one can reach compensation temperature where the net magnetic moment goes to zero, called the compensation composition [5, 6]. In our previous work, we have demonstrated that a thin film of Co<sub>0.85</sub>Tb<sub>0.15</sub> alloy exhibits sperimagnetic ordering along with perpendicular magnetic anisotropy [8, 9]. However, the same film deposited on a curved substrate of anodic alumina (AAO) was found to be isotropic [10].

One of the most striking properties of amorphous Co-Tb alloy-based thin films is the presence of the perpendicular magnetic anisotropy (PMA), which is often attributed to the growth-induced strain (modification) of the microstructure of the amorphous films [11]. Usually, the strength of PMA in Co-Tb depends on various factors such as deposition condition, the composition of the alloy, thickness of the film, post-annealing, and the nature of under-layer and adjacent layer [3, 12–15]. In addition to these influencing factors on PMA,

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## Magnetic Property of Thin Film of Co-Tb Alloys Deposited on the Barrier Layer of Ordered Anodic Alumina Templates

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Received: 1 October 2019 / Accepted: 13 January 2020  
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### Abstract

Recently, search for novel materials for bit patterned media (BPM) has been very intense due to their potential application in ultra-high-density hard disk drive. In a quest of finding new materials for BPM, we have taken up to study ordered array of nanostructured Co-Tb alloy. Thin films of Ta (1 nm)/Co<sub>1-x</sub>Tb<sub>x</sub> (24 nm)/Ta (4 nm) ( $x = 0.10, 0.15, 0.18$  and  $0.33$ ) alloys were deposited on the barrier layer of auto-assembled anodic alumina template using dc magnetron sputtering to form a nanostructured array, the so-called nanobump. Similar array of compounds on a flat Si substrate was also deposited for comparison (reference sample). The measurement of room temperature magnetization ( $M$ ) versus field ( $H$ ) curve indicates that the coercivity and the squareness [ $M_r/M_s$ ] of nanobumps as well as reference samples were found to increase with increase of Tb content. However, the values of  $H_C$  and  $M_r/M_s$  for nanobumps were found to be higher than those of reference samples. The measurements of in-plane and out-plane M-H curves reveal that Co<sub>1-x</sub>Tb<sub>x</sub> ( $x = 0.15, 0.20$  and  $0.33$ ) nanobumps exhibit magnetic isotropy behaviour. The measurements of temperature variation of magnetization demonstrate that these films exhibit ferrimagnetism with a compensation temperature much above the room temperature.

**Keywords** Bit patterned media · Co-Tb alloy · Thin film

### 1 Introduction

Since many years, there has been a consistent frantic race in academia as well as in industry to enhance the storage density of hard disk drive (HDD). With time, there has been dramatic advancement in recording media and technology for HDD [1, 2]. In recent years, bit-patterned media (BPM) has been projected as one of the promising media for high-density magnetic recording beyond conventional magnetic recording medium [3, 4]. The advantage of BPM is that here each bit is recorded across artificially fabricated isolated magnetic nanostructure, in contrast to the conventional media where each bit is stored across 20–30 magnetic grains within a continuous

magnetic film [1, 2]. Moreover, BPM offers a promising solution for thermal instability and prevents inter granular exchange interaction and media noise, which usually arises in conventional media [3, 4]. Thus, BPM media technology has been projected as an alternative potential media to achieve a recording density up to 20–300 Tb/in<sup>2</sup>. From the fabrication point of view, it is a very challenging task to tune artificially created nanostructure for BPM. Usually, in BPM, a periodic array of magnetic nanodots is defined lithographically by ensuring that nanodots must have small fluctuations and should have sufficiently narrow switching field distribution [5, 6]. But, considering the fact that the lithographic technique is one of the very expensive tools, there has been consistent demand to look for non-lithographic approach for the fabrication of BPM. Recently, one non-lithographic technique was proposed for the fabrication of BPM, with the help of nanoporous anodic alumina (AAO) templates as a two-dimensional (2D) curved substrate [7], and this approach was successfully tested by depositing [Co/Pt] magnetic multilayers [8] to form isolated Co/Pt based BPM.

In order to obtain high-density BPM, not only the optimization of fabrication process is important but the selection of appropriate materials is also required. Out of many available

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## EDITORIAL

### Conservation of the tea (*Camellia sinensis* (L.) O. Kuntze) ecosystem through enhancement of natural enemies of pests

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Tea (*Camellia sinensis* (L.) O. Kuntze), being its perennial and monoculture nature, provides a stable microclimate for various insect pests, which cause substantial loss of crop (Li *et al.*, 2019). With the escalating cost of insect pest management and increasing concern about the adverse effects of the pesticide residues in manufactured tea, there is an urgent need to explore other avenues of alternate pest management strategies (Babu, 2011). In general, the tea plantations provide a stable microclimate and food supply for several notorious pests, such as insects, mites, and nematodes, etc. They also support an array of natural enemies in the ecosystem. Although there are numerous non-conventional methods available, pest control in the tea ecosystem was mainly achieved by the use of synthetic pesticides until today. Biological pest control methods are adopted globally in major crops to avoid the negative impact of synthetic pesticides (Gillespie *et al.*, 2000). Several tea pests may be controlled by using natural enemies as biological control agents in an integrated pest management approach (Babu *et al.*, 2011).

The natural enemy guild is dominated by predators in several ecosystems. Muraleedharan and Roy (2016) reported a total of 200 predatory arthropod species were recorded in the tea ecosystem. The overall species composition reflects the richness of arthropod natural enemies, *i.e.*, predators and parasitoids of tea pests, where the natural enemy to pest ratio is 1.7:1. The tea plantations in Northeast India harbour several species of coccinellids, such as *Cryptogonus bimaculatus*, *Juravia quadrinotata*, *J. opaca*, *Menochilus sexmaculatus*, and *Stethorus gilvifrons*, which feed on eriophyid mites, spider mites, aphids, and scale insects (Somchoudhury *et al.* 1995). The parasitoids, *Apanteles coedicius*, *Trioxys indicus*, and *Aphidius colemani*, have several hosts, like *Toxoptera aurantii* feeding on tea, and *Aphis gossypii* and *Aphis craccivora* on weeds in tea fields. The tea mosquito bug *H. theivora* are being preyed upon by *Chrysoperla carnea*, *Oxyopes* sp., *Plexippus* sp., *Phidippus* sp., and *Scymnus* sp. and mantids. Eggs of *H. theivora* were found parasitized by *Erythemelus helopeltidis* Gahan in South India (Sudhakaran and Muraleedharan, 2006). The activities of predators and parasitoids have been found to be high in Northeast India. In the areas of North Bengal, Roy

*et al.* (2005) found 35 species of spiders and 25 species of coccinellids as natural enemies in the tea ecosystem, while 94 species of predators and 33 species of parasitoids were reported from the sub-Himalayan tea plantations of North Bengal, among which the predators, spiders and ladybird beetles, and among the parasitoid groups, Braconidae and Ichneumonidae, were dominant (Das *et al.* 2010).

#### *Sycanus collaris* (Fabricius):

Reduviidae a large family that belongs to the order Hemiptera, are found to be efficient predators of different insect pests, preferably lepidopteran larvae (Ambrose *et al.*, 2009). *Sycanus collaris*, (Fabricius), known as the assassin bug, all of its life stages efficiently feed on the target insect. The sequential predatory behaviour of the genus *Sycanus* on its prey is very active (Ambrose *et al.*, 2009). *S. collaris* is found to feed on different hosts, like the tea red slug caterpillar, *Eterusia magnifica* (Butler) as well as the pupal stage of the tea looper, *Hyposidra talaca* Walker. During the winter period (December to February), when the tea plants are subjected to pruning, *S. collaris* forages for food and shelter in the un-pruned plots and shade trees. They preferred to shelter in small jungle trees associated with tea fields. The voracious predatory behaviour of *S. collaris* effectively prevented the increasing population density of *H. talaca* under field conditions. Sarkar *et al.*, (2019). Sarkar *et al.*, (2019) reported the predatory efficiency of *S. collaris* on the larvae of *H. talaca* and reconfirmed that the larger size of life stage *S. collaris* preferred by the later stages (IV and V instar larvae) to fulfill the nutritional requirements. Predatory behaviour of feeding preference highlights the vital role of this predator as an efficient biological control agent in the tea ecosystem. Conservation of this predator in the plantation belt would be useful in developing a bio-control-based looper pest management strategy in the tea ecosystem.

#### *Eocanthecona furcellata* (Wolff):

The stink bug, *Eocanthecona furcellata* (Wolff) is one of the important predator that has recently included in the field of biological control due to its potential to prey different orders of insect pests such as, lepidoptera,

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# Molecular characterization of Glutathione S-transferase in two eel species, *Monopterus cuchia* (Hamilton) and *Monopterus albus* (Zuiew)

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Submission Date: 19-02-2020; Revision Date: 26-03-2020; Accepted Date: 18-04-2020

## ABSTRACT

The present investigation has been carried out for DNA isolation, sequencing, sequence analysis, tertiary structure prediction and phylogenetic analysis of Glutathione S-transferase from two freshwater synbranchid eel species of the genus *Monopterus* in different states of Northeast India (Assam and Manipur). Glutathione S-transferase is potentially used as a biochemical marker of aquatic pollution and they are the decisive indicators of the toxic effect. The GST gene sequences of *M. cuchia* is more G: C rich than *M. albus* and the GST gene of *M. albus* is more A: T rich than that of *M. cuchia*. The instability index (II) value of GST enzyme of the present study ranged from 49.26 to 52.67, which classifies the GST protein as unstable. The phylogenetic analysis of GST gene revealed that, *M. cuchia* and *M. albus* formed two separate clades with high bootstrap separation 98% and 100% in ML and MP tree respectively clearly indicates the possibility for existence of two sub-species in *M. cuchia*. The MP phylogeny of GST gene also revealed genetic diversity within *M. albus* at 73% bootstrap separation. Some of the samples of *M. albus* and *M. cuchia* in the GST gene phylogenetic tree revealed the possibility of interbreeding or hybridization in the *Monopterus* species. The predicted 3D structure of GST will reveal more insights on GST activity in *M. albus* and *M. cuchia* in order to reveal the detailed detoxification mechanism freshwater eels.

**Key words:** Glutathione S-transferase, *Monopterus*. Northeast India, Synbranchid.

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## EDITORIAL

### Strategic protection of Asian rhinos: the conservation success of the greater one-horned rhinoceros

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An environment with resounding species diversity reinforces economic stability and human livelihoods over time (UNEP, 2008). This comes from the fact that the environment generates substantial scientific, ecological, cultural and spiritual dividends to the societies they are a part of (Abbot and Neba, 2001). As such, existence and survival of the rhinoceros directly or indirectly assists other wildlife and people who depend on the health of that environment (Brook *et al.*, 2014). At the dawn of the twentieth century, 500,000 rhinos roamed Africa and Asia (Shelley, 2018). These numbers dropped to 70,000 by 1970, and today, a little over 27,000 rhinos remain in the wild. Due to continuous hunting and habitat degradation over decades, few few rhinos have survived outside national parks and reserves (Gustafson *et al.*, 2018). Three of the five rhino species that have survived are from Asia: the greater one-horned rhino or Indian rhinoceros (*Rhinoceros unicornis*), which has an estimated 3,500 individuals, the Javan rhinos (*Rhinoceros sondaicus*), which has fewer than 70 individuals, and the Sumatran rhinos (*Dicerorhinus sumatrensis*), which has fewer than 80 individuals. The Javan and Sumatran are now classified as critically endangered (CR) species on the IUCN Red List. These rhinos, which are now located in Indonesia, continue to suffer a variety of threats. Surprisingly, the Indian rhinoceros was downlisted from endangered (EN) to vulnerable (VU) category in 2008 owing to its improved condition. Following substantial population gains, the larger one-horned rhino has become one of Asia's greatest conservation success stories (Ghosh-Harihar *et al.*, 2019). The species is still threatened, however, by poaching for its horn and habitat loss and degradation.

Consumer demand for rhino horn, particularly in Asia, promotes poaching. In 2015, poachers murdered at least 1,300 rhinos in Africa. 691 rhinos were poached in 2017. In 2018, 508 rhinos were poached, a modest decrease. Stopping this is vital for their protection, especially for Asian indigenous species. Poaching will continue to be a big threat to rhinos. Preventive measures must be strengthened. The ability to detect illegal wildlife traffickers' movements is important to their capture (Soud and Talukdar, 2013).

Only 67 Javan rhinos are believed to exist in the wild, making it one of the most endangered big mammals. They are exclusively found in Ujung Kulon National Park in Java's extreme southwest. The WWF supports the Ujung Kulon Rhino Protection Units to protect the surviving Javan rhino population from poaching and environmental deterioration. In 2011, Vietnam declared a rhino subspecies extinct (Brook *et al.*, 2014). As part of

this effort, the WWF is clearing Arenga palm trees from 6,178 acres of historic habitat. Removing palm trees and aggressively restoring natural flora and food plants is vital for rhino survival. Data on Javan rhino activity, distribution, mobility, population size and genetic diversity are being collected using video traps (Haryono *et al.*, 2015).

A total of less than 80 individuals survive in dispersed subpopulations across Indonesia's Sumatra and Borneo islands. The Javan rhino population is tiny, but it is a robust reproductive population. However, the Sumatran rhino is a rare species found only on the Indonesian islands of Sumatra and Kalimantan (Havmiller *et al.*, 2016). The few survivors live in scattered woodlands, making breeding difficult. Sumatran rhinos, the world's tiniest rhinoceros, cannot breed in the wild. As a result, their population has decreased.

Native to the Indian subcontinent, the Indian rhinoceros thrives majorly in the alluvial Terai-Duar savanna, grasslands and river forests of the Kaziranga National Park and Pobitora Wildlife Sanctuary in the Indian state of Assam, and Chitwan National Park of Nepal. Exotic species, natural succession, and changes in water regimes are the primary threats to its habitat. The Indian and Nepalese governments have helped conserve this species. Reintroduction efforts have been made in India's designated rhino Protected Areas, notably Kaziranga. India passed a species-preservation law, which helped. However, approximately 70% of the Indian rhino population is limited to Kaziranga National Park. Land-use changes in the plateau, Pesticide run-off, civil unrest, increased poaching, and habitat degradation all threaten the Indian rhino's current state. This begs us to understand why and how conservation efforts in the Kaziranga led to conservation success of the greater one-horned rhinoceros in the Indian subcontinent. Kaziranga National Park (KNP) is "the largest pristine and representative section in the Brahmaputra floodplain" (UNESCO, 1985). It has 2,413 rhinos (KNP Rhino Census, 2018), 2/3 of the global population. A natural World Heritage Site in India. KNP has been in the forefront of India's environmental conservation efforts for decades due to river bank erosion, sedimentation, and land creation/destruction (Hazarika and Kalita, 2019).

To combat poaching, the Indian government has undertaken many conservation measures. The Indian Wildlife (Protection) Act, 1972, and the Indian Forest Act, 1927, safeguard KNP. It also protected forest

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## Research Article

# Sequence Analysis and Structure Prediction of SARS-CoV-2 Accessory Proteins 9b and ORF14: Evolutionary Analysis Indicates Close Relatedness to Bat Coronavirus

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Received 8 June 2020; Revised 12 September 2020; Accepted 30 September 2020; Published 21 October 2020

Academic Editor: Gyrgy Schneider

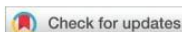
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Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has a single-stranded RNA genome that encodes 14 open reading frames (ORFs), eight of which encode accessory proteins that allow the virus to infect the host and promote virulence. The genome expresses around 29 structural and nonstructural protein products. The accessory proteins of SARS-CoV-2 are not essential for virus replication but do affect viral release, stability, and pathogenesis and finally contribute to virulence. This paper has attempted the structure prediction and functional analysis of two such accessory proteins, 9b and ORF14, in the absence of experimental structures. Sequence analysis, structure prediction, functional characterization, and evolutionary analysis based on the UniProtKB reviewed the amino acid sequences of SARS-CoV-2 9b (P0DTD2) and ORF14 (P0DTD3) proteins. Modeling has been presented with the introduction of hybrid comparative and *ab initio* modeling. QMEANDisCo 4.0.0 and ProQ3 for global and local (per residue) quality estimates verified the structures as high quality, which may be attributed to structure-based drug design targets. Tunnel analysis revealed the presence of 1-2 highly active tunneling sites, perhaps which will be able to provide certain inputs for advanced structure-based drug design or to formulate potential vaccines in the absence of a complete experimental structure. The evolutionary analysis of both proteins of human SARS-CoV-2 indicates close relatedness to the bat coronavirus. The whole-genome phylogeny indicates that only the new bat coronavirus followed by pangolin coronaviruses has a close evolutionary relationship with the novel SARS-CoV-2.

## 1. Introduction

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is a positive-sense, single-stranded RNA virus with a genome size of 29,903 nucleotides in length. The 5' terminus of the SARS-CoV-2 genome encodes a polyprotein (pp1ab), which is further cleaved into 15 nonstructural proteins (nsp-1 to nsp-10 and nsp-12 to nsp-16), whereas the 3' terminus encodes four structural proteins (spike, envelope, membrane, and nucleocapsid) and eight accessory proteins (3a, 3b, p6, 7a, 7b, 8b, 9b, and ORF14) [1, 2]. The virus is the causative agent of coronavirus disease 2019 (COVID-

19) and is contagious through human-to-human transmission. Previously identified human CoVs that cause human disease include alphaCoVs hCoV-NL63 and hCoV-229E and the betaCoVs HCoV-OC43, HKU1, severe acute respiratory syndrome CoV (SARS-CoV), and Middle East respiratory syndrome CoV (MERS-CoV) [3]. Among the seven strains coronaviruses (CoVs) discovered so far, three strains proved to be highly pathogenic (SARS-CoV, MERS-CoV, and 2019-nCoV), which caused endemic to severe CoV disease [4, 5]. The viruses can be classified into four genera: alpha, beta, gamma, and deltaCoVs [6]. The SARS-CoV and MERS-CoV infections can result in life-threatening

Cite this: *Org. Biomol. Chem.*, 2021, **19**, 6256Received 24th April 2021,  
Accepted 23rd June 2021  
DOI: 10.1039/d1ob00797a  
rsc.li/obc

## Pd(II)-Catalyzed oxidative alkenylation of 4-hydroxycoumarin with maleimide via a C–H bond activation strategy†

Kumud Sharma,<sup>a,b</sup> Kashmiri Neog,<sup>a,b</sup> Abhilash Sharma<sup>a,b</sup> and Pranjal Gogoi<sup>\*,a,b</sup>A Pd(II)-catalyzed oxidative alkenylation of 4-hydroxycoumarins with maleimides for the synthesis of 4-hydroxy-3-maleimidecoumarins has been described. This methodology proceeds via C–H activation and C(sp<sup>2</sup>)–C(sp<sup>2</sup>) bond formation providing a series of alkenylated Heck-type products.

### Introduction

Transition metal-catalyzed C–H activation reactions have emerged as an efficient and atom economical synthetic protocol for the construction of various pharmaceutical intermediates and complex molecules.<sup>1</sup> Among them, the oxidative alkenylation reaction has received much attention as one of the most powerful tools in modern organic synthesis for the construction of the C(sp<sup>2</sup>)–C(sp<sup>2</sup>) bond without prefunctionalization of both the starting materials.<sup>2</sup> Being atom-economical with low chemical cost and less waste formation, this coupling strategy was privileged over other traditional cross coupling reactions such as Heck, Suzuki–Miyaura, Stille and Negishi reactions. Using this synthetic strategy, a number of cyclic or acyclic olefins could be installed for the functionalization of a wide range of carbocycles and heterocycles.<sup>3</sup> In this regard, maleimide has always been a targeted molecule for the direct oxidative alkenylation of its electron deficient olefinic bond due to its wide availability in nature and bioactive compounds (Fig. 1).<sup>4</sup> Direct oxidative alkenylation of maleimide via the C–H activation process is a challenging task due to the lack of the *syn*-periplanar  $\beta$ -hydrogen atom of the rigid bicyclic intermediate of the succinimide ring. Consequently, rotation of the  $\sigma$ -bond is restricted and elimination of the  $\beta$ -hydrogen atom is not feasible.<sup>5</sup> Therefore, most of the reports are based on transition metal-catalyzed C–H bond alkylation/1,4-addition<sup>5a–f,h–k</sup> and different annulation reactions.<sup>5g</sup> To circumvent this problem, Capretta and his group utilized bromomaleimide as a starting material for the arylation of maleimide via a coupling

reaction.<sup>6a</sup> Later, a major breakthrough was achieved by Prabhu and co-workers without prefunctionalization of both the starting materials. In this perspective, they reported various directing group assisted Rh(III)-catalyzed oxidative alkenylation reactions of maleimides leading to the formation of Heck-type products (Scheme 1a and b).<sup>5a–d,6b</sup> In addition to these, Jeganmohan and group reported a Rh(III)-catalyzed *ortho*-alkenylation of anilides and an aerobic oxidative alkenylation of arylacetamides with maleimides to furnish some Heck-type products.<sup>6c,d</sup> Later on, Sharma *et al.* disclosed a Rh(III)-catalyzed regioselective C–H activation strategy for the alkenylation of 2-amino-1,4-naphthoquinones with maleimides (Scheme 1c).<sup>7b</sup>

Furthermore, Ravikumar's group described a Co(III)-catalyzed regioselective alkenylation reaction between indoles and maleimides (Scheme 1d).<sup>7c</sup> This reaction is triggered by a weakly coordinating acetyl group providing 4-maleimide substituted 3-acetylindoles via C–H bond activation/functionalization. Recently, Hajra and co-workers reported a Rh(III)-catalyzed site selective alkenylation reaction of 2-arylidazoles with maleimides to accomplish the functionalization at the less nucleophilic *ortho*-position of the aryl ring (Scheme 1e).<sup>7d</sup> In addition to these, several reports on a site-selective catalytic

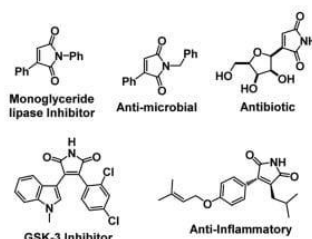



Fig. 1 Examples of bioactive maleimides.

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† Electronic supplementary information (ESI) available: Copies of <sup>1</sup>H and <sup>13</sup>C NMR and HRMS spectra of all products. See DOI: 10.1039/d1ob00797a



## Dissecting the morpho-physiological and biochemical responses in some traditional rice cultivars under submergence stress

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Received: 24 January 2020 / Revised: 26 October 2020 / Accepted: 14 December 2020 / Published online: 28 January 2021  
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### Abstract

Submergence is a major constraint that delimits rice productivity in Assam of Northeast India where rice is widely cultivated. Most of the agricultural field of Assam are flood prone that leads to a huge decrease in rice production and therefore, it is necessary to identify the submergence tolerant rice to be exploited for future rice breeding program. Six traditional rice cultivars selected from flood prone area of Assam, India were subjected to submerge stress for 7 and 14 days and their morpho-physiological, biochemical and antioxidant properties were analysed. Based on the overall analyses, *Maguri*, *Nania* and *Kota Joha* have been recorded as tolerant while *Bora* and *Prasadbhog* showed susceptible traits as compared to controls. However, in biochemical analysis, shoot and root showed significant differences in antioxidant activity. In case of shoots, *Swarnasub1*, *Nania* and *Maguri* exhibited the tolerance characteristics while *Lachit* along with *Bora*, *Prasadbhog* and *Kota Joha* were susceptible. On the other hand, root antioxidant analyses showed that *Kota Joha* was showing tolerance trait with *Swarnasub1* whereas, *Prasadbhog* and *Bora* appeared to be susceptible. From this investigation, we also evaluated the enzymatic and non enzymatic analyses under submergence stress with an aim to screen out the best cultivars that could be further utilized for developing submerged tolerant rice cultivar.


**Keywords** Antioxidant · Enzymatic · Non-enzymatic · Rice · Submergence stress

### Introduction

Submergence is considered as the most important constraint in growth and production of rice among different abiotic stresses (Setter et al. 1998). Submergence is a major constraint to rice production during the monsoon season in the rainfed lowlands in south and Southeast Asia. The North-eastern region of India in general and Assam in particular experiences a plenty of rainfall that possesses a productive land which is distinctly advantageous for agriculture. However, due to the adverse effect of climate change, untimely rainfall causes water logging in almost 17 districts of Assam that drastically reduce the rice productivity.

Unlike other crops, rice has several mechanisms of submergence tolerance. Various morphological and physiological changes occurs under stress condition viz., organization of longitudinal interconnected air cavities or aerenchyma is one of a mechanism, which allows transportation of oxygen to submerged roots from well-aerated shoots (Jackson and Armstrong 1999; Colmer and Pedersen 2008; Nahar et al. 2020; Kalita and Tanti 2020). Aerenchyma helps in diffusing oxygen to the apical meristem of the root that are used both in the process of disperse respiration and release of the oxygen into the rhizosphere for oxygenation (Gambrell et al. 1991; Colmer 2003; Rehman and Tanti 2020). Moreover, reactive oxygen species (ROS) are the major key molecules; act as main regulators of cellular responses under abiotic stresses (Apel et al. 2004; Bhattacharjee 2012; Sharma et al. 2012).

Submergence results in a huge loss of rice productivity and hence there is a need of identifying promising submergence tolerant traditional rice varieties to be used as cultivars in the rice improvement program.

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## ISOLATION AND IDENTIFICATION OF MICROORGANISMS FROM SOME SPOILED FRUITS AND VEGETABLES COLLECTED FROM NAGAON, ASSAM

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(Date of Receiving-12-01-2021; Date of Acceptance-31-03-2021)

### ABSTRACT

Fruits and vegetables provide sufficient condition for the growth of several fungi and bacteria. Microorganisms spoil the fruits and vegetables and changes the texture and makes them uneatable. There is a heavy loss of fruits and vegetables due to spoilage by microorganisms; however during handling and transportation also, there is a greater risk to get damaged. Thus farmers suffered a great loss due to spoilage. In the present study a total of about 3 spoiled fruits and 3 spoiled vegetables were taken from some local markets of Nagaon, from which fungal and bacterial isolates were isolated and identified. Biochemical tests for the isolated bacteria were also done.

**Keywords:** Contaminated, spoilage, fungi, bacteria and surface sterilized

### INTRODUCTION

Fruits and Vegetables are rich source of vitamins, minerals and fibers and thus are essential to sustain a healthy lifestyle. They are also a rich source of antioxidants thus are essential to protect us from various diseases (Kalia and Gupta, 2006). Vegetables are consumed on a daily basis and their consumption is also key area for maintaining a balanced diet. One of the major risks for the preservation of fruits and vegetables is that they have a very short shelf life and they are exposed to the microbial contamination if contacted through soil, dust and water. Thus preservation of fruits and vegetables are very much important for consumption for a longer duration.

Many countries are engaged in the production of fruits and vegetables to a larger extent. India being an agricultural rich country produces fruits and vegetables in a huge scale. India is the second largest producer of fruits and vegetables after China. According to Kumar (2011), Food and agricultural organization (FAO) data shows that India has produced about 76424.2 tons of fruits, 156325.5 thousand tons of vegetables and 388269.2 tons of food grains in 2011. Even due to enormous production of fruits and vegetables, during transportation, handling, storage heavy losses of fruits and vegetables are reported (Chukwuka *et al.*, 2010, Zubair, 2009, Barth *et al.*, 2013).

The differences in the presence or absence of microorganisms could be due to various factors which can be due to resident microflora in the soil, presence of any non-resident microflora through animal manures (Khatri and Sharma, 2018). Microorganisms spoil them and thus leads to a great loss to the Mankind. Spoilage

leads to change in texture, taste and which can't be eatable (Akinmusire, 2011). The present study aims to isolate and identify microorganisms from some spoiled fruits and vegetables collected from Nagaon, Assam.

### MATERIALS AND METHODS

Some unprocessed spoiled fruits like apple, banana and grapes and vegetables like potato, tomato and onion were collected from three different markets of Nagaon and are directly brought to the Botany laboratory for the isolation and identification of microorganisms which are responsible for their spoilage.

#### Isolation of fungi

Isolation of fungi from the spoiled fruits and vegetables were done following standard protocols in which they were firstly washed with sterile distilled water and ultimately surface sterilized with 1% Ca(OCl)<sub>2</sub> and with the help of sterilized sharp razor, tissues adjacent to the diseased portion were cut and placed into PDA media which was supplemented with penicillin (100000 units/L) and streptomycin (0.2 g/L). The plates with the sterilized tissues were incubated for a week at 26±2°C until the growth of the fungi was not observed. The fungi growing out from the adjacent tissues were identified following standard identification manuals (Barnett and Hunter, 1988; Gilman, 1957).

#### Isolation of bacteria

Isolation and identification of bacteria from the spoiled fruits and vegetables collected from three different sites of Nagaon were done following serial dilution method

Dipanjali Devi and Rupjyoti Gogoi

**Table 1-** Table representing occurrence of different isolates of fungi from spoiled fruits and vegetable samples

Isolates	Colony morphology	Apple	Banana	Grapes	Potato	Tomato	Onion	Frequency
<i>Aspergillus</i> sp.1	Black mold like structure	+	-	+	-	+	-	3(20)
<i>Aspergillus</i> sp.2	Purplish colony	-	+	-	+	+	-	3(20)
<i>Penicillium</i> sp.1	White smooth colonies	+	+	-	+	+	-	4(26.6)
<i>Penicillium</i> sp.2	Green smooth	+	+	+	-	-	-	5(33.3)
<i>Monilia</i>								4(26.6)
<i>Phytophtho</i>								3(20)
<i>Sclerotinia</i>								4(26.6)



Tools



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## Astromodal wave dynamics in multifluidic structure-forming cloud complexes

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MS received 30 October 2019; accepted 8 September 2020

**Abstract.** The evolutionary dynamics of bimodal pulsational mode, arising because of the long-range conjugational gravito-electrostatic interplay in viscoelastic polytropic complex multicomponent astroclouds with partial ionisation, is classically examined using a non-relativistic generalised hydrodynamic model approach. The equilibrium distribution of the diversified constitutive species forms a globally quasi-neutral hydrostatic homogeneous configuration. The primitive set of the astrocloud structuring equations specifically includes polytropic (hydrodynamic action) and nonlinear logatropic barotropic (turbulence action) effects simultaneously. A normal mode analysis over the perturbed cloud results in a unique form of sextic polynomial dispersion relation with variable poly-parametric coefficients. A numerical analysis technique is provided to show the exact nature of the modified viscoelastic (turbo-viscoelastic) pulsational mode in the two extreme hydrodynamic and kinetic regimes. It is seen that, in the former regime, the dust–charge ratio (negatively-to-positively charged grains) plays a destabilising role to the instability. In contrast, the dust–mass ratio (negatively-to-positively charged grains) develops a stabilising influence in the wave-dynamical processes. In the latter regime, the viscoelastic relaxation velocity associated with the positively charged grains acts as an amplitude stabiliser. Conversely, the viscoelastic relaxation velocity of the negatively charged grain fluid introduces destabilising influences. The unique features of the propagatory and non-propagatory mode characteristics are elaborately illustrated. The reliability of the investigated results is judiciously validated by comparing the results with the specific reports available in the literature. Lastly, the first-hand astronomical implications and applications of our study are summarily outlined.

**Keywords.** Astroclouds; turbo-viscoelasticity; pulsational mode.

**PACS Nos** 52.27.LW; 92.60.Nv

### 1. Introduction

The natural existence of conjugational bimodal instability dynamics (pulsational type) in complex astrophysical plasma fluids under the conjoint gravito-electrostatic interplay is one of the most fundamental tenets in astrophysics for decades. The instability dynamics is triggered by the counteraction of long-range conjugational gravito-electrostatic force fields in partially ionised complex dusty astrofluids [1–8]. The threshold condition responsible for triggering such an instability leading to bounded structures to form is that the gravito-electrostatic forces should be nearly comparable [4]. In other words, bounded structures would result in the existence of an overlapping scale between the self-gravitational and electromagnetic interactions by the constitutive dust grains. Its relevance is primarily

pronounced in various complex mechanisms of wave-induced fluid material redistribution leading to the phase dynamics initiation of astrophysical large-scale bounded structures, such as planetsimals, stellesimals, comets, etc. [1,2].

A good number of researchers have carried out systematic investigations to explore the complex instability dynamics of pulsational source leading to structure formation in astrofluid media in the recent past. The conjugational instability dynamics in the presence of fluid viscoelasticity has recently been addressed by Dutta and Karmakar [7]. The most important point reported in their study is that the grain mass and the viscoelastic relaxation time associated with the charged dust fluid play stabilising roles on the fluctuations in the hydrodynamic regime. In contrast, in the kinetic regime, the stabilising effects are introduced by the

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## 1. A DESCRIPTIVE STUDY ON THE ROLE OF BODO WOMEN IN SEASONAL FESTIVALS

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### Abstract

The present paper attempts to study and identify the seasonal festivals celebrated by the Bodos of Assam. An attempt has also been made to explore and highlight the roles and participation of womenfolk in celebrating the seasonal festivals in Bodo society. Assam is one of North-East India's states, where many tribal and non-tribal people inhabit since time immemorial. Bodo is one of the ethnic groups of Assam, having its rich culture, traditions, customs, language, literature and folklore by which they represent their world view. The Bodos traditionally celebrate several major and minor festivals and ceremonies during a year based on their folk custom. They have four seasonal festivals of their own, like *Bwisogu*, *Magor* or *Domari*, *Kati gasa Soanai* and *Amhizura*, which are still prevalent in their society. During the festival, women's participation plays a vital role in the celebration without whom these festivals are incomplete. It is hoped that the study will help in terms of understanding, documenting and preserving the traditional festivals of the Bodos and the role and participation of women in the celebration.

*Keywords:* Bodo, Bwisogu, Domasi, Kati Gasa Soanai, Amhizura

### Introduction

The Bodos, an ethnic group of Assam, is one of the earliest settlers and the single largest group amongst the scheduled tribes of Assam. However, they are scattered throughout India's North-Eastern region, mainly inhabiting Assam and some adjacent areas of Arunachal Pradesh, Meghalaya, Nagaland, Mizoram, Manipur, Tripura and the northern part of West Bengal, Bihar and the adjoining regions of Bangladesh, Nepal and Bhutan. The Bodo community is also known by different names in Assam, such as Boro, Kachari, Boro Kachari, etc. The Bodos have their own distinct and rich culture, tradition, folklore, language, literature, agricultural and socio-religious practices and festivals.

The Bodo society has an egalitarian nature of ideology. They are very liberal in terms of gender equality in every aspect. Although the Bodos' social structure is based on patriarchal social system, women's place in the Bodo society is high. Since time immemorial, women play a very active role in almost every field, in the family, socio-economic life, cultural activities and socio-religious festivals and ceremonies. The Bodos traditionally celebrate several major and minor festivals and ceremonies during a year based on their folk custom. During the festival, women's participation plays a vital role in the celebration without whom these festivals are incomplete. Therefore, the study is determined to reveal the importance of the role of womenfolk in celebrating seasonal festivals in the Bodo community of Assam.

## Exploration Of Contemporary Women Themes In Ismat Chughtai's "The Crooked Line"

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**Abstract:** The paper explores the study of women by a women contemporary writer in the post modernism conventions. The title of the paper enhances to the ideas and concepts brought out in the novel by Ismat Chughtai's "The Crooked Line" where several themes of women related needed to be studied. Common traits of human personality are addressed in the exploration of women themed novels. The novel explores the core of the female psyche. The novel surfaces the struggle of modern women's existential capacity to establish her own identity and individuality.

**Keywords:** women, race, sexuality, conservative

### **Introduction:**

Ismat Chughtai, a prolific women writer of the 20<sup>th</sup> century has brought her magna opus, The Crooked Line (Terhi Lakeer) in a time of political and social revolution during India's colonial period. Chughtai screens out the complex relationships emerged within women living and working in relative seclusion, and the intellectual and emotional contradictions lying in the heart of a rebellious country in the time of freedom movement. The Crooked Line was published in the year 1943. Chughtai explores out the inner realms of women's lives. The novel comprehends the story of a young spirited woman who rebels against the traditional Indian life of purdah or female seclusion. Shamman, the protagonist and her sisters are raised in a conventional Muslim household entitled to constraints. As a semi-autobiographical novel of a strong minded fiery spirited middle class Muslim girl bent on exploring the shape and nature of consuming desire, Chughtai explores the complex relationships between women caught in a changing culture. It is a fact that human relationships have been efficiently dealt in the novels of various Indian novelists and Chughtai was the one who shook the very foundation of the biasness in their society through her novel Tehri lakeer. In the novel, the novelist use the technique of bildungsroman which focuses on the development of the central protagonist from birth to a position of stability. The writer divides the narrative which encompasses India's movement for independence into three phases of shamman's turbulent life- childhood, adolescence, and adulthood.

## Some Significant Cultural Aspects of the Society as Depicted in the *Padmaprābhṛtaka*

Mridusmita Bharadwaj\*  
Prof. Kameshwar Shukla\*\*

### Introduction:

Sanskrit literature with its affluent literary forms enriches the Indian society and its culture. The two main divisions of *kāvya* viz. *drśyakāvya* and *śravyakāvya* have assimilated different kind of literary forms of Sanskrit literature. *Drśyakāvya* comprises of ten *rūpakas*<sup>1</sup> and eighteen *uparūpakas*<sup>2</sup>. *Bhāṇa* is one of the ten kinds of *rūpakas*. In the works of Sanskrit dramaturgy such as the *Nāṭyaśāstra*<sup>3</sup>, *Daśarūpaka*<sup>4</sup>, *Sāhityadarpaṇa* etc., the features of *bhāṇa* have been prescribed. *Bhāṇa* ensures its remarkable position in the Sanskrit literature with distinctive delineation of subject-matter, characterization and aesthetic essence. The *Padmaprābhṛtaka bhāṇa* provides literary evidences for the critical appraisal of the contemporary society. Different aspects of society have been exhibited by the author. The appearance of various characters enriches a broad spectrum of social issues in the *bhāṇa*.

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1. nāṭakamūlhaprakaraṇaḥbhāṇavyāyogasamāvākṛaḥjīmāh/ ihāmrṅgāṅkav/ṭhyah/praḥasanamitirūpakānidāsa // *Sāhityadarpaṇa*, VI.3
2. Ibid., VI.4-6
3. *Nāṭyaśāstra*, (part III), XVIII.108-111
4. *Daśarūpaka*, III. 49-51



## অসমীয়া বৰ্ণমালাৰ উচ্চাৰণ পদ্ধতি

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সংক্ষিপ্তসাৰ : ভাষাৰ ধ্বনি বুজোৱা চিন বা আখৰকে বৰ্ণ বোলে। অৰ্থাৎ, যি আখৰেৰে ভাষা লিখা হয় সেয়াই হৈছে বৰ্ণ। বৰ্ণবোৰ একোটা নিৰ্দিষ্ট ক্ৰমত সজাই লৈ একোখন ফলা তৈয়াৰ কৰা হয়। বৰ্ণৰ এনে ফলাই হৈছে বৰ্ণমালা। অসমীয়া ভাষাত ব্যৱহৃত বৰ্ণৰ ফলাখনক অসমীয়া বৰ্ণমালা বোলে। অসমীয়া ভাষাৰ মূল হৈছে প্ৰাচীন ভাৰতীয় আৰ্যভাষা। বৈদিক আৰু পৰৱৰ্তী পৰ্যায়ত সংস্কৃত ভাষাই প্ৰাচীন ভাৰতীয় আৰ্যভাষাৰ মূল ভিত্তি। সেয়ে অসমীয়া বৰ্ণমালাত সংস্কৃত ভাষাৰ কিছু প্ৰভাৱ নপৰাকৈ থকা নাই।

অসমীয়া ভাষাত বৰ্ণ আৰু আখৰৰ মাজত কিছু পাৰ্থক্য থকা দেখা যায়। সংস্কৃত ভাষাত বৰ্ণ শব্দই আখৰ আৰু সেই আখৰে বুজোৱা ধ্বনি দুয়োটাকৈ সূচাইছিল। সেয়ে সংস্কৃত ভাষাত ধ্বনি আৰু ধ্বনিৰ প্ৰতীক আখৰৰ মাজত সম্বন্ধ অটুত আছিল। অসমীয়া ভাষাত বৰ্ণ শব্দটোৱে বিশিষ্ট ধ্বনিকহে বুজাইছে। অসমীয়া ভাষাত বিশিষ্ট ধ্বনি বা বৰ্ণৰ সংখ্যা ৩১ টা। ইয়াৰে ২৩ টা বিশিষ্ট ব্যঞ্জন ধ্বনি বা বৰ্ণ আৰু ৮টা বিশিষ্ট স্বৰধ্বনি বা বৰ্ণ। অসমীয়া ভাষাত স্বৰ আৰু ব্যঞ্জনবৰ্ণ মিলি পোৱা মুঠ ৩১টা বৰ্ণ বুজাবলৈ লিপিমালাত ৫২ টা আখৰ ব্যৱহাৰ কৰা হয়। ভাষাবিজ্ঞান অধ্যয়ন কৰা ছাত্ৰ-ছাত্ৰীসকলে বৰ্ণ আৰু আখৰৰ এই পাৰ্থক্যবোৰ বুজিব পাৰে। কিন্তু নতুনকৈ ভাষা শিকিবলৈ লোৱা প্ৰাথমিক বিদ্যালয়ৰ ছাত্ৰ এজনে ভালদৰে বুজি নাপায়। সেইবাবে অসমীয়া বৰ্ণমালাত বৰ্ণ আৰু আখৰক একে অৰ্থত ব্যৱহাৰ কৰা হয়।

প্ৰাথমিক বিদ্যালয়বোৰত শিশুক ভাষাৰ প্ৰাথমিক জ্ঞান দিয়া হয়। কিন্তু বৰ্তমান সময়ত অসমৰ প্ৰাথমিক বিদ্যালয়বোৰত দেখা দিয়া আটাইতকৈ ডাঙৰ সমস্যাটোৱে হৈছে বৰ্ণমালাৰ শুদ্ধ উচ্চাৰণৰ অভাৱ। বহুক্ষেত্ৰত শিক্ষক-শিক্ষয়িত্ৰীসকলৰ মাজতো এই বিষয়ে অজ্ঞতা দেখা যায়। ভাষাবিদসকলে বৰ্ণমালাৰ এই আঁসোৱাহ সমূহ আঁতৰ কৰাৰ বাবে বিভিন্ন আলোচনা আগবঢ়াইছে। তেওঁলোকে আগবঢ়োৱা আলোচনাকে মুখ্য কৰি এই গৱেষণাপত্ৰত অসমীয়া বৰ্ণমালাৰ পদ্ধতিগত আৰু বিজ্ঞানসন্মত শুদ্ধ উচ্চাৰণ পদ্ধতি আগবঢ়াবলৈ যত্ন কৰা হৈছে।

বীজশব্দ : অসমীয়া বৰ্ণমালা, স্বৰবৰ্ণ, ব্যঞ্জনবৰ্ণ

पर्यावरणीय आलोचनात्मक दृष्टिकोण से, आर.के. नारायण के उपन्यास "द मैन ईटर ऑफ मालगुडी"  
और अनुराधा शर्मा पुजारी के "इयात एखन अरण्य आछिल"  
(यहाँ एक जंगल था) का तुलनात्मक अध्ययन

डॉ० दुलाल चंद्र दास\*

## शोध सारांश

समकालीन साहित्य में पर्यावरण का महत्वपूर्ण भूमिका है। प्रकृति के साथ साहित्य का गहरा संबंध है। पर्यावरण में परिवर्तन के कारण दुनिया भर में भयानक परिस्थितियों का सामना करना पर रहा है। दुनिया के विभिन्न हिस्सों में पानी की कमी हो रही है। एशिया, अफ्रीका और यूरोप की कई नदियां सूख चुकी हैं। इस पर्यावरण के परिवर्तन में मानवीय भूमिका कहीं अधिक है। शिक्षा के प्रकाश ने पर्यावरण को और अज्ञानी बना दिया है। ज्ञान के प्रकाश में मनुष्य इतना शक्तिशाली हो गया है कि वह स्वयं को अजेय शक्ति समझने लगा है। अब लोग राक्षसों के रूप में प्रकट हुए हैं। आर. के. नारायण के अंग्रेजी उपन्यास 'द मैन ईटर ऑफ मालगुडी' और अनुराधा शर्मा पुजारी के असमिया उपन्यास "इयात एखन अरण्य आछिल" (यहाँ एक जंगल था) भारतीय उपन्यास साहित्य की दो उल्लेखनीय रचनाएँ हैं। ये दोनों उपन्यास पर्यावरण पर आधारित हैं। दोनों उपन्यासों को तुलनात्मक अध्ययन की गई है साथ ही पर्यावरण के महत्वपूर्ण पहलुओं को कैसे दर्शाते हैं, इसका विश्लेषण प्रस्तुत किया गया है।

Keywords: आर.के. नारायण, द मैन ईटर ऑफ मालगुडी, अनुराधा शर्मा पुजारी, इयात एखन अरण्य आछिल, पर्यावरण।

### परिचय:

साहित्यिक अभ्यास में एक महत्वपूर्ण प्रवृत्ति पर्यावरणियों की आलोचना है। प्रकृति को नष्ट करने की मानव प्रवृत्ति पर्यावरण में अजीब से बदलाव ला रही है और पर्यावरणीय समस्याएं पैदा कर रही हैं। यह समस्या एक दिन मानव समाज को नष्ट कर सकती है। इस तरह की आशंकाओं ने प्रकृति-जागरूक लेखकों को प्रेरित कर दिया है। विलियम रूफर्ट ने 1978 में "लिटरेचर एंड एनवायरनमेंट: एन एक्सपेरिमेंट इन इकोक्रिटिसिज्म" अपने निबंध में प्रकृति के विनाश से उत्पन्न पर्यावरणीय समस्याओं का उल्लेख किया है। आर. के. नारायण की 'द मैन ईटर ऑफ मालगुडी' और अनुराधा शर्मा पुजारी की 'इयात एखन अरण्य आछिल' पर्यावरण आलोचना का एक उत्कृष्ट उदाहरण है। वे दोनों उपन्यास में टैक्सिडेरमी और प्रकृति के विनाश और उसके दुष्प्रभावों के बारे में चर्चा किया गया है। पर्यावरण आलोचना में साहित्य और पर्यावरण के बीच अंतर्संबंध के बारे में अध्ययन करने के लिए एक वैचारिक आधार तैयार करता है। अंग्रेजी उपन्यासकार आर के नारायण के 'द मैन ईटर ऑफ मालगुडी' और असमिया साहित्य के उपन्यासकार अनुराधा शर्मा पुजारी के 'इयात एखन अरण्य आछिल' उपन्यासों का पर्यावरण आलोचना के नजरिए से तुलनात्मक अध्ययन किया गया है।

साहित्यिक कार्यों में पर्यावरण आलोचना का उपयोग विशेष रूप से उल्लेखनीय है। प्रकृति और मानव की संबंध पर्यावरण की दृष्टि से आलोचनात्मक विमर्श में स्पष्ट होता है। दोनों उपन्यासों में पर्यावरण जागरूकता और पर्यावरण साक्षरता के पहलुओं की भी जांच करते हैं।

### आर के नारायण की 'द मैन ईटर ऑफ मालगुडी':

आर के नारायण का उपन्यास 'द मैन ईटर ऑफ मालगुडी' पहली बार 1961 में विलियम हेनमैन लिमिटेड, लंदन द्वारा प्रकाशित किया गया था। नारायण ने दक्षिण भारत में मालगुडी की अनुठी प्राकृतिक सेटिंग पर आधारित उपन्यास लिखा है। उपन्यास का केंद्रीय पात्र नटराज जो पेशे से एक छोटे से प्रिंटिंग प्रेस का मालिक है। उपन्यास का मुख्य विषय टैक्सिडेरमी के लिए जानवरों की हत्या और उनके साथ क्रूर व्यवहार है। टैक्सिडर्मिस्ट वासु मालगुडी आकर नटराज के घर में किराए पर रहने लगा। वासु के आगमन से क्षेत्र में अशांति और अस्वास्थ्यकर वातावरण का माहौल पैदा हो गया। वासु ने आवारा कुत्तों, मेम्पी के जंगल के जानवरों और पक्षियों को गोली मार दी और पूरे इलाके में बदबूदार माहौल पैदा कर दिया। जब नटराज ने वासु से पूछताछ की तो उन्होंने उनके खिलाफ शिकायत दर्ज करा दी और अधिकारियों से जुट गए। वासु ने इलाके में असामाजिक माहौल





## Fabrication of a vertical Y-tube olfactometer for the assessment of spatial repellency of essential oils against *Helopeltis theivora* waterhouse

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Received: 5 December 2020 / Accepted: 12 July 2021  
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### Abstract

Pesticide resistance, cross-resistance, and limitation of potential biopesticide on *Helopeltis theivora* Waterhouse [Commonly known as tea mosquito bug (TMB)] have strongly triggered notable economic losses in tea [*Camellia sinensis* (L.) O. Kuntze] industries across African and some selected Asian countries like India and Bangladesh. Repellent agents like essential oils (EOs) could be quite promising to reduce the adverse and numerous side effects of synthetic pesticides; however, scientific study on chemoreception through olfaction, as a sensory modality on this pest, is yet to be done. In this study, therefore, spatial olfactory response of few selected essential oils ( $N=7$ ) has been highlighted in a modified vertical Y-tube olfactometer (VYTO), which is based on the negative geotaxis crawling movement (NGCM) of the pest within the confined environment of the olfactometer. The NGCM distance covered by the TMBs was 80 cm in  $16.02 \pm 1.47$  (Mean  $\pm$  SD) min with a speed of  $8 \times 10^{-3}$  m/s. This study is also first to report the spatial repellency, as spatial activity index (SAI), of transfluthrin as a positive control (0.88%) against TMBs [SAI of  $0.849 \pm 0.042$  (Mean  $\pm$  SD)]. Based on EOs yield, natural abundance, and growth, wild *Ageratum conyzoides* (L.) was found to be a potential spatial repellent agent [SAI of  $0.925 \pm 0.036$  (Mean  $\pm$  SD)] against adult female TMBs. GC-MS analysis of *A. conyzoides* detected precocene I and precocene II, as the most probable metabolites within the highest peak area (%). This study will definitely help in the behavioral study on TMBs in the future; especially, in the elucidation of spatial bio-insecticidal properties of the abundant volatile aromatic compounds in the natural environment.

**Keywords** *Helopeltis theivora* · Vertical olfactometer · Spatial activity index · Essential oil · Negative geotaxis crawling movement · *Ageratum conyzoides*

### Highlights

- Negative geotaxis crawling movement (NGCM) of adult female *H. theivora*, within an artificial chambered condition, covers a distance of 80 cm in  $16.02 \pm 1.47$  (Mean  $\pm$  SD) min with a speed of  $8 \times 10^{-3}$  (m/s).
- This study has evaluated the spatial activity index (SAI) of hydrodistillate essential oils (EOs) using a fabricated vertical Y-tube olfactometer (VYTO) against adult female *H. theivora*.
- Transfluthrin (0.88%) is quite promising with an SAI value of  $0.849 \pm 0.042$  (Mean  $\pm$  SD) and knockdown % of 5 in 8 replicates ( $N=40$ ).
- EO of *Ageratum conyzoides* (L.) is a potential spatial repellent with a SAI value of  $0.925 \pm 0.036$  (Mean  $\pm$  SD), where precocene I and precocene II are present in the higher peak areas (%) of the GC-MS chromatogram.
- The significance of this study relies on the application of the VYTO and NGCM for the future assessment of spatial activity of different EOs against this tea pest.

Extended author information available on the last page of the article

### Introduction

Tea [*Camellia sinensis* (L.) O. Kuntze] is the most commonly used alcohol-free beverage around the world (Nath and Bhattachayya 2014) which is also popular due to health promoting benefits such as chemopreventive and chemotherapeutic effects on cancer (Khan et al. 2008; Khan and Mukhtar 2008). Among the top important tea pests, tea mosquito bug (TMB) or *Helopeltis theivora* Waterhouse is a serious sucking-pest of this monoculture plantation that is under the Heteropteran group and in the family Miridae (Capsid bugs) (Roy et al. 2011). Apart from tea, TMB is also getting importance as a pest due to the damages in various crops: cocoa, cashew, and cotton (Barbora and Biswas 1996). Since tea is a perennial crop, it provides a stable and favorable microclimate for TMB that has geared up to the status of a major tea pest in India



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## Glass microfiber based method for extraction and detection of BVOCs of *Camellia sinensis* (L.) O. Kuntze

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## ARTICLE INFO

## Keywords:

BVOCs  
*Camellia sinensis*  
 Injured stem  
 Glass microfiber filter  
 GC-MS  
 Perfume industry

## ABSTRACT

Under natural and ecological interaction like biotic and abiotic stresses, plants constitutively synthesize secondary metabolites which are extremely necessary for their normal growth and survival. Biogenic volatile organic compounds (BVOCs) are such secondary metabolites from adverse environmental conditions like different biotic/abiotic stresses where herbivory and mechanical wounding, such as leaf cuttings, are easily observed. However, BVOCs released from plucking injury on the young stem of *Camellia sinensis* (L.) O. Kuntze has very limited understanding which is usually experienced as "pleasing aroma" in the tea plantations. Moreover, "direct volatile injection" is a common method for BVOCs molecular characterization. In this work, a modified method, i.e., vacuum pressure coupled adsorption of BVOCs in glass microfiber filter, was used to firstly explore BVOCs from the stem injured young tea foliages (TV22), followed by molecular detection of its n-hexane fraction by GC-MS analysis. GC-MS chromatogram with stable baseline has shown the presence of a 13 (thirteen) lower MW metabolites (C<sub>2</sub>-C<sub>12</sub>) below 3 min of runtime which has signified the successful modification of earlier methods. In terms of power consumption, time, heat sensitive volatiles, and detection of low molecular weight/concentration metabolites, this method has strong advantages over the hydrodistillation method. Coupled with other downstream analyses, this method of extraction and detection of BVOCs of "pleasing aroma" from hand-plucked tea foliages has the potential to be observed for future application in perfume industry as a room, or body freshener.

## 1. Introduction

In addition to primary metabolites, plants also produce secondary metabolites for ecological interactions with different biotic and abiotic stress agents, growth, and their behavior through different hormones (Holopainen and Gershenzon, 2010; Pichersky and Gang, 2000; Spinelli et al., 2011; Theis and Lerdau, 2003; Vickers et al., 2009; Vivaldo et al., 2017). Plants generate a wide range of biogenic volatile organic compounds (BVOCs) as green leaf volatiles (GLVs), nitrogen-bearing compounds, and aromatic compounds by a constitutive way or in the presence of different stimuli (Holopainen et al., 2010; Holopainen and Gershenzon, 2010). Leaf tissues of plants commonly find critical stress from mechanical damage throughout their whole life cycle (Brilli et al., 2014). For all the plant species, GLVs are universally generated and swiftly released (Brash, 1999; Hatanaka et al., 1987) from membrane breakdown in response to adverse environmental conditions such as drying (Capitani et al., 2009; Graus et al., 2010), freezing (Fall et al., 2001), herbivory outbreaks (Degen et al., 2004; Turlings and Tumlinson, 1992; Vancanneyt et al., 2001; Wu et al., 2008) and mechanical

wounding like leaf cutting (Brilli et al., 2014; Loreto et al., 2006). Likewise, green stem volatiles (GSVs), i.e., VOCs released from stem injury (mechanical or herbivory) to plants' young foliages are reported to have a different molecular profile (Mayer et al., 2008; Piesik et al., 2011).

*Camellia sinensis* (L.) O. Kuntze, commonly known as "Tea plant", is an evergreen, perennial monoculture crop resembling a "single-species forest" of genetically diverse cultivars (Banerjee, 1983; Cranham, 1966; Roy et al., 2015). The aroma or BVOCs of processed tea leaves like black, green, oolong tea (Kawakami, 1997; Kumazawa and Masuda, 2002; Schreier, 1988; Takeo, 1996; Takeo and Mahanta, 1983; Yamanishi et al., 1970), and fresh leaves by distillation process (Mu et al., 2014) were reported earlier. However, the actual model of BVOCs for every processed product and all the present tea varieties is still unclear due to limitations in the different hydrodistillation processes. Apart from these, the hand-plucking of young foliages of tea plant (two leaves and one bud), the economic portion for the tea industry, used to produce a typical pleasing aroma in the field which certainly could have tremendous potential application in the perfume industry. However, till date,

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<https://doi.org/10.1016/j.jarmap.2021.100319>

Received 25 August 2020; Received in revised form 15 May 2021; Accepted 27 May 2021

Available online 2 June 2021

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## A REVIEW ON THE ANIMAL VIRUSES WITH SPECIAL REFERENCE TO THE COVID-19, DISEASE, SYMPTOMS, GENOMICS, TREATMENT ETC.

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**Abstract:** a group of RNA virus that mainly infect mammals and birds. There are some corona viruses that are capable of infecting human are 229E, OC43, HCoV-NL63, SARS-CoV, MERS-CoV, HKU1 etc. COVID-19 is a new strain of corona originated from Wuhan, China in December, 2019. COVID-19 has club- shaped glycoprotein spikes in the envelope that gives the virus a crown- like appearance that help them in attacking and binding. Corona viruses infect the respiratory tract and cause various infections like high fever, sore throat, dry cough, respiratory problem etc. The virus is transmitted through coughing and sneezing. Despite of great efforts, there is no specific treatment of this disease. So, for now prevention and management are the best options. It has been reported that various treatments like Remdesivir, chloroquine etc. has been use to control it. Use of convalescent plasma transfusion has also shown some sort of success for COVID-19. Several vaccines have been prepared for the treatment of COVID-19 and hope it may available soon.

**Keywords:** *Corona virus, Covid19, Disease, DNA, RNA.*

**Introduction:** Viruses are tiny, obligate, intracellular parasitic agent which contains either a RNA or DNA as genetic material which is surrounded by a protective, virus- coded protein coat called capsid [1]. Capsid protects the genome from environmental danger and also helps in efficient delivery of viral genomes into new host cell [2]. Viruses have to rely on specialized host cells for propagation, which supply the complex metabolic and biosynthetic machinery of eukaryotic and prokaryotic cells. A complete virus particle is known as a 'Virion'. The principle role of virion is to release its DNA or RNA genome into host cell so that the viral genome can be expressed by the host cell. The viral genome is usually associated with some basic proteins, which is packed inside a protein capsid. The nucleic acid, protein, together with the genome called as nucleocapsid. In enveloped viruses, the virus is surrounded by a lipid bilayer which is modified host cell membrane and studded with an outer layer of virus envelope glycoproteins [1]. Animal viruses can be classified on the basis of the type of genome (i.e., DNA or RNA) which may be single stranded (ss) or double stranded (ds). In addition, viruses are usually called

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on the basis of their morphological features. DNA viruses are divided into 5 families among which Parovirus family includes all the viruses having ss linear genome. The other families of DNA viruses are Polyomavirus, Papillomavirus (which having ds circular genome) and Adenovirus, Herpesvirus (having ds linear genome). RNA viruses are grouped into positive (+) single- stranded RNA virus, negative (-) single stranded RNA virus and double- stranded viruses. Positive (+) stranded RNA virus includes 5 families of viruses namely Picornavirus, Flavivirus, Togavirus and Coronavirus. The family Coronavirus includes prototypes namely Mouse hepatitis virus (MHV), SARS. Negative (-) single- stranded RNA viruses are grouped into 3 families namely, Rhabdovirus, Orthomyxovirus, Paramyxovirus. Double- stranded RNA viruses include Reoviruses [3]. Corona viruses are group of enveloped viruses having single- stranded, positive-sense RNA genomes and they mainly infect mammals and birds and cause respiratory or gastro-intestinal disease [4]. In some cases, it also causes neurological illness or hepatitis [5].



OPEN

# Antimony induced structural and ultrastructural changes in *Trapa natans*

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Antimony (Sb) is considered as a priority toxic metalloid in the earth crust having no known biological function. The current study was carried out in a hydroponic experiment to study the accumulation of ecotoxic Sb in subcellular level, and to find out the ultrastructural damage caused by Sb in different vegetative parts of *Trapa natans*. Sb-induced structural and ultrastructural changes of *T. natans* were investigated using scanning electron microscope (SEM) and transmission electron microscope (TEM). Experimental plants were exposed to different Sb(III) treatments: SbT1 (1.5  $\mu\text{mol/L}$ ), SbT2 (40  $\mu\text{mol/L}$ ) and SbT3 (60  $\mu\text{mol/L}$ ). Calculated bioconcentration factor (BCF) and translocation factor (TF) showed that at higher concentration (SbT2, SbT3), *T. natans* is a potent phytoexcluder whereas it can translocate a substantial amount of Sb to the aerial parts at lower concentration (SbT1). SEM analysis revealed Sb-mediated structural changes in the size of stomatal aperture, intercellular spaces and vascular bundles of different vegetative tissues of *T. natans*. TEM results showed subcellular compartmentalization of Sb in vacuole and cell wall as electron dense deposition. This is considered as a part of strategy of *T. natans* to detoxify the deleterious effects under Sb stress conditions. Fourier transform infrared spectroscopy (FTIR) study of plant biomass revealed possible metabolites of *T. natans* which can bind Sb.



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# Pollution and health risk assessment of toxic metals in solid waste dumping site soil and its impact on groundwater: a case study

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Pages 612-632 | Received 13 Oct 2020, Accepted 03 Dec 2020, Published online: 11 Jan 2021

“ Cite this article <https://doi.org/10.1080/03067319.2020.1862813>



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## ABSTRACT

DOI: 10.1080/03067319.2020.1862813



# Nanopesticides: A Systematic Review of Their Prospects With Special Reference to Tea Pest Management

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**Background:** Tea is a natural beverage made from the tender leaves of the tea plant (*Camellia sinensis* Kuntze). Being of a perennial and monoculture nature in terms of its cultivation system, it provides a stable micro-climate for various insect pests, which cause substantial loss of crop. With the escalating cost of insect pest management and increasing concern about the adverse effects of the pesticide residues in manufactured tea, there is an urgent need to explore other avenues for pest management strategies.

**Aim:** Integrated pest management (IPM) in tea invites an multidisciplinary approach owing to the high pest diversity in the perennial tea plantation system. In this review, we have highlighted current developments of nanotechnology for crop protection and the prospects of nanoparticles (NPs) in plant protection, emphasizing the control of different major pests of tea plantations.

**Methods:** A literature search was performed using the ScienceDirect, Web of Science, Pubmed, and Google Scholar search engines with the following terms: nanotechnology, nanopesticides, tea, and insect pest. An article search concentrated on developments after 1988.

**Results:** We have described the impact of various pests in tea production and innovative approaches on the use of various biosynthesized and synthetic nanopesticides against specific insect pest targets. Simultaneously, we have provided support for NP-based technology and their different categories that are currently employed for the management of pests in different agro-ecosystems. Besides the broad categories of active ingredients (AI) of synthetic insecticides, pheromones and natural resource-based molecules have pesticidal activity and can also be used with NPs as carriers as alternatives to traditional pest control agents. Finally, the merits and demerits of incorporating NP-based nanopesticides are also illustrated.

**Conclusions:** Nanopesticides for plant protection is an emerging research field, and it offers new methods to design active ingredients amid nanoscale dimensions. Nanopesticide-based formulations have a potential and bright future for the development of more effective and safer pesticide/biopesticides.

**Keywords:** nanotechnology, tea, insect pest, nano pesticides, IPM

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### Edited by:

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### Specialty section:

This article was submitted to  
Nutrition and Sustainable Diets,  
a section of the journal  
Frontiers in Nutrition

Received: 26 March 2021

Accepted: 08 June 2021

Published: 10 August 2021

### Citation:

Deka B, Babu A, Baruah C and  
Barthakur M (2021) Nanopesticides: A  
Systematic Review of Their Prospects  
With Special Reference to Tea Pest  
Management. *Front. Nutr.* 8:686131.  
doi: 10.3389/fnut.2021.686131

REVIEW ARTICLE

Open Access

# Entomopathogenic microorganisms: their role in insect pest management



Bhabesh Deka<sup>1\*</sup>, Chittaranjan Baruah<sup>2</sup> and Azariah Babu<sup>1</sup>

## Abstract

**Background:** Entomopathogens are pathogenic to insect pests. Several types of naturally occurring, viz. fungus, bacteria, viruses, and nematodes, infect a range of insect pests and help manage crop growth. They offer several advantages over chemical pesticides, including being precise, safe, and ecologically sustainable. Agricultural systems are streamlined, and changes to natural ecosystems occur. Viruses, bacteria are host-specific, while fungi have a greater host range, and they may infect both soil-dwelling and aboveground pests.

**Main body:** The study highlights the current state of knowledge on entomopathogenic microorganisms (EM) (entomopathogenic fungi, nematodes, viruses, bacteria, etc.) as it relates to their current usage as biological pest management. It is essential to enhance our understanding of the ecology of EM and their role in nature to use a variety of biological control techniques against insect hosts. This article may help to comprehend their accomplishments in the significant field. Some recent researches indicated common patterns in interactions between insect pests and EM.

**Conclusion:** More focus has been placed on the use of natural enemies like entomopathogens for pest control in recent years. EM expands possibilities for insect control. Eco-friendly alternatives to existing agricultural pesticides are being developed which are utilized to control insect pests and support agricultural sustainability.

**Keywords:** Entomopathogenic fungi, Bacteria, Viruses, Nematodes, Pest management

## Background

Plant pathogens (fungi, oomycetes, bacteria, viruses, and nematodes), weeds, arthropods (mainly insects and mites), molluscs (slugs and snails), and a few vertebrates are among the agricultural pests. By feeding on crops, they degrade the production and quality of a product. Pest species are believed to number in the millions globally. They have a major impact on a limitation on agricultural output that has resulted in a 40% reduction in potential world crop yields these setbacks (Mantzoukas and Eliopoulos 2020). Mites and insect pests host several naturally occurring bacteria, fungi, nematodes, and viruses that infect a wide range of organisms. Insect pests are considered important deterrents, accounting for an

estimated 10.80% of worldwide agricultural losses in the post-green revolution age (Dhaliwal et al. 2015). In addition, an estimated 18–26% decrease in world yearly agricultural output, worth \$470 billion, was recently recorded (Mantzoukas and Eliopoulos 2020). Insecticides are used to reduce these losses and, as a result, have become an essential method for controlling insect pest infestations due to their low application effort, high usefulness, and expediency (Sharma 2019). However, concentrated application of chemicals has resulted in the advancement of resistance to one or more classes of insecticides in as much as 80% of cases (Sharma 2019). As a result, entomopathogens, which include fungi, viruses, protozoa, and bacteria, are seen as regulatory operators of pest infestations. Entomopathogens that occur naturally are important control elements for insect populations (Roy and Cottrell 2008). The word entomopathogens was coined by Tanzini et al. (2001) to describe microorganisms that control the population of insect pests to levels

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## Acaricidal and ovicidal properties of *Lippia alba* essential oil and its chemical constituents against red spider mite, *Oligonychus coffeae* Nietner (Acari: Tetranychidae) infesting tea crops

Bhabesh Deka, Abhay K. Pandey, Azariah Babu, Chittaranjan Baruah & Suman Sarkar

To cite this article: Bhabesh Deka, Abhay K. Pandey, Azariah Babu, Chittaranjan Baruah & Suman Sarkar (2021): Acaricidal and ovicidal properties of *Lippia alba* essential oil and its chemical constituents against red spider mite, *Oligonychus coffeae* Nietner (Acari: Tetranychidae) infesting tea crops, Archives of Phytopathology and Plant Protection, DOI: [10.1080/03235408.2021.1938354](https://doi.org/10.1080/03235408.2021.1938354)

To link to this article: <https://doi.org/10.1080/03235408.2021.1938354>



Published online: 26 Jun 2021.



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## In silico tertiary structure prediction and evolutionary analysis of two DNA-binding proteins (DBP-1 and DBP-2) from *Hyposidra talaca* nucleopolyhedrovirus (HytaNPV)

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Received: 15 June 2020 / Accepted: 2 December 2020  
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### Abstract

*Hyposidra talaca* is a vicious pest of tea plants in the Eastern Himalayan's Darjeeling foothills and NE India. The infestation of this pest leads to crop loss, as early instars prefer to feed the young harvestable leaves and late instars feed the matured leaves, which leads to loss of photosynthetic capacity of the entire tea bush. Among the few accessible methods to control *H. talaca* is the baculovirus *H. talaca* nucleopolyhedrovirus (HytaNPV). DNA-binding protein (DBP) plays a significant role in HytaNPV during viral replication and transcription. The present study attempted to predict the structure and the functional analysis of two crucial DNA-binding proteins (DBP-1 and DBP-2) in the absence of experimental structures. Analysis of sequence, prediction of structure, functional characterization, and evolutionary analysis based on UniProtKB studied the amino acid sequences of DBP-1 and DBP-2 proteins. Modeling of these two proteins was presented using ab-initio modeling. QMEANDisCo 4.0.0 global and local per-residue quality estimates verified the structure as high quality. Phylogenetic analysis of both HytaNPV DBP-1 and DBP-2 proteins revealed a close evolutionary relationship with *Buzura suppressaria* nucleopolyhedrovirus. Tunnel analysis revealed multiple tunnels in DBP-1 (six) and DBP-2 (eleven), indicating a large number of transport pathways for small ligands that influence their reactivity. The theoretical structures and statistical verifications were successfully deposited in the Model Archive. They will be useful for advanced computational analysis of each protein's interactions for detailed functional analysis and understanding of viral pathogenesis in the absence of a complete experimental structure.

**Keywords** *Hyposidra talaca* · Baculovirus · HytaNPV · Ab-initio modeling · DNA-binding proteins · Evolutionary relationship

### Abbreviations

NPV	nucleopolyhedrovirus
HytaNPV	<i>Hyposidra talaca</i> nucleopolyhedrovirus
Bp	base pair
DBP	DNA-binding protein
BmNPV	<i>Bombyx mori</i> nucleopolyhedrovirus
DBP-1	DNA-binding protein-1
DBP-2	DNA-binding protein-2

### Introduction

*Hyposidra talaca* (Lepidoptera: Geometridae), commonly known as the black inch looper, is considered a major tea pest, which causes considerable damage to tea plantations, leading to a loss in yield and the quality of manufactured tea as well. In general, chemical insecticides are being used for the control of tea pests, including this black inch looper by the tea planters (Hazarika et al. 2009). The use of chemical pesticides has many negative impacts, such as the development of resistance in insects, abolition of natural enemies, imbalance in natural ecosystems, and increasing environmental contamination besides affecting human health. Therefore, non-chemical control measures are extremely important for managing destructive pests (Deka et al. 2017; Nguyen et al. 2018). Bio-control agents play a vital role in managing pests, especially lepidopteran pests with well-balanced ecological systems, by helping in the reduced use of pesticides in major agricultural crops, including tea. The nucleopolyhedrovirus (NPV) is a baculovirus that infects insects, primarily moths, and butterflies and has a high demand as a

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## EDITORIAL

### The COVID-19 Pandemic and its impact on wildlife

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COVID-19 is possibly the greatest and most enormously significant crisis against humans in the planet's modern history. The group of Coronaviridae includes viruses with very long RNA genomes of up to 33,500 nucleotides. SARS-CoV-2 belongs to the Sarbecovirus family, with an approximate genome size of 30,000 nucleotides (Wu *et al.*, 2020). SARS-CoV-2 has four main structural proteins: spike (S), envelope (E), membrane (M), and nucleocapsid (N). Additionally, some other non-structural proteins are encoded in the pp1a and pp1ab polyproteins, essential for viral replication (Wu *et al.*, 2020; Baruah *et al.*, 2020; Baruah *et al.*, 2021; Sharma and Baruah, 2021). The coronavirus has upended our way of life, but it's also having a dramatic impact on animals across the globe too, from black rhinos being poached in Botswana to a coughing tiger in New York and emboldened goats on the streets of Wales.

Current view, based on certain evidence, says the coronavirus originated in bats, yet it is not known how it got into the human populace, causing pandemic situations in 2020 and 2021 as the first and second waves of infectivity, with the death of several hundred thousand human lives. Researchers overwhelmingly believe that it's a wild virus, which was probably passed to people through an intermediate species. But no one has found the virus in the wild yet, so other explanations cannot be ruled out entirely.

Given the similarity of SARS-CoV-2 to bat SARS-CoV-like coronaviruses2, it is likely that bats serve as reservoir hosts for its progenitor. Although the genome named RaTG13, sampled from a bat named *Rhinolophus affinis* (Wan *et al.*, 2020), is 96% identical to SARS-CoV-2, its spike diverges in the receptor binding domain (RBD), which suggests that it may not bind efficiently to human ACE2 (Zhou *et al.*, 2020). That RaTG13 was 96% identical to SARS-CoV-2, making it the closest known relative and strongly suggesting the new virus originated in bats.

Pangolins were among the first animals suspected of being the intermediates. Two teams in China reported that they'd found similarities between SARS-CoV-2 and coronaviruses isolated from tissue of Malayan pangolins (*Manis javanica*) that had been confiscated. Trading pangolins is illegal in China. Malayan pangolins (*Manis javanica*) illegally imported into Guangdong province contain coronaviruses similar to SARS-CoV-2 (Zang *et al.*, 2020). Although the RaTG13 bat virus remains the closest to SARS-CoV-2 across the genome (Zhou *et al.*, 2020), some pangolin coronaviruses exhibit strong similarity to SARS-CoV-2 in the RBD, including all six key RBD residues (Zang *et al.*, 2020). This clearly shows that

human-like ACE2 is the result of natural selection. However, pangolin coronaviruses turned out to be too distant to be direct ancestors of SARS-CoV-2. However, they are the only wild mammals besides bats living with coronaviruses similar to SARS-CoV-2, suggesting an intermediate source.

It has been well argued that many species, like cats, fruit bats (*Rousettus aegyptiacus*), ferrets, rhesus macaques, and hamsters, have been shown to be susceptible to SARS-CoV-2. Outside the laboratory, animals including pet cats and dogs, tigers and lions at zoos, and farmed mink have also caught the virus—probably from people. So far, more than 215 vertebrates have found that the receptor in many mammals, including sheep, chimpanzees, and gorillas, engages well with the spike protein on the surface of the virus, which suggests that these animals might be susceptible to infection.

The negative perception of wildlife as disease carriers may result in retaliatory killings of possible carrier species such as bats and pangolins, resulting in severe repercussions for these threatened species (Kissui, 2008). For example, all Asian pangolins are endangered or critically endangered, and any future retaliatory killings may push the species toward extinction. Human migration and a jobless atmosphere might put added pressure on wildlife and habitats for food and livelihood by way of increased poaching, hunting, and logging, leading to closer contact between humans and wildlife and possibly causing certain zoonotic diseases (Bloomfield *et al.*, 2020). Reducing the likelihood of another viral spillover sweeping the world requires a fundamental change in how we interact with nature. It requires minimizing human interface with wild animals and wild spaces and eliminating transmission points where the likelihood of viral spillover to humans is high, such as unhygienic commercial markets in wild animal meat and live animals. Effective monitoring of the legal trade in wildlife has diligently suppressed the illegal and unsustainable trade in wildlife and conserved natural habitats. Conserving natural habitats in turn requires profound changes in human food production and human encroachment on remaining natural habitats, but such changes are necessary despite having lots of difficulties (Felbab-Brown, 2021). While such instances have been witnessed in other parts of the globe, lions testing positive in Hyderabad's zoo—spread over 300 acres and home to over 1500 species of animals and birds—is one of the first such cases in India. After veterinarians in the zoo began noticing the eight lions around the 40-acre safari area displaying symptoms of the virus, officials

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**A SINGLE SERVER MARKOVIAN QUEUING SYSTEM WITH LIMITED BUFFER AND REVERSE BALKING**

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*Submission: 10/22/2020*  
*Accept: 11/6/2020*

**ABSTRACT**

The phenomena are balking can be said to have been observed when a customer who has arrived into queuing system decides not to join it. Reverse balking is a particular type of balking wherein the probability that a customer will balk goes down as the system size goes up and vice versa. Such behavior can be observed in investment firms (insurance company, Mutual Fund Company, banks etc.). As the number of customers in the firm goes up, it creates trust among potential investors. Fewer customers would like to balk as the number of customers goes up. In this paper, we develop an M/M/1/k queuing system with reverse balking. The steady-state probabilities of the model are obtained and closed forms of expression of a number of performance measures are derived.

**Keywords:** Finite capacity; Performance Measure; Queuing Model; Reverse Balking; Steady-State Solution



## The McDonald Lindley-Poisson Distribution

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### Abstract

We propose the McDonald Lindley-Poisson distribution and derive some of its mathematical properties including explicit expressions for moments, generating and quantile functions, mean deviations, order statistics and their moments. Its model parameters are estimated by maximum likelihood. A simulation study investigates the performance of the estimates. The new distribution represents a more flexible model for lifetime data analysis than other existing models as proved empirically by means of two real data sets.

**Key Words:** Lindley-Poisson distribution; Maximum likelihood estimation; McDonald distribution; Moment; Monte Carlo simulation.

**Mathematical Subject Classification:** 62E10, 62E15.

### 1. Introduction

The Poisson distribution has been used to generate several flexible continuous distributions by compounding methods for modeling survival data. Many generalizations based on the Poisson distribution are investigated in recent years. For example, the Conway-Maxwell-Poisson discussed in Minka et al. (1) and Shmueli et al. (2), exponential Poisson proposed by Kus (3), Weibull Poisson studied by Hemmati et al. (4) and exponentiated Burr XII Poisson proposed and studied by Silva et al. (5).

Further, the Lindley distribution was introduced by Lindley (6) to illustrate the difference between fiducial and posterior distributions. Ghitany et al. (7) investigated the properties of the latter distribution and showed that it is a better model than the exponential distribution. The Lindley has also some advantages since to its hazard rate function (hrf) can exhibit bathtub shapes, and then it becomes more versatile and flexible for compounding with other distributions.

Sankaran (8) introduced the Poisson-Lindley distribution by assuming that the Poisson parameter follows a Lindley distribution. Mahmoudi and Zakerzadeh (9) generalized the Poisson-Lindley distribution and showed that their generalization has more flexibility in analyzing count data. Bhati et al. (10) proposed a

## A new extension of Odd Half-Cauchy Family of Distributions: properties and applications with regression modeling

Subrata Chakraborty<sup>1</sup>, Morad Alizadeh<sup>2</sup>, Laba Handique<sup>3</sup>,  
Emrah Altun<sup>4</sup>, G. G. Hamedani<sup>5</sup>

### ABSTRACT

The paper proposes a new family of continuous distributions called the extended odd half Cauchy-G. It is based on the  $T - X$  construction of Alzaatreh et al. (2013) by considering half Cauchy distribution for  $T$  and the exponentiated  $G(x; \xi)$  as the distribution of  $X$ . Several particular cases are outlined and a number of important statistical characteristics of this family are investigated. Parameter estimation via several methods, including maximum likelihood, is discussed and followed up with simulation experiments aiming to assess their performances. Real life applications of modeling two data sets are presented to demonstrate the advantage of the proposed family of distributions over selected existing ones. Finally, a new regression model is proposed and its application in modeling data in the presence of covariates is presented.

**Key words:**  $T - X$  method; regression; simulation; estimation

### 1. Introduction

Following the  $T - X$  construction of Alzaatreh et al. (2013), Cordeiro et al. (2017) proposed a new generator of continuous probability distribution by considering Half-Cauchy for  $T$  and exponentiated  $G$  (Lehmann alternative-I) for  $X$ . They called the family generalized odd Half-Cauchy (GOHC- $G(\alpha, \xi)$ ) and investigated its properties and applications. In the present paper we introduce a new generator called extended half Cauchy family of distribution following the same construction by considering exponentiated  $G$  (Lehmann alternative-II) for  $X$  and  $T$  following Half-Cauchy with probability density function (pdf)  $q(t) = \frac{2}{\pi(1+t^2)}$ ,  $t > 0$ , where  $G(x; \xi)$  is the cumulative distribution function (cdf) of the baseline distribution with parameter vector  $\xi$ . Now, following Alzaatreh et al. (2013) we define

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Thailand Statistician  
April 2021; 19(2): 248-260  
<http://statassoc.or.th>  
Contributed paper

## Properties and Applications of a New Member of the T-X Family of Distributions

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Received: 7 March 2019

Revised: 14 August 2019

Accepted: 23 November 2019

### Abstract

In this paper, we introduce a new family of distributions by the use of the so-called T-X transformation defined with the Weibull distribution as generator and a sophisticated transformation involving logarithmic and power functions. We motivate the interest of this family in the fields of probability and statistics by complete theoretical and practical studies. Our theoretical investigations show how the family can be handle analytically, with formula for moments, moment generating function and order statistics. Then, the applied side is considered with a special focus on the member based on the so-called Lomax distribution. The motivation behind this member is to define a new five parameter lifetime distribution having a very flexible probability density function. We apply the related model by the means of two well-known real-life data sets, showing that the new distribution fits better than seven recent competitors.

**Keywords:** Weibull-X family, Akaike information criterion, Anderson-Darling test, Cramer von-Mises test.

### 1. Introduction

The recent literature has suggested several ways of extending well-known distributions. A common way consists in defining new classes of univariate continuous distributions by introducing additional shapes parameter(s) to a baseline distribution. The role of this additional parameter(s) is useful in exploring tail properties and also for improving the goodness-of-fit of the generator family. The well-known families are: the beta-G family (B-G) by Eugene et al. (2002) and Jones (2004), Kumaraswamy-G family (Kw-G) by Cordeiro and de Castro (2011), McDonald-G family (Mc-G) by Alexander et al. (2012), gamma-X family by Alzaatreh et al. (2014), gamma-G family (type I) by Zografos and Balakrishanan (2009), gamma-G family (type II) by Ristic and Balakrishanan (2012), gamma-G family (type III) by Torabi and Montazari (2012), log-gamma-G family by Amini et al. (2014), logistic-G family by Torabi and Montazari (2014), transformed-transformer family (T-X) by

## Poisson Transmuted-G Family of Distributions: Its Properties and Applications



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### Abstract

In this article, an extension of the transmuted-G family is proposed, in the so-called Poisson transmuted-G family of distributions. Some of its statistical properties including quantile function, moment generating function, order statistics, probability weighted moment, stress-strength reliability, residual lifetime, reversed residual lifetime, Rényi entropy and mean deviation are derived. A few important special models of the proposed family are listed. Stochastic characterizations of the proposed family based on truncated moments, hazard function and reverse hazard function, are also studied. The family parameters are estimated via the maximum likelihood approach. A simulation study is carried out to examine the bias and mean square error of the maximum likelihood estimators. The advantage of the proposed family in data fitting is illustrated by means of two applications to failure time data sets.

**Key Words:** Transmuted-G family; hazard rate function; Maximum likelihood technique; Truncated moments; Simulation.

**Mathematical Subject Classification:** 60E05, 62E15

### 1. Introduction

In the last decades, many generalized families of continuous models have been introduced by extending classical probability models and applied to model various phenomena. However, there is a clear need for extended forms of the well-known models by adding one or more parameter(s) in order to obtain greater flexibility for modelling and evaluation different types of data. Shaw and Buckley (2007) proposed the transmuted-G (T-G) family of distributions. The cumulative distribution function (cdf, for short) and probability density function (pdf, for short) of the T-G family can be expressed respectively as follows

$$G^{T-G}(x; \alpha) = G(x)[1 + \alpha - \alpha G(x)] \quad (1)$$

and

$$g^{T-G}(x; \alpha) = g(x)[1 + \alpha - 2\alpha G(x)], \quad (2)$$

where  $G(x)$  and  $g(x)$  are the baseline cdf and pdf, respectively. For  $\alpha = 0$ , ( $|\alpha| \leq 1$ ), Eq. (1) gives the baseline distribution. Chakraborty *et al.* (2020) introduced the Kumaraswamy Poisson-G family, where generalized the Poisson-G (P-G) family of distributions. The cdf of the P-G family can be formulated as follows

$$F^{P-G}(x; \beta) = \frac{1 - e^{-\beta F(x)}}{1 - e^{-\beta}}, \beta \in R - \{0\}. \quad (3)$$

The pdf corresponding to Eq. (3) is given by

## A New Three-parameter Xgamma Fréchet Distribution with Different Methods of Estimation and Applications



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### Abstract

In this article an attempt is made to introduce a new extension of the Fréchet model called the Xgamma Fréchet model. Some of its properties are derived. The estimation of the parameters via different estimation methods are discussed. The performances of the proposed estimation methods are investigated through simulations as well as real life data sets. The potentiality of the proposed model is established through modelling of two real life data sets. The results have shown clear preference for the proposed model compared to several know competing ones.

**Key Words:** Xgamma Model; Fréchet Model; Simulations; Least Squares; Cramer-Von-Mises; Maximum Product Spacing Distance; Bootstrapping.

**Mathematical Subject Classification:** 62N01; 62N02; 62E10.

### 1. Introduction and genesis

The probability density function (PDF) and cumulative distribution function (CDF) of Fréchet (Fr) distribution are given, respectively, by

$$g_{a,b}(x) = ba^b x^{-(b+1)} e^{-\left(\frac{a}{x}\right)^b} \Big|_{x>0}, \quad (1)$$

and

$$G_{a,b}(x) = e^{-\left(\frac{a}{x}\right)^b}, \quad (2)$$

where  $a > 0$  is a scale parameter and  $b > 0$  refers to the shape parameter. Recently, Yousof et al. (2018c) investigated and new family called the extended odd Fréchet family of distributions based on (2). Due to Cordeiro et al. (2020), the CDF of the Xgamma Fréchet (XG-Fr) model can be expressed as

$$F_{\theta,a,b}(x) = \left[ 1 - \frac{1}{1+\theta} \left[ 1 - e^{-\left(\frac{a}{x}\right)^b} \right]^\theta \left( 1 + \theta - \theta \log \left[ 1 - e^{-\left(\frac{a}{x}\right)^b} \right] \right) \right] \left( \frac{1}{2} \theta^2 \left\{ \log \left[ 1 - e^{-\left(\frac{a}{x}\right)^b} \right] \right\}^2 \right) \Big|_{\theta>0}. \quad (3)$$

The PDF corresponding to (3) reduces to

$$f_{\theta,a,b}(x) = \frac{\theta}{1+\theta} ba^b x^{-(b+1)} e^{-\left(\frac{a}{x}\right)^b} \left[ 1 - e^{-\left(\frac{a}{x}\right)^b} \right]^{\theta-1} \left( \theta + \frac{1}{2} \theta^2 \left\{ \log \left[ 1 - e^{-\left(\frac{a}{x}\right)^b} \right] \right\}^2 \right). \quad (4)$$

For  $a = 1$ , the XG-Fr reduces to the two-parameter XG-Fr distribution (Yousof et al. (2020)). The XG-Fr density in (4) can be expressed as



## A STUDY ON THE PROBLEMS FACED BY LOWER-INCOME GROUP PARENTS IN EDUCATING THEIR CHILDREN WITH SPECIAL REFERENCE TO MAIBANG AREA OF DIMA HASAO DISTRICT OF ASSAM

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**ABSTRACT** : It is education by which a Nation can develop. It makes a child physically strong, mentally equipped, emotionally balanced, socially adjustable etc. It develops a right attitude towards life and work. Education being related to all aspects of human life, is also closely related to economics. And in developing countries like India, many people live below the poverty line which leads to uncountable chain of problems. Among various problems faced by lower income group families, problems related to educating their children are also seen most often. The present paper focused on the various problems faced by lower income group parents in educating their children in Maibang area of Dima Hasao district of Assam. Descriptive Survey method was used for the present study and the population included all the lower income group parents of Maibang area of Dima Hasao district of Assam. The sample collected was 30 by using simple random sampling technique. The tool used was interview schedule and statistical technique used was simple percentage for the fulfillment of research objectives.

**Key-words:** lower-income group, parents, education, children.

**INTRODUCTION** – No Nation can develop itself fully until and unless its citizens are educated irrespective of sex, caste, class, color etc. Education is that process which makes a man responsible citizen of a country and effective member of a society. It helps not only in building individual's personality and character, but also his productive capacity and his ability to perform his share of work most effectively and efficiently.

Ancient educationists were of the opinion that education promotes only the physical, mental, moral and spiritual development of the child and economic was considered as an item of expenditure only. However, in modern times, education is regarded as productive investment for material growth and economic welfare. For better development of the country, better education, better economy is essential. Thus the economy of a particular society influences education and education of a particular society influences its economy. Education is the most powerful instrument for economic changes and development of the nation.

But, in India, large proportion of people live below poverty line where they don't have adequate financial sources to satisfy their basic needs like food, shelter, clothing etc. and in such condition, education is ignored and given less importance where they are not able to fulfill even their basic needs. Lower Income Group (LIG) means households with monthly household income between Rs. 5001/- to Rs. 10000/- per month or as fixed by the Ministry of Housing and Urban Poverty Alleviation, Government of India from time to time. Similarly, in Assam also, poverty is high among agricultural and other labors. Keeping in view this problem, the researcher has undertaken Maibang area of Dima Hasao district of Assam to study the various problems faced by lower income group parents in educating their children.

### OBJECTIVES

- To study the various problems faced by lower income group parents in educating their children in Maibang area of Dima Hasao district of Assam.
- To study the interests of the children of lower-income group families in Maibang area of Dima Hasao district of Assam.

### REVIEW OF RELATED LITERATURE

Ashfaq, Yousuf and Dahar (2018) conducted a study on the problems faced by the parents for providing higher education to their children in rural areas. It was found from the study that majority of parents perception regarding the problem is high rate unemployment. There are lack of facilities and lack of awareness about education. It is also due to limited resources, shortage of colleges and non-availability of transport. The parents are facing some other financial, social, and economic problems for providing graduate level education to their children. Drajea and Sullivan (2014) conducted a study on the influence of parental education and family income on children's education in rural Uganda. Findings indicated a significant relationship between parents' income and literacy levels and the quality of support to their children's education. Household poverty emerged as a major obstacle to educational success for children across the three socio-economic categories of family studied. Compromised lack of day-to-day survival of their families. Humble and Dixon (2017) studied the effects of schooling, family and poverty on children attainment, potential and confidence-evidence from Kinondoni, Dar es Salaam. It was found from the study that lack of electricity at homes of lower-income group are more likely to affect the academic achievement of the students. Also, those students who are identified as good readers by teachers have high ability, and peer and teacher nomination around students ability showing significant levels of concordance.

**How to Cite:**

Devi, P. (2022). Assessment of water quality and overall biodiversity of certain wetlands of Sivasagar urban area. *International Journal of Health Sciences*, 6(S1), 3363-3371.  
<https://doi.org/10.53730/ijhs.v6nS1.5352>

## **Assessment of Water Quality and Overall Biodiversity of Certain Wetlands of Sivasagar Urban Area**

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**Abstract**--Various physico-chemical parameters such as pH, Dissolved Oxygen (DO), free CO<sub>2</sub> are commonly used criteria for water quality assessment. It provides information about the overall health of the water bodies. Biodiversity of macro-invertebrates and physico-chemical water quality parameters of Juliva fishery and Moribeel wetland of Sivasagar district of Assam were assessed from different sampling sites monthly from April, 2017 to April, 2018. By studying macro-invertebrates diversity of the wetland as bioindicator, we have assessed the overall quality of these water bodies, mainly about their pollution status.

**Keywords**--Wetland, Physico-chemical property, Bio-diversity, Macro-invertebrates, Biological indicator.

### **Introduction**

Limnology is the study of inland waters. It is often regarded as the division of ecology or environmental sciences. It covers the biological, chemical, physical, geographical and other attributes of all inland waters. This includes the study of lakes and ponds, rivers, springs, streams and wetlands. A more recent sub-discipline of limnology, termed landscape limnology, studies, manages and conserves these aquatic ecosystems using a landscape perspective.

Limnology is closely related to aquatic ecology and hydrobiology, which study aquatic organisms in particular regard to their hydrological environment. Although limnology is sometimes equated with freshwater science, this is erroneous since limnology also comprises the study of inland salt lakes.

Biological diversity means the variability among living organisms. From all sources including, interlay, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part, this included diversity within species, between species of ecosystems. The terms' contracted form biodiversity

International Journal of Health Sciences ISSN 2550-6978 E-ISSN 2550-696X © 2022.

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Manuscript submitted: 18 Jan 2022, Manuscript revised: 09 Feb 2022, Accepted for publication: 27 March 2022

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may have been coined by W.G. Rosen in 1985 while planning the 1986 National Forum on Biological Diversity organized by the National Research Council. Ecological biodiversity is a biodiversity of ecosystems, natural communities and habitats. Biodiversity boosts ecosystem productivity where each species, no matter how small, all have an important role to play.

It is very essential and important to test the water before it is used for drinking, domestic, agricultural or industrial purposes. Water must be tested with different physico-chemical parameters. Water does contain different types of floating, dissolved, suspended and microbiological as well as bacteriological impurities. The quality of water is of vital concern for the man-kind since it is directly linked with human welfare.

Numbers of institutions are working on the various aspects of water at national



Contents lists available at ScienceDirect

Saudi Pharmaceutical Journal

journal homepage: www.sciencedirect.com



Original article

## Fertility regulatory potential of *Persicaria hydropiper* (L.) Delarbre methanolic root extract in female albino mice: An insight into the phytochemicals present and role of the extract in contraception

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### ARTICLE INFO

#### Article history:

Received 18 March 2022

Accepted 5 September 2022

Available online 9 September 2022

#### Keywords:

Antifertility potential

GCMS

Estrous cycle

Uterine histology

*Persicaria hydropiper*

Total cholesterol

### ABSTRACT

People from some parts of the world traditionally depend on different herbal medicines for fertility regulation. The Mishing women of Assam, India have been using the dry root powder of *Persicaria hydropiper* for years as a birth control medicine. The present study was designed to investigate the chemical composition of methanolic extract from the dry roots of *P. hydropiper* as well as to study its anti-implantation effect. *P. hydropiper* roots were collected from paddy fields and the methanolic extract was prepared using dry powdered roots. Gas chromatography-mass spectrometry (GCMS) analysis of the methanolic root extract was performed for phytochemical analysis. The estrous cycle of the female mice was monitored by observation of the cells in the vaginal smear. The estrogenic and anti-implantation effect was observed using routine histological procedures with Haematoxylin & Eosin staining performed in mice. Total serum cholesterol level was also measured. The GCMS analysis revealed the presence of stigmaterol and 3-deoxyestradiol, which are known to possess antifertility properties. The extract (1000 mg/kg bodyweight dose) altered the duration and sequence of the estrous cycle of cyclic females with a prolonged metestrus of 2 days, followed by an early estrus. There was hyperplasia in the endometrial epithelium and even shedding of the same on high duration treatment on day 6. There was a significant ( $p < 0.05$ ) rise in total cholesterol levels in the treated groups. The highest rise was observed in the day 1 group (from  $67.91 \pm 1.98$  to  $147.53 \pm 3.20$  mg/dl) while the lowest change was there in the day 2 group (from  $78.76 \pm 2.04$  to  $103.26 \pm 2.34$  mg/dl). The presence of compounds like stigmaterol and 3-deoxyestradiol with profound antifertility properties possibly has an influence on the molecular pathway for embryo implantation. The changes in uterine histoarchitecture in the form of uterine hyperplasia on treatment with the extract point out towards the effect of the estrogenic compounds. Such implantation preventing results provides support to the traditional belief and opens the door for new drug discovery for reproduction regulation. A detailed molecular study is necessary in this regard.

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Peer review under responsibility of King Saud University.



Production and hosting by Elsevier

### 1. Introduction

The dependency of the animals on plants for food, oxygen and shelter started with the beginning of higher life forms. With the beginning of civilization, human beings learned to recognize the plants that are meant for meeting the necessities of their life. The use of plant extracts for medicinal purposes can be traced to myths and traditions (Mamodev, 2012). Almost all the folk healing methods around the globe use herbs as a part of their tradition (Anttila et al., 2002). The evolution of such folk healing methods

<https://doi.org/10.1016/j.jsps.2022.09.005>

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## Review

# A review on the ethnopharmacology, phytochemistry and pharmacology of *Polygonum hydropiper* Linn.

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## Abstract

**Objectives** *Polygonum hydropiper* is a herb with worldwide distribution, having tremendous value as traditional medicine among different communities. It is used to cure many kinds of ailments such as gynaecological disorders, ulcer, anxiety, pain, cancer, etc. The present review gives emphasis on a thorough and updated study of the botanical description and taxonomy, distribution, habitat, ethnopharmacology, phytochemical constituents, pharmacological activities and toxicological aspects of *P. hydropiper*.

**Methods:** The information included in this review was collected from different scientific databases like PubMed, ScienceDirect, Google Scholar, etc. In addition to the botanical description and taxonomy, lots of ethnomedicinal use of the water-pepper plant could be found.

**Result:** A good number of compounds belonging to the categories like alkaloids, carbohydrates, flavonoids, etc. were confirmed to be present in the plant. Moreover, in different studies, this plant was found to possess activities like anti-Alzheimer, antibacterial, antidementia, antifertility, neuropharmacological, sedative, anxiolytic, thrombolytic and membrane-stabilizing activity, etc. with minimal toxicity.

**Conclusion:** These properties may be directly related to its possession of a large number of bioactive molecules of different categories. Based on these properties, isolation of responsible compound(s), evaluation of molecular mechanisms of their action and clinical trials are recommended.

**Keywords:** *Polygonum hydropiper*, review, ethnopharmacology, pharmacology, phytoconstituents

## Introduction

The tradition of using different natural products like diverse plants, animals and microorganisms has been carried out since time immemorial.<sup>[1]</sup> Apart from offering food, shelter and other necessities of life, natural resources are providing medications for the treatment of an array of diseases. Since prehistoric times, human beings are exploring the Mother Nature in search of plants that may be beneficial for health.<sup>[2]</sup> Evidence from the fossils show the human use of medicinal plants at least from the Middle Paleolithic age, dating back to approximately 60000 years.<sup>[3]</sup> Almost all medical preparations in ancient times were made up simply of plant parts only or with complex forms like different mixtures or crude extracts.<sup>[4]</sup> Even before 200 years, herbal medicines dominated the pharmacopoeia.<sup>[5]</sup> It was only at the beginning of the nineteenth century when discovery and application of 'modern' drugs came into play.<sup>[1]</sup> However, ethnomedicinal use of plants and their parts are still practiced in the rural areas of many developing countries.<sup>[6]</sup> Basic and sophisticated ingredients for medicinal use are produced by a large number of plants, which encourage their human use as

natural remedies.<sup>[7]</sup> Interestingly, there is no synthetic alternative available till now for 121 major plant-based drug molecules.<sup>[8]</sup> Despite all these benefits, biological activities of only 6% of plant species have been screened as well as 15% of the reported plants have been evaluated phytochemically.<sup>[3]</sup>

The family Polygonaceae, commonly known as the knotweed, smartweed-buckwheat or simply buckwheat family, includes some dicotyledonous angiospermic species.<sup>[9]</sup> Most of the members of the family are mainly confined to the Northern Hemisphere, while a few inhabit the Southern Hemisphere.<sup>[10]</sup> Many species of the Polygonaceae family are economically important as food, medicine or ornamental plants.<sup>[9]</sup> The Chinese pharmacopoeia includes 5 genera and 10 species of Polygonaceae family.<sup>[11]</sup> A good number of medicinal uses like in asthma, ear ache, diarrhoea, dysentery, bronchitis, jaundice, paralysis, kidney diseases, etc. are recorded for the Polygonaceae members.<sup>[8]</sup>

Polygonaceae family consists of 49 genera and approximately 1200 species with a variety of trees, herbs, shrubs, vines and lianas.<sup>[10, 12]</sup> The plant *Polygonum hydropiper* is a prominent member of the family Polygonaceae.<sup>[13]</sup> This

Received: July 22, 2021. Editorial Acceptance: December 9, 2021

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# Plant Extracts as Potential Acaricides for the Management of Red Spider Mite, *Oligonychus coffeae* Nietner (Acarina: Tetranychidae), in the Tea Ecosystem: An Eco-Friendly Strategy

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## OPEN ACCESS

### Edited by:

Jouda Mediouini-Ben Jemâa,  
Institut National de la Recherche  
Agronomique de Tunisie  
(INRAT), Tunisia

### Reviewed by:

Vasanthakumar Duraikkannu,  
UPASI Tea Research Foundation, India  
Abir Soltani,  
Institut National de la Recherche  
Agronomique de Tunisie  
(INRAT), Tunisia

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### Specialty section:

This article was submitted to  
Pest Management,  
a section of the journal  
Frontiers in Agronomy

Received: 25 March 2021

Accepted: 10 February 2022

Published: 22 March 2022

### Citation:

Deka B, Babu A, Baruah C and  
Sarkar S (2022) Plant Extracts as  
Potential Acaricides for the  
Management of Red Spider Mite,  
*Oligonychus coffeae* Nietner (Acarina:  
Tetranychidae), in the Tea Ecosystem:  
An Eco-Friendly Strategy.  
Front. Agron. 4:685568.  
doi: 10.3389/fagro.2022.685568

The effects of the application of aqueous extracts of a selection of five traditional plants (*Murraya paniculata*, *Cassia tora*, *Amphineuron opulentum*, *Tithonia diversifolia*, and *Cassia alata*) were compared with that of synthetic acaricide in reducing the population of red spider mite (*Oligonychus coffeae*), a major tea pest, alongside their impact on natural enemies and green leaf yield. Analysis of large-scale field trials showed that all the five plants extract treatments resulted in similar yield; this was analogous to the application of synthetic acaricide. A reduction in the pest population was observed to be on par with the synthetic acaricide, with a higher number of natural enemies treated using the pesticide-plant-treated plot in comparison to the synthetic acaricide-treated plot, which indicated pesticidal plants had a lower impact on natural enemies. A phytotoxicity study on tea leaves indicated that aqueous extracts of selected plants are non-phytotoxic and do not impart any taint to the prepared tea samples. Therefore, the present investigation outlines how plant extracts used as a botanical pesticide display toxicity against red spider mite on tea plants without harming the beneficial insects, increasing the yield and avoiding any lethal consequence for the tea plants or consumers.

**Keywords:** pesticidal plants, tea, red spider mite, phytotoxic effect, natural enemies

## INTRODUCTION

Tea, *Camellia sinensis* (L.) O. Kuntze, is a perennial plantation crop and requires warm humid weather for ample growth and production. Such climate conditions also house a diverse range of insect pests and diseases that attack this crop, which turns them into a limiting factor for the production of tea (Hazarika et al., 2009; Majumder et al., 2012). The red spider mite, *Oligonychus coffeae* Nietner (Acarina: Tetranychidae), is among the foremost tea pests in India (Somchoudhury et al., 1995; Babu, 2010; Barua et al., 2016), and it causes the loss of up to 35–40% of the crop (Sundararaju and Sundara Babu, 1999; Hazarika et al., 2009). The tea plant's mature leaves are attacked by the veins and the mid-rib; finally, the whole leaf is affected. In cases of severe infestation, the tender foliage may also become damaged (Rau, 1965; Jeppson et al., 1975). The red spider mite feeds on the leaf epidermis by constantly puncturing it using their chelicerae (Jeppson et al., 1975; Babu, 2010). This pest remains active throughout the year, and unhindered infestation leads to

## EDITORIAL

### A ray of hope in the darkness: What we have learned from Yangtze giant soft-shell turtle *Rafetus swinhoei* (Gray, 1873) conservation?

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The Swinhoe's softshell turtle, *Rafetus swinhoei* (Gray, 1873), is one of the world's largest freshwater turtles, and possibly the most endangered turtle species on the planet (Stanford *et al.*, 2018). It has an overall length of over 100 cm and a width of up to 70 cm, and it can easily weigh up to 70–100 kg, maximum weight was recorded at 169 kg (Solimine, 2013; Trong, 2018). Despite its enormous size and unusual look, this species is incredibly secretive and only comes to the surface to breathe, preferring to remain submerged deep down. For this species, there is very little ecological information, and the remaining distribution is unclear. This could explain why it's so

holding facility, a situation bringing new uncertainties to the conservation efforts. Suzhou Zoo's sole female turtle died on April 13, 2019, just following the most recent reproductive period (Al Jazeera, 2019). In total, 90% of the *Rafetus swinhoei* hunters believed that wild *R. swinhoei* individuals should still be present at their particular sites, and some hunters also reported a few recent sightings that they attributed to the target species (Pham Van *et al.*, 2020).

Now the greatest questions will repeatedly come, what and which situations will bring this species to the edge of the ditch of extinction? It is straightfor-



# Certain Geomorphological Features and Fish Fauna of River Mara Bharali in Sonitpur District of Assam

A Das, S.P. Biswas

10.18805/ag.D-5560

## ABSTRACT

**Background:** Rapid industrialization, water abstraction and the extensive use of pesticides in agriculture have severe strains on rivers and resulted in deterioration of water quality. The present investigation on certain geomorphological aspects and fish fauna was conducted in the remnants of old channel of river Jia Bharali called as Mara Bharali at Tezpur in the Sonitpur district of Assam from December 2017 to November, 2019.

**Methods:** Five sampling stations were selected that covers a stretch of 16.5 km. River width, river depth, bank type and riparian vegetation were assessed following Armantrout (1999) and statistical analysis were conducted. Fish species were collected and identified following Talwar and Jhingran (1991).

**Result:** Maximum value of river width was found at site MB5 (12.821±6.067 m). Mean water current velocity was found to be maximum at site MB5 (0.645±0.056 ms<sup>-1</sup>) followed by MB1 (0.433±0.045 ms<sup>-1</sup>). The river depicts riffle-pool morphology and consisted of substrates in the form of pebbles, sand and silt. Thirty four fish species belonging to 25 genera, 08 orders and 17 families has been recorded. Moreover, random sampling analysis shows the presence of 14 rare species in Mara Bharali.

**Key words:** Cypriniformes, Fish abundance, Riffle-pool, Riparian vegetation, Water velocity, Width depth ratio

## INTRODUCTION

Rivers and streams characterized by flowing waters have four dimensions: a longitudinal dimension with pronounced zonation of chemical, physical and biological factors, a lateral dimension involving exchanges of organic matter, nutrients and biota between the stream channel and adjacent floodplain, a vertical dimension consisting of a hydraulic connection linking the river channel with groundwater and a fourth dimension of time which pertains to the velocity of the water flow.

Rivers borrow a great part of their character from the terrestrial ecosystem that is the catchment through which they flow. Indeed, if the landscape is in a good condition, then the river is too and if the landscape is badly treated, then the river flowing through it will magnify and mirror that abuse (Davies and Day, 1998). Globally, climate change and human activities have strongly influenced the world in terms of land use, soil characteristics, hydrological regime, water quality and biota in aquatic ecosystems (Xu, 2015). Environmental variation can exert direct or indirect effects on species arranged along a gradient from proximal to distal attributes (Austin, 2002; Guisan and Thuiller, 2005).

Freshwater habitats harbour diverse fauna, with fish serving as prime indicators of ecosystem status (Karr *et al.* 1986). Riverine fauna show a high degree of endemism, with most endemic fish species living in headwater streams and/or short stretches of river (Groombridge 1992, Kottelal and Whitten 1997). The present investigation was carried out with the objective to analyze certain geomorphological features and fish fauna of river Mara Bharali as no such work on the river system has been conducted so far.

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**How to cite this article:** Das, A. and Biswas, S.P. (2022) Certain Geomorphological Features and Fish Fauna of River Mara Bharali in Sonitpur District of Assam. *Agricultural Science Digest* 42(6): 774-779. DOI: 10.18805/ag.D-5560

Submitted: 24-01-2022 Accepted: 01-09-2022 Online: 09-09-2022

## MATERIALS AND METHODS

The river morphology, bank type and riparian vegetation were assessed following Rosgen (1996) and Armantrout (1999). A total area of 500 m<sup>2</sup> was taken into consideration from each sampling site. Width of the channel was measured with simple measuring tape. Width-depth ratio was estimated as the bankfull width divided by the depth at each site. The water current velocity of the river was calculated in the field by float method using the formula:

$$V = D/t$$

Where,

D = Distance covered by the float.

t = Time taken.

Substrate and channel types were analyzed by visual observations and were classified after Armantrout (1999). Altitude, latitude and longitude were measured on the spot with the help of Garmin eTrex-20X GPS.

The mean values of different parameters of Mara Bharali river from different locations in different seasons were



## USE OF AQUATIC INSECTS TO ASSESS THE BIOLOGICAL STATUS OF A PERENNIAL POND IN ASSAM, NORTHEAST INDIA

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### ABSTRACT

An investigation was carried out on "Hazara Pukhuri", a perennial pond in Sonitpur district, North East India, between July 2019 and June 2020. To assess the health of the waterbody, various biotic and diversity indices were applied, with aquatic and semi-aquatic hemipteran populations functioning as bioindicators. The pond's hemipterans include 17 species from 13 genera and 8 families, including Gerridae, Corixidae, Pleidae, Notonectidae, Nepidae, Belostomatidae, Hydrometridae, and Mesoveliidae. The biotic indices Average Score per Taxon (ASPT), Stream Invertebrate Grade Number-Average Level (SIGNAL-2), and The Biological Monitoring Working Party (BMWP) Score, as well as other diversity indices, were assessed to indicate that the waterbody was unpolluted/ slightly polluted. The presence or lack of littoral vegetation and flooding and drying of nearby shallow water pools and swampy areas were important drivers of the distribution, abundance, and community composition of aquatic and semi-aquatic hemipterans in the studied water body.

**Key words:** Perennial pond, Assam, Hemiptera, Heteroptera, BMWP, ASPT, abundance, diversity indices, water quality, hydropereid, population, vegetation

Aquatic insects represent the majority of the functional feeding group, which includes predators, shredders, grazers, filter feeders, gatherers, piercers, and parasites (Mackie, 2001). Hemipterans are true "bugs" (Hemiptera) and its aquatic and semiaquatic members can be found in and around all types of freshwater habitats. These are classified as suborder Heteroptera (Thirumalai, 2007). Hemipterans are important in the ecology of freshwater ecosystems. Thirumalai and Raghunathan (1988) and Ramakrishna (2000) concluded that aquatic bug population dynamics influence the quality of the aquatic environment. Many organisms, including fish, amphibians, waterfowl, and other animals, rely on them for food (Clark, 1992). These insects typically occupy an intermediate position in food chains and are important predators. Certain hemipteran families are useful in the biological control of mosquito larvae (Jenkins, 1964; Bisht and Das, 1981; Ohba and Nakasuji, 2006; Saha et al., 2007). Aquatic Hemiptera can live in an environment that would be extremely stressful for other organisms, as in German mining lakes with a pH <3 (Woolmann, 2001). Thus, these bugs are frequently used to assess the levels of toxins in an environment as they can survive in heavily polluted areas (Papacek 2001; Woolman 2001; Jansson 1987). The diversity and distribution of aquatic Hemiptera in the freshwater ecosystems of the Indian subcontinent have been extensively studied

by Thirumalai (2002a, 2002b, 2007), Thirumalai and Suresh Kumar (2006), Thirumalai and Raghunathan (1988), and Bal and Basu (1994a,b, 2000a,b, 2003, 2004). Thirumalai (2002a) found 80 genera and 275 species of aquatic and semiaquatic Hemiptera in India. Chetri et al. (1997), Kalita (2008), Hazarika and Goswami (2010), Gupta and Parkayastha (2012), Gupta and Das (2012), Barman and Baruah (2013, 2015), Barman and Deka (2015), and Barman and Gupta (2015) studied the aquatic and semiaquatic hemipterans of this region previously. These studies overlook the use of aquatic and semiaquatic hemipterans as bioindicators, particularly in the northeastern region of India. The current study, therefore focused on studying the community composition and population dynamics of aquatic and semiaquatic hemipterans in a manmade, perennial fish pond in Sonitpur, Assam.

### MATERIALS AND METHODS

At an elevation of 245 feet, Hazara Pukhuri is located within the geographical ranges of 26°38'0"N-26°37'58"N and 92°46'30"E-92°46'47"E. It is the largest perennial pond in Tezpur, Sonitpur District. The pond attracts visitors from all over the world because of its historic significance and its importance as a migratory and resident aquatic bird habitat. The experiment was conducted from July 2019 to June 2020, selecting four sampling sites. Insects from the littoral zones





## Review article

## Environmental hypoxia: A threat to the gonadal development and reproduction in bony fishes

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## ARTICLE INFO

## Keywords:

Sex hormones  
Endocrine disruption  
Gametogenesis  
Gonadal development  
Fish reproduction  
HPG-Axis

## ABSTRACT

Vast stretches of open water bodies are gradually becoming hypoxic as a result of depletion of oxygen levels mainly due to various human anthropogenic activities. This problem of hypoxic stress on the fish population is likely to be exacerbated soon since the aquatic hypoxic environment is continuously spreading over vast areas worldwide. In recent years, various harmful effects of hypoxia to bony fishes have been reported, such as the restriction of energy-consuming metabolic processes, arrest of the growth of ovary and testes that are associated with endocrine disruption, loss of sperm and egg quality, inhibition of fertilization, hatching success, and also the reduction of larval survivability, thereby impairment of overall reproductive and developmental processes in fish. Disruption of the brain-pituitary-gonad axis, and certain enzymes related to steroidogenesis and vitellogenesis in fish have also been reported as the primary targets for an endocrine malfunction during hypoxia. Hypoxia-sensitive downregulation of key genes responsible for controlling sex hormones' synthesis has been documented in certain bony fishes. Further, continuous exposure to hypoxia was reported to induce early expression of pro-apoptotic/tumor suppressor p53 genes, thereby causing immense cell death in hypoxic embryos. However, the cellular responses to long-term hypoxia exposure and the degree of reproductive impairments in bony fishes are still not adequate to figure out the actual underlying mechanisms. The present review intends to highlight the current knowledge about the detrimental impact of chronic/acute hypoxia at different stages of fish reproduction and the associated underlying molecular mechanisms.

## 1. Introduction

### 1.1. En route to aerobic respiration

The emergence of molecular oxygen ( $O_2$ ) in the atmosphere is considered a crucial factor for transforming the biochemical makeup of life and probably paved the way for the evolution of organismal diversification. From extensive biological and geological investigations, the vital role of atmospheric oxygen on biological evolution has been recognized (Jiang et al., 2012; Reinhard et al., 2016; Sessions et al., 2009). The atmosphere of the Earth existed in anoxic conditions during the Archean era (about 2.4–2.5 billion years ago), and the stromatolites/biofilms of microorganisms, especially the cyanobacteria, were the primary life forms on the planet earth (Kump, 2008; Makishima, 2017). During the Paleoproterozoic era (approximately 2.0–2.4 billion years ago), the shallow ocean and the atmosphere of the Earth first experienced a rise in oxygen after the great oxidation event (GOE) and subsequently triggered the appearance of eukaryotes (Lyons et al., 2014;

Zimorski et al., 2019). The Cambrian explosion of animal diversity, observed over 750 million years ago, was probably associated with the substantial rise in the level of atmospheric oxygen (Hsia et al., 2013; Lutz & Prentice, 2002). About 205 million years ago, the changes in animal body size and their metabolic activities that had occurred were mainly due to the elevation of atmospheric oxygen levels (Wheaton & Chandel, 2011). The GOE led to the extermination of most of the contemporary life forms, having no line of defense against reactive oxygen species (ROS), in a process that has been characterized as the "oxygen holocaust." However, through the evolutionary process, oxygen-consuming organisms took advantage of more energy-efficient aerobic metabolism via aerobic respiration.

### 1.2. Normoxia v/s hypoxia

Aerobic organisms require molecular oxygen to regulate interdependent cell metabolism, growth, and survival. The oxygen demand of aerobes is fulfilled through an effective system that distributes oxygen

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<https://doi.org/10.1016/j.aaf.2022.02.002>

Received 17 December 2021; Received in revised form 11 February 2022; Accepted 14 February 2022

Available online 1 March 2022

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## Spatial Pattern of Covid-19 in Relation to Population Density: A Case Study in Assam (India)

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### Abstract

Since the time of occurrence of first wave of COVID-19, its study from multi dimensional directions becomes visible across academic disciplines globally. In this paper we analyze the correlation between spread of corona virus and population density. The study is undertaken at district level in the state of Assam, (North-eastern India), considering the confirmed COVID-19 cases (during the first wave) and population density of the districts. We use the Karl Pearson's correlation method for assessing the level of correlation, which is further tested with t-test application. A cartographic representation is also constructed using GIS platform to observe the COVID-19 spatial incidence in relation to population density pattern. We have observed that the number of infection and population density at district level have a positive relationship with R value 0.641, which can be considered statistically significant.



### Article History

Received: 17 June 2022  
Accepted: 23 September 2022

### Keywords

COVID-19,  
Pandemic,  
Population Density,  
Spatial Pattern.

### Introduction

COVID-19 is a global catastrophic pandemic that has destabilized the entire humanity during 2020-21 in terms of their life and livelihood. World Health Organization (henceforth WHO) is continuously working on various dimensions of COVID-19 issues including data collection to general health care and specific prevention including vaccination etc. By end of January 2020, 20 countries had reported COVID-19, that gone up to 54 in February, and 202 by end of March that further rises to 212 by April 2020. It thus quickly literally becomes a global health crisis, excluding Antarctic and few islands of the Pacific. In India where the third wave

of COVID-19 is already pending, the country is battling with 25 million cases since the pandemic began. Thus, the country ranked the second highest confirmed infections cases after the United States of America.

According to a WHO global report, worldwide 243,857,028 confirmed COVID cases are detected (as on October 2021) that includes 4,953,246 deaths. India has 34,202,202 confirmed COVID cases (which are just about 14% of the global COVID cases) with 455,068 deaths, representing 9.2% of the global COVID deaths (WHO report). According to the latest updated global statistics total coronavirus

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Doi: <http://dx.doi.org/10.12944/CWE.17.3.22>

## Greenhouse Industry! Role of Nursery Service in Environmental Restoration of Tezpur Town, Assam (India)

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(Received 02 February, 2022; Accepted 15 March, 2022)

### ABSTRACT

As a managed site nursery is an area where the plants are propagated and maintained in the initial years. Mostly the horticultural crops including flowers, fruits and vegetables are raised in nurseries and then transplanted in the field. In this paper emphasis is given on the emerging trend of nursery services at Tezpur town of Assam and its role in environmental restoration. Tezpur, one of the most beautiful towns of north bank of the Brahmaputra river, is well known for its greenery and scenic beauty in which the trend of emergence of this greenhouse industry gives extra look in the aesthetic view of the town. Along with the beautification the nursery business is related with the employment opportunities too. For this purpose, an attempt to study about the distributional pattern of plant nurseries and its role on the environmental restoration of Tezpur town is made with the help of both primary and secondary data sources. With the thought of 'A green step towards a healthy future' Govt. can also promote this greenhouse industry among the people of Tezpur town and become a contributor in enriching the quality of the environment.

**Key words:** Aesthetic, Greenhouse Industry, Nursery, Environmental Restoration

### Introduction

Nursery is a managed site in which new saplings are raised and nourished under favorable conditions to a desired age. It is a place where variety of plants are propagated and grown with care before transplanting. Nowadays, plant nursery becomes very popular for artificial plantation in which superior quality of plants are raised with right size at the right time. 'All nurseries primarily aim to produce sufficient quantities of high quality seedlings to satisfy the needs of users' (Krishnan *et al.*, 2014). As a natural factory it is the hub of various horticultural crops from which public can purchase varieties of

flowering, fruits and ornamental plants. 'The nursery site should be located in the nutrient rich/medium soil, near to water source, free from soil pathogens and insects, availability of cheap and skilled labors and has good access to the main road for easy transportation. The site of nurseries needs to be on gently sloping area that is away from other tall crops for good drainage and air circulation' (Krishnan and *et al.*, 2014). The location should be naturally (under the trees) or artificially shaded; various designs of shaded house like natural greenhouse, artificial shade net house, glass house are designed as per the need and resource availability. In order to get superior quality desired species in good and healthy con-

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## Role of Channel Migration and Influencing Hydro-Geomorphic Attributes in Dibru River Basin Using Remote Sensing and GIS

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Nat. Env. & Poll. Tech.  
Website: www.neptjournal.com

Received: 11-07-2022

Revised: 28-08-2022

Accepted: 07-09-2022

### Key Words:

Channel migration  
Remote sensing  
GIS  
Channel avulsion  
Dibru river basin

### ABSTRACT

The action of the river is dynamic and exhibits morphological changes over time. River channel migration may take place because of sedimentation, geology, soil properties, geomorphic setup, precipitation, land use pattern, natural bank geometry (e.g., channel width, meander length, meander wavelength, amplitude, the radius of curvature, arc angle, and sinuosity), discharges of various frequencies (Brice 1992, MacDonald et al. 1991, Garcia et al. 1994), distribution of riparian vegetation, and vertical and horizontal heterogeneity of floodplain soils (Motta et al. 2012), etc. are some factors for channel migration. The present study is undertaken in the Dibru River Basin, the left-bank tributary of the Brahmaputra River. To identify the Spatio-temporal changes, satellite imagery is used in the GIS environment. The extraction of the river is done from the GIS software (Arc GIS 10.4) by digitizing process and tries to overlay the different time periods of shifting of the river and find out the rate of magnitude and nature of the river course changes. An interval of 10 years is taken to find the rate of magnitude and nature of changes in the river courses from satellite imagery. The time period is taken from 1977-2020 at 10 years intervals. Along with the rate of river course changes, channel avulsion is also shown with the help of satellite imagery. The Dibru Saikhowa National Park falls within the Dibru river basin, where numerous streams are found, within the national park. The Saikhowa river and Ajuka river flow within the national park. The Sursa river is a small channel linked with the Dangori river. With phases of time, the river made a headward erosion and confluence with the Ajuka river and formed a channel. The Saikhowa river flowed till 1987; due to deposition, the river abandoned its original course. In 1988, the Ajuka river and Sursa river merged and flowed northwest direction. The high discharges of the Lohit river diverted towards the Ajuka and Sursa Rivers and took a new channel named the Lower course of Lohit river within the study area. It can be called an avulsion channel because it changed its direction from its original to a new course in 1990. Since 1990, the course of the channel has been tremendously expanding its length and breadth, causing a flood, bank erosion, and deposition nearby human habitats and Dibru Saikhowa National Park. From the multi-temporal satellite imagery, the river courses were studied, and found the year of avulsion took place in the channel. Multi-temporal satellite imagery is used to identify the channel's avulsion. An avulsion is the rapid separation of a river channel to form a new course, which is only possible due to flood, high discharge, soil properties or tectonic activity, etc. that creates instability and causes the channel avulsion.

### INTRODUCTION

River morphology is changeable and active in varying environmental landscapes over both spatio-temporal scales. An avulsion is a process by which flow is diverted from the parent channel into a new course in the floodplain. A local avulsion forms a new channel that joins its parent channel downstream (Heller & Paola 1996). Channel diversion mainly occurs within the floodplain region, and bank erosion is held because of lateral shifting of the course. Usually, it is a natural process, but with the ages of time, its terms

as semi-natural because of human intervention. Changing channel courses create great havoc on the socio-economic life of the people living in the region. Sometimes, many people lose their homes, agriculture fields, and infrastructure due to channel migration. It is variable; some changes are gradual and some are unnoticeable, while others depend upon the phenomena like extreme floods and droughts. Channel avulsion is a natural process associated with changing channel patterns over space and time. Different channel patterns are identified in the same river course because of the behavior of the river. In floodplains, sinuous

to meandering channel patterns are common in the river course.

The Brahmaputra River has been causing severe bank erosion along different parts of its alluvial banks in Assam. Among the localities afflicted by severe bank erosion in Assam (such as Majuli, Moriahola, Kaziranga, Laharighat, Palasbari, Gomi, Mokalmua, and Bogribari), the Rohmoria area has the highest rate of bank erosion in the south bank of the Brahmaputra (Sarma & Phukan 2006). An attempt has been made for the first time to evaluate the role of a neotectonic fault on rapid bankline migration vis-à-vis bank erosion of the Brahmaputra River around Rohmoria locality of Assam (Sarma & Acharjee 2012).

The Dibru River is a left-bank tributary of the Brahmaputra river. The Dibru river is a northward-flowing river system that drains into the Brahmaputra River in the plains region. The Dibru river origin near the village name called Natun Maithang bujilban and flows northwards to drain into the Brahmaputra river. The Dangori river is a sub-tributary of the Dibru river and confluence at the Raidang wetland. It is just a tributary of the mainstream river but changes its morphological characteristics by expanding its bank over time. Before, it was just a tiny channel or Nala. Now, Dangori is known as the second Brahmaputra by the local people of the study area. The river creates great havoc on the physical and socio-economic

landscapes. The 20 m wide small channel of the Dangori river of 1995 has become about 2,000 m wide channel of the Lohit in 2007 causing severe bank erosion, flooding, and loss of life and property (Sarma et al. 2011).

GIS is the most sophisticated tool used for environmental deterministic research studies. Various multi-temporal satellite imagery is used to identify the temporal change of the Dibru river course and the lower course of the Lohit river. The advantage of using advanced tools for geo-referencing, image processing, visualization, overlay, water bodies extraction, and channel migration position over multiple years to a single extensive system. The high-resolution images give accurate and precise data for a particular region and are essential to evaluating the trend of river shifting. This will be helpful for ordinary people for earlier vulnerability to communities living on the flood plains.

### OBJECTIVES OF THE STUDY

1. To identify the high-risk point of channel migration of the Dibru river using satellite imagery.
2. To assess the magnitude of channel change of the Dibru river using geospatial tools.
3. To study the hydro-geomorphic indicator of channel migration.



**Spatial Pattern of Covid-19 in Relation to Population Density:  
A Case Study in Assam (India)**

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**Abstract**

Since the time of occurrence of first wave of COVID-19, its study from multi dimensional directions becomes visible across academic disciplines globally. In this paper we analyze the correlation between spread of corona virus and population density. The study is undertaken at district level in the state of Assam, (North-eastern India), considering the confirmed COVID-19 cases (during the first wave) and population density of the districts. We use the Karl Pearson's correlation method for assessing the level of correlation, which is further tested with t-test application. A cartographic representation is also constructed using GIS platform to observe the COVID-19 spatial incidence in relation to population density pattern. We have observed that the number of infection and population density at district level have a positive relationship with R value 0.641, which can be considered statistically significant.



**Article History**

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Accepted: 23 September 2022

**Keywords**

COVID-19,  
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Spatial Pattern.

**Introduction**

COVID-19 is a global catastrophic pandemic that has destabilized the entire humanity during 2020-21 in terms of their life and livelihood. World Health Organization (henceforth WHO) is continuously working on various dimensions of COVID-19 issues including data collection to general health care and specific prevention including vaccination etc. By end of January 2020, 20 countries had reported COVID-19, that gone up to 54 in February, and 202 by end of March that further rises to 212 by April 2020. It thus quickly literally becomes a global health crisis, excluding Antarctic and few islands of the Pacific. In India where the third wave

of COVID-19 is already pending, the country is battling with 25 million cases since the pandemic began. Thus, the country ranked the second highest confirmed infections cases after the United States of America.

According to a WHO global report, worldwide 243,857,028 confirmed COVID cases are detected (as on October 2021) that includes 4,953,246 deaths. India has 34,202,202 confirmed COVID cases (which are just about 14% of the global COVID cases) with 455,068 deaths, representing 9.2% of the global COVID deaths (WHO report). According to the latest updated global statistics total coronavirus

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Doi: <http://dx.doi.org/10.12944/CWE.17.3.22>

*Eco. Env. & Cons.* 28 (January Suppl. Issue) : 2022; pp. (S311-S318)  
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ISSN 0971-765X

 <http://doi.org/10.53550/EEC.2022.v28i01s.044>

# Land use and Land cover Detection using Geo-spatial Tools for Sustainable Land Use Planning

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(Received 10 August, 2021; Accepted 16 September, 2021)



## Role of Channel Migration and Influencing Hydro-Geomorphic Attributes in Dibru River Basin Using Remote Sensing and GIS

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Nat. Env. & Poll. Tech.  
Website: www.neptjournal.com

Received: 11-07-2022

Revised: 28-08-2022

Accepted: 07-09-2022

### Key Words:

Channel migration  
Remote sensing  
GIS  
Channel avulsion  
Dibru river basin

### ABSTRACT

The action of the river is dynamic and exhibits morphological changes over time. River channel migration may take place because of sedimentation, geology, soil properties, geomorphic setup, precipitation, land use pattern, natural bank geometry (e.g., channel width, meander length, meander wavelength, amplitude, the radius of curvature, arc angle, and sinuosity), discharges of various frequencies (Brice 1992, MacDonald et al. 1991, Garcia et al. 1994), distribution of riparian vegetation, and vertical and horizontal heterogeneity of floodplain soils (Motta et al. 2012), etc. are some factors for channel migration. The present study is undertaken in the Dibru River Basin, the left-bank tributary of the Brahmaputra River. To identify the Spatio-temporal changes, satellite imagery is used in the GIS environment. The extraction of the river is done from the GIS software (Arc GIS 10.4) by digitizing process and tries to overlay the different time periods of shifting of the river and find out the rate of magnitude and nature of the river course changes. An interval of 10 years is taken to find the rate of magnitude and nature of changes in the river courses from satellite imagery. The time period is taken from 1977-2020 at 10 years intervals. Along with the rate of river course changes, channel avulsion is also shown with the help of satellite imagery. The Dibru Saikhowa National Park falls within the Dibru river basin, where numerous streams are found, within the national park. The Saikhowa river and Ajuka river flow within the national park. The Sursa river is a small channel linked with the Dangori river. With phases of time, the river made a headward erosion and confluence with the Ajuka river and formed a channel. The Saikhowa river flowed till 1987; due to deposition, the river abandoned its original course. In 1988, the Ajuka river and Sursa river merged and flowed northwest direction. The high discharges of the Lohit river diverted towards the Ajuka and Sursa Rivers and took a new channel named the Lower course of Lohit river within the study area. It can be called an avulsion channel because it changed its direction from its original to a new course in 1990. Since 1990, the course of the channel has been tremendously expanding its length and breadth, causing a flood, bank erosion, and deposition nearby human habitats and Dibru Saikhowa National Park. From the multi-temporal satellite imagery, the river courses were studied, and found the year of avulsion took place in the channel. Multi-temporal satellite imagery is used to identify the channel's avulsion. An avulsion is the rapid separation of a river channel to form a new course, which is only possible due to flood, high discharge, soil properties or tectonic activity, etc. that creates instability and causes the channel avulsion.

### INTRODUCTION

River morphology is changeable and active in varying environmental landscapes over both spatio-temporal scales. An avulsion is a process by which flow is diverted from the parent channel into a new course in the floodplain. A local avulsion forms a new channel that joins its parent channel downstream (Heller & Paola 1996). Channel diversion mainly occurs within the floodplain region, and bank erosion is held because of lateral shifting of the course. Usually, it is a natural process, but with the ages of time, its terms

as semi-natural because of human intervention. Changing channel courses create great havoc on the socio-economic life of the people living in the region. Sometimes, many people lose their homes, agriculture fields, and infrastructure due to channel migration. It is variable; some changes are gradual and some are unnoticeable, while others depend upon the phenomena like extreme floods and droughts. Channel avulsion is a natural process associated with changing channel patterns over space and time. Different channel patterns are identified in the same river course because of the behavior of the river. In floodplains, sinuous

to meandering channel patterns are common in the river course.

The Brahmaputra River has been causing severe bank erosion along different parts of its alluvial banks in Assam. Among the localities afflicted by severe bank erosion in Assam (such as Majuli, Moriahola, Kaziranga, Laharighat, Palasbari, Gomi, Mokalmua, and Bogribari), the Rohmoria area has the highest rate of bank erosion in the south bank of the Brahmaputra (Sarma & Phukan 2006). An attempt has been made for the first time to evaluate the role of a neotectonic fault on rapid bankline migration vis-à-vis bank erosion of the Brahmaputra River around Rohmoria locality of Assam (Sarma & Acharjee 2012).

The Dibru River is a left-bank tributary of the Brahmaputra river. The Dibru river is a northward-flowing river system that drains into the Brahmaputra River in the plains region. The Dibru river origin near the village name called Natun Maithang bujilban and flows northwards to drain into the Brahmaputra river. The Dangori river is a sub-tributary of the Dibru river and confluence at the Raidang wetland. It is just a tributary of the mainstream river but changes its morphological characteristics by expanding its bank over time. Before, it was just a tiny channel or Nala. Now, Dangori is known as the second Brahmaputra by the local people of the study area. The river creates great havoc on the physical and socio-economic

landscapes. The 20 m wide small channel of the Dangori river of 1995 has become about 2,000 m wide channel of the Lohit in 2007 causing severe bank erosion, flooding, and loss of life and property (Sarma et al. 2011).

GIS is the most sophisticated tool used for environmental deterministic research studies. Various multi-temporal satellite imagery is used to identify the temporal change of the Dibru river course and the lower course of the Lohit river. The advantage of using advanced tools for geo-referencing, image processing, visualization, overlay, water bodies extraction, and channel migration position over multiple years to a single extensive system. The high-resolution images give accurate and precise data for a particular region and are essential to evaluating the trend of river shifting. This will be helpful for ordinary people for earlier vulnerability to communities living on the flood plains.

### OBJECTIVES OF THE STUDY

1. To identify the high-risk point of channel migration of the Dibru river using satellite imagery.
2. To assess the magnitude of channel change of the Dibru river using geospatial tools.
3. To study the hydro-geomorphic indicator of channel migration.



## Greenhouse Industry! Role of Nursery Service in Environmental Restoration of Tezpur Town, Assam (India)

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(Received 02 February, 2022; Accepted 15 March, 2022)

### ABSTRACT

As a managed site nursery is an area where the plants are propagated and maintained in the initial years. Mostly the horticultural crops including flowers, fruits and vegetables are raised in nurseries and then transplanted in the field. In this paper emphasis is given on the emerging trend of nursery services at Tezpur town of Assam and its role in environmental restoration. Tezpur, one of the most beautiful towns of north bank of the Brahmaputra river, is well known for its greenery and scenic beauty in which the trend of emergence of this greenhouse industry gives extra look in the aesthetic view of the town. Along with the beautification the nursery business is related with the employment opportunities too. For this purpose, an attempt to study about the distributional pattern of plant nurseries and its role on the environmental restoration of Tezpur town is made with the help of both primary and secondary data sources. With the thought of 'A green step towards a healthy future' Govt. can also promote this greenhouse industry among the people of Tezpur town and become a contributor in enriching the quality of the environment.

**Key words:** Aesthetic, Greenhouse Industry, Nursery, Environmental Restoration

### Introduction

Nursery is a managed site in which new saplings are raised and nourished under favorable conditions to a desired age. It is a place where variety of plants are propagated and grown with care before transplanting. Nowadays, plant nursery becomes very popular for artificial plantation in which superior quality of plants are raised with right size at the right time. 'All nurseries primarily aim to produce sufficient quantities of high quality seedlings to satisfy the needs of users' (Krishnan *et al.*, 2014). As a natural factory it is the hub of various horticultural crops from which public can purchase varieties of

flowering, fruits and ornamental plants. 'The nursery site should be located in the nutrient rich/medium soil, near to water source, free from soil pathogens and insects, availability of cheap and skilled labors and has good access to the main road for easy transportation. The site of nurseries needs to be on gently sloping area that is away from other tall crops for good drainage and air circulation' (Krishnan and *et al.*, 2014). The location should be naturally (under the trees) or artificially shaded; various designs of shaded house like natural greenhouse, artificial shade net house, glass house are designed as per the need and resource availability. In order to get superior quality desired species in good and healthy con-

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ditions at a reasonable cost establishment of nurseries are important. Proper care and maintenance are original manure behind the success of a commercialized nursery for which the operator and the staff members should have technical knowledge and competency. 'Undoubtedly, tree growing provides economic and environmental benefits' (Edralin and Mercado, 2010). Along with its various environmental benefits, this greenhouse business now has great potentiality in the field of self employment espe-

Brahmaputra on the south. The Himalayan foothills have a clear cut east west alignment where the malayan falls abruptly to the plain of the region is gently sloping towards south of the Brahmaputra. Physiographically, this beautiful town of Tezpur is decorated with a range of lower hills and luxuriant growth of ever-green and semi-deciduous forests. Climatically, with 1836 mm of annual rainfall Tezpur town experiences average 36 °C (97°F) and 13 °C (55°F) temperature during summer





## Hydro-Geomorphic Approach for Identifying River Dolphin Habitation in Kulsi River, India

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**Abstract:** *The Gangetic dolphin (Platanista gangetica) is a rare species found in the Kulsi river, a left-bank tributary of the Brahmaputra. These species are found everywhere in the entire course of the river during the monsoon season, but at the time of post-monsoon, they are found only in some selected sites due to the requirement for food, shelter, water quality, water quantity and geomorphic character of the river. The present study looks into the hydro-geomorphic parameters of the river as the suitable habitat of these rare species. The study is based entirely on field data collected from the channel at selected cross-section sites. Primary data on channel width, depth, velocity of flow, pH and water turbidity, riparian conditions and other geomorphologic characteristics was collected to identify suitable sites for the habitation of the dolphin species in the Kulsi river. The physicochemical, hydrological, and geomorphologic characteristics of the Kulsi river specify that the river health is satisfactory and suitable for resident dolphin population at a number of sites, which from upstream to downstream direction of the channel are Dumukh, Kukurmara, Jiakur, Chamaria, and Nagarbera. In these locations the depth of the channel is more near the confluence of tributaries, and also in the convex meander bends of the river where eddy counter-current prevails.*

**Keywords:** *channel shape, hydro-geomorphic, Gangetic dolphin, physiochemical, riparian condition, satellite image, GIS.*

### Introduction

The Gangetic river dolphin, locally known as 'Sishu' or 'Hihi' in Assam was first reported by Roxburgh (1801), and are distributed along the Kulsi river, a tributary of the Brahmaputra. Mohan et al. (1997) confirmed the existence of the Gangetic dolphin in the Brahmaputra river and its tributary Subansiri and Kulsi. Wakid in 2005 assessed the dolphin population status and distribution pattern in the Brahmaputra river system. He conducted a detailed ecological investigation on dolphins in eastern Assam in 2009 and recorded 17

dolphins in the Kulsi river from Gharamara to its confluence with the Brahmaputra near Nagarbera, about 76 km stretch of the river (Wakid and Braulik, 2009). They usually prefer to live where there is clean air, good quality deep waters near meander belts and confluence points of tributaries. Maximum number of dolphins are found in the rainy season (August to November), which starts decreasing dry season from December to February. The low count of dolphins in the dry season is mainly due to concentration of polluted water and their movement to other

large rivers (Khondker and Abed, 2013). The Kulsi river is well known not only for its population of river dolphins but also for the extensive sand extraction activity from the river bed. During the monsoon season, the river experiences high water level, and people enjoy the aesthetic view of diving dolphins at every river site. However, in post-monsoon, the dolphins are found only in some selected sites depending on the physiochemical properties of the river water and also on the hydro-geomorphic parameters of the channel such as width, depth, velocity, eddy counter current, meander planform, interconnectivity of wetlands and tributary confluences. The dolphins prefer locations which are away from human interference and prey fishes are easily available. The dolphin habitat has been adversely affected by the depositional activity of the river which leads to decrease in depth in the lower reaches of the river and also due to the activity of sand mining with the use of machines, creating a noisy environment.

The downstream stretch of the Kulsi river is being degraded by frequent flooding, pollution by agrochemicals, sand mining

Schedule-I of the Wildlife (Protection) Act, 1972, and was declared the National Aquatic Animal in 2009. Research on the distribution pattern of Gangetic river dolphins, their population status, ecological investigation, and protection of this endangered species in the Brahmaputra-Barak river system has already been carried out. However, a comprehensive study on the hydro-geomorphic and environmental conditions of the dolphin habitat site has not been conducted yet. The present study investigates the hydro-geomorphic characteristics of the Kulsi river from the Ukium to Nagarbera (Fig. 2) for proposing suitable sites for the long-term conservation of the resident Gangetic dolphin population.

### Geographical background

The Kulsi river is a left-bank tributary of the Brahmaputra river. In Meghalaya, the river is known as the Khri river, where the tributaries Um Krisinya, Um Siri, and Um Ngi meet with the Khri river at Ukium. After reaching the alluvial plain of Assam, the river is known as Kulsi river. The Kulsi river basin

## Reassessing the Archaeological Evidence for a Panchayatana Temple on Bamuni Pahar Assam

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### Abstract

Bamuni Paharis a small hillock situated along the north bank of the river Brahmaputra in Tezpur, the headquarters of the Sonitpur district in Assam. The archaeological remains found at the site consist of several stone structural components of temples/temple, including sculptures. Of late the site has attracted the attention of scholars. Hence an attempt has been made to reassess the archaeological remains of Bamuni Pahar to examine the possibility of the existence of a panchayatana temple at the site.

Key Words: Visnu, Dasavatara, panchayatana, Bamuni Pahar

### Introduction

The Bamuni Pahar (Hill), located at Lat 26° 37' N, Long 92° 47' E, lies within the jurisdiction of modern Tezpur, the headquarters of Sonitpur District (Fig.1) Tezpur was the seat of power of the Salastambha dynasty that ruled over Assam from the middle of the seventh century CE to the tenth century CE when it was known variously as Hadupesvara, Hattapesvara and also as Hatapyaka by the Pala kings of Assam who succeeded the Salastambhas. Oral traditions identify the region with the legendary kingdom of Sonitpur, ruled by the asura Bana who was vanquished by Krishna in a bloody battle, giving the city its present name (city of blood). The entire district headquarters

of Tezpur is littered with ancient remains in the form of temple ruins, sculptures, pottery, and coins. Copper plate inscriptions refer to temple-building activities in the region. However, due to Assam lying in a zone of great seismic activity, heavy rainfall and dense vegetation the roots of which destroy old structures, no standing temple of that bygone era now remains.

### Methodology

This paper is primarily based on a field study of the site. An exploration of the Bamuni Pahar ruins reveals remains of massive temple structural components. Due to the vagaries of time, the temple/temple that once stood there are totally in ruins with not

## The Sālastambhas and the Growth of Haduppesvara as a Political and Urban Centre in Ancient Assam

Sweta Mahanta

### Introduction

The historical period of ancient Assam can be traced to the first half of the 4<sup>th</sup> century C.E. when Prāgjyotisha-Kāmarūpa came to be ruled by the dynasty of the Varmans. Pushyavarman was the founder of the Varman dynasty and during the rule of the Varmas, Prāgjyotisha became the seat of power of the Varmans. The Varman line of kings ruled for about three hundred years. During that period, they rose from the status of a frontier kingdom of the Guptas to one formidable force who even engaged in northern Indian politics. The most famous ruler of the Varmans was Bhāskarvarman during whose rule the Buddhist pilgrim Hieun Tsang visited Kāmarūpa. However with the death of Bhāskarvarman, the rule of the Varmans ended and a new line of kings ascended the throne of Kāmarūpa. The founder of this dynasty was Sālastambha who might have been a frontier governor during the rule of the Varmans. With the accession of Sālastambha in the 7<sup>th</sup> century C.E., the political centre saw a shift from Prāgjyotisha to

Haduppesvara. Archaeological evidences locate the city of Tezpur with ancient Haduppesevara. Through this work an attempt has been made to look into the conditions favourable for the rise of the new political centre of Haduppesvara. At the same time it also tries to evaluate on the basis of epigraphic and material remains the rise of Haduppesvara as an urban centre. Haduppesvara also became an important religious centre during the rule of the Sālastambha. This also helped in the urbanisation of the region.

Assam, situated in the North-Eastern part of the Indian sub-continent was earlier known as Prāgjyotisha, which included the territory around the city of that name while later it came to be known as Kāmarūpa, the name first emerging in the Allahabad pillar inscription of Samudragupta<sup>1</sup> of the 4<sup>th</sup> century C.E. Though the territories of the kingdom contracted or expanded from time to time, 'in the period of the epics the kingdom of Prāgjyotisha included the greater portions of modern Assam, along with Koch-Bihar, Jalpaiguri, Rangpur, Bogra, Mymensing,

# **The Concept of Sāṃkhya Trigūṇa: An Analytical Study from Psychological Perspective**

**Mridusmita Bharadwaj**

## **Abstract**

Philosophy is an elusive and prevalent branch of knowledge. The various systems of Indian philosophy provide ideas regarding knowledge of truth. Despite the differences of ideas, the Indian philosophical systems aim to get the liberation. Psychological discipline plays an important role to get detached from the worldly attachment and therefore, Upanisads, the Yogasūtra, the Sāṃkhyasūtra, the Bhagavad Gita and the schools of Buddhism and Jainism raise the importance of psychological discipline. In ancient period there was no independent branch of knowledge of Psychology but the Indian philosophical thinkers had developed highly systematic views regarding mind and its management. The present research paper tries to analyse the concept of Sāṃkhya Trigūṇa from Psychological Perspective. The relation between the Sāṃkhya Trigūṇa and Psychological behaviour of an individual is tried to explain in this research paper.

**Key words:** Trigūṇa, Psychological behaviour, Philosophy, Sāṃkhya.

Indian philosophy is considered as the most important achievement of Indian thought. The practical and theoretical activities of India revolve around the spiritual connectivity that is only rendered to us by means of philosophy. In Indian philosophy, spiritual aspiration is regarded as the superior to everything else. Indian system of philosophy can be divided into two divisions- Nāstika i.e., Heterodox and Āstika i.e., Orthodox. The Nāstika philosophy is three in number- Cārvāka, Bauddha and Jaina. They are called as Nāstika

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because they do not believe in the authority of the Vedas. Again, Āstika philosophies are six in number viz. Sāṃkhya, Yoga, Nyāya, Vaiśeṣika, Mīmāṃsā and Vedānta. In modern Indian languages Āstika and Nāstika generally mean 'theist' and 'atheist' respectively. As Satishchandra Chatterjee and Dhirendramohan Datta discuss in their book entitled 'An Introduction to Indian Philosophy' the

## Navakanta Barua's Posthuman Wonderland in Siyali Palegoi Ratanpur

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### Abstract

In the wake of the emerging body of scholarship on Posthumanism and Animality studies, the borderline between the human and the 'non-human' has been 'thoroughly breached'. Interestingly, one of the key areas where the boundaries between the human and the animal are problematized is the field of children's literature. Children's literature has the potential to radically challenge the anthropocentric worldview of Man as an 'exceptional' being by deploying a playful, but subversive logic. The paper attempts to examine how Navakanta Barua deploys nonsense and fantasy in his novella, *Siyali Palegoi Ratanpur* to challenge this very prospect of human supremacy as opposed to the non-human 'other'. The paper also seeks to examine how the fantastic encounters between Barua's child-protagonist and the mysterious non-human entities challenge the centrality and superiority of the 'human', and, in doing so, how the text draws attention to the complexities of our lived relations with non-human others.

**Keywords:** Posthumanism, Non-human, Animality, Children's Literature.

### Introduction: The Posthumanist Turn

One of the crucial 'boundary breakdowns', which Donna Haraway (1985) mentions in her significant manifesto, *A Cyborg Manifesto*, is the borderline between humans and animals. As Haraway (1985) proposes, "by the late twentieth century in United States scientific culture, the boundary between human and animal is thoroughly breached (p. 68). Haraway's path-breaking *Manifesto* opens up new avenues to revisit humanity's relationships with non-human 'other' as it undercuts the long-established, 'absolutist' discourse of humanism. For a long time, the Biblical discourse of the 'origin myths' has legitimized the human-animal divide. Citing William Henderson, Tom Tyler (2020), in *The Palgrave Handbook of Animals and Literature* emphasizes how human exceptionalism had its roots in the Biblical teachings. To put in Henderson's words,

"Biblical teaching is [...] *anthropocentric*, so far as the world is concerned, the true centre of it being, not earth so much as man. The sun, physical centre of the system as he may be, shines for our sakes: the moon walks the night in our interest: the stars are there for our use. From the Biblical point of view, everything turns round the earth as the habitation of human *spirit*" (Tyler, 2020, p. 17).



## হোমেন বৰগোহাঞিৰ গদ্যবীতি : এটি অধ্যয়ন

● ড° দুলাল চন্দ্ৰ দাস

সহকাৰী অধ্যাপক, অসমীয়া বিভাগ, দৰং মহাবিদ্যালয়।

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সংক্ষিপ্তসৰ : হোমেন বৰগোহাঞি অসমীয়া সাহিত্যৰ এগৰাকী সফল গদ্যকাৰ। গল্প, উপন্যাস, প্ৰবন্ধ, জীৱনী-আত্মজীৱনী, সমালোচনা আদি বিভিন্ন বিষয়ৰ গদ্য সাহিত্য বচনাৰে অসমীয়া সাহিত্যক শক্তিশালী ৰূপত প্ৰতিষ্ঠা কৰা হোমেন বৰগোহাঞিৰ গদ্যবীতিৰ এটা নিজস্ব বিশেষত্ব আছে। বৰগোহাঞিৰ এই স্বকীয় গদ্যবীতিয়ে পাঠকক এক আমেজ দিয়ে। বাচকবনীয়া শব্দচয়ন, মন-পৰশা যুৰীয়া শব্দ, সাৱলীল বাক্য গাঁথনি, সাৰ্থক জতুৱা ঠাচ আৰু ফকৰা-যোজনাৰ ব্যৱহাৰ, স্থান-বিশেষে কাব্যিক আৰু অলংকাৰপূৰ্ণ ভাষা, যুক্তিনিষ্ঠ আৰু চিন্তামূলক গদ্যশৈলী আৰু প্ৰয়োজন সাপেক্ষে বৰ্ণনামূলক বীতিৰ যথার্থ ব্যৱহাৰেৰে বৰগোহাঞিয়ে তেওঁৰ গদ্যবীতিক এটি শক্তিশালী গদ্য-ধাৰা হিচাপে গঢ়ি তুলিছে।

বীজ শব্দ : হোমেন বৰগোহাঞি, ভাষা, গদ্য, শব্দ, বাক্য, পিতা-পুত্ৰ, অন্তৰ্ভাগ, হালধীয়া চৰায়ে বাওধান খায়, মৎস্যগন্ধা, সুবালা, গদ্যবীতি।

### অৱতৰণিকা :

ভাষাৰ সমৃদ্ধতাই সাহিত্যক কালজয়ী কৰে। ভাষাৰ সাৱলীলতাই পাঠকক মোহাচ্ছন্ন কৰি ৰাখে। শব্দৰ নিৰ্বাচন আৰু তাৰ প্ৰয়োগত, বাক্যৰ গঠন আৰু তাৰ প্ৰয়োগত একোজন লেখকৰ ভাষাৰ মনোহাৰিত্ব বঢ়াই তোলে আৰু ভাষাক স্বকীয়তা প্ৰদান কৰে। প্ৰতিগৰাকী লেখকে নিজৰ ভাৱবস্তুক উজ্জীৱিত কৰিব পৰাকৈ শব্দচয়ন কৰে আৰু সেই শব্দচয়নে তেওঁলোকে গঢ়ি তোলে ভাষাশৈলীৰ এক আৱেষ্টনী। বহু সময়ত এটা ভাল লেখাও শব্দচয়ন আৰু প্ৰকাশভঙ্গীৰ দুৰ্বলতাৰ বাবে পাঠকৰ মাজত জনপ্ৰিয়তা লাভ কৰিব নোৱাৰিব পাৰে। হোমেন বৰগোহাঞি অসমীয়া সাহিত্যৰ এগৰাকী প্ৰতিষ্ঠিত কথাশিল্পী। তেওঁৰ সাহিত্য ক্ষেত্ৰখন ব্যাপক আৰু বৰ্ণাঢ্য। ইয়াত হোমেন বৰগোহাঞিৰ উপন্যাস, চুটিগল্প, প্ৰবন্ধ আৰু আত্ম-জীৱনীৰ আঁত ধৰি তেওঁৰ গদ্যবীতিৰ বিশ্লেষণ দাঙি ধৰাৰ প্ৰয়াস কৰা হ'ব।

অধ্যয়নৰ পদ্ধতি : বিশ্লেষণাত্মক পদ্ধতিৰ সহায়ত আলোচ্য বিষয়টো প্ৰণালীবদ্ধভাৱে দাঙি ধৰা হ'ব।

অধ্যয়নৰ লক্ষ্য আৰু উদ্দেশ্য : হোমেন বৰগোহাঞি অসমীয়া সাহিত্যৰ এগৰাকী প্ৰতিষ্ঠিত সাহিত্যিক। তেওঁৰ গদ্য সাহিত্যৰ ভাষাই পাঠকক এক সুকীয়া আমেজ দিয়ে। তেওঁৰ গদ্যবীতিৰ সুকীয়া বিশেষত্বই পাঠকক আকৃষ্ট কৰি আহিছে। তেওঁৰ গদ্যবীতিৰ সামগ্ৰিক দিশটো বিশ্লেষণ কৰাটোৱেই এই অধ্যয়নৰ মূল লক্ষ্য আৰু উদ্দেশ্য।

### অধ্যয়নৰ পৰিসৰ :

হোমেন বৰগোহাঞিৰ ভাষাবীতি অৰ্থাৎ গদ্যবীতি সম্পৰ্কে এই গৱেষণা পত্ৰত আলোচনা কৰা হ'ব। বৰগোহাঞিৰ সাহিত্যৰ ক্ষেত্ৰখন বৰ বিশাল। এই বিশাল ক্ষেত্ৰখনৰ সকলো সাহিত্য সামৰি নলৈ কেৱল গদ্য সাহিত্যৰাজিৰ ভাষাৰ আধাৰত তেওঁৰ গদ্যবীতিৰ এক প্ৰণালীবদ্ধ আলোচনা ইয়াত দাঙি ধৰা হ'ব।

## ভূপেন হাজৰিকাৰ গীতত সামাজিক চেতনা আৰু দায়বদ্ধতা



ড° পল্লবিকা শৰ্মা

সংক্ষিপ্ত সাৰ :

ভূপেন হাজৰিকা এনে এগৰাকী সৃষ্টিশীল কলাকাৰ; যাৰ সৃষ্টিৰ মাজেৰে নিৰবিচ্ছিন্নভাৱে প্ৰবাহিত হৈ আছিল নতুন সমাজ গঢ়াৰ সপোন। সকলোৰে মাজত সমতা স্থাপন কৰি সাম্য-মৈত্ৰীৰে পৰিপূৰ্ণ এক নতুন আদৰ্শবাদী তথা শৃংখলাবদ্ধ সমাজ আৰু জাতিৰ স্বকীয়তা ৰক্ষা কৰি সমাজক উন্নতিৰ জখলাত আঙুৰাই নিব পৰাকৈ গীত ৰচনা কৰা ভূপেন হাজৰিকাৰ গীতৰ মূলমন্ত্ৰই যেন আছিল- সমাজৰ পৰিপুষ্টিৰণ। সেয়েহে তেওঁৰ দ্বাৰা ৰচিত অধিকাংশ গীততেই সামাজিক চেতনা অথবা দায়বদ্ধতাৰ অনুৰণন গুনিবলৈ পোৱা যায়। প্ৰস্তুত গৱেষণা পত্ৰখনৰ মাজেৰে ভূপেন হাজৰিকাৰ গীতত প্ৰকাশিত সামাজিক চেতনা আৰু দায়বদ্ধতাৰ বিষয়ে আলোচনা কৰা হ'ব। আলোচনা প্ৰসংগত তেওঁৰ গীতত প্ৰকাশ পোৱা ঐতিহ্যপ্ৰীতি, বৈপ্লৱিক চিন্তা, মানৱতাবাদ, জাতীয়-প্ৰীতি, লোক-সাংস্কৃতিক চিন্তা, প্ৰেমমূলক ভাৱনা আদিয়ে কিদৰে সামাজিক চেতনা অথবা দায়বদ্ধতাৰ পৰিচায়ক হৈ পৰিছে সেই বিষয়ে আলোচনা দাঙি ধৰা হ'ব। তেওঁৰ গীতৰ ভাষাই এই দায়বদ্ধতাৰ পৰিপুষ্টিৰণত কেনেদৰে সহায় কৰিছে সেই বিষয়েও গৱেষণা পত্ৰখনত আলোচনা দাঙি ধৰা হ'ব। 'ভূপেন হাজৰিকাৰ গীতত সামাজিক চেতনা আৰু দায়বদ্ধতা'- শীৰ্ষক বিষয়ৰ বিশ্লেষণে ভূপেন হাজৰিকাৰ গীতৰ আলোচনাৰ ক্ষেত্ৰত এক নতুন দিশৰ উন্মোচন ঘটাব বুলি আশা প্ৰকাশ কৰিয়েই এই গৱেষণা পত্ৰখন যুগুত কৰি উলিওৱা হৈছে। গৱেষণা পত্ৰখন প্ৰস্তুতকৰণৰ ক্ষেত্ৰত বিশ্লেষণাত্মক পদ্ধতিৰ অবলম্বন কৰা হৈছে।

সূচক শব্দ : ভূপেন হাজৰিকা, গীত, সামাজিক চেতনা, দায়বদ্ধতা, অসম।

০.০ প্ৰস্তাৱনা :

জীৱন্ত কালতেই কিংবদন্তি আখ্যা পোৱা সুৰসভাট ভূপেন হাজৰিকা অকল গীতিকাৰ অথবা সুৰকাৰেই নহয়; অসমীয়া সাহিত্য-সংস্কৃতি জগতৰেই এজন পুৰোধা ব্যক্তি। প্ৰায় চাৰিশ গীতেৰে সুৰৰ ঝংকাৰ তুলি সকলোৰে মন পুলকিত কৰি তোলা ভূপেন হাজৰিকাৰ গীতবোৰ যেন প্ৰকৃতাৰ্থতেই 'অনিৰ্বচনীয় সৃষ্টিলীলা'। তেওঁৰ গীতৰ মাজেৰে ধ্বনিত হৈছিল- অসমৰ

সহকাৰী অধ্যাপক

অসমীয়া বিভাগ

দৰং মহাবিদ্যালয়

ম'বাইল : ৯৮৬৪৬০৬২৮৫

ই-মেইল : pallabikasarmah@gmail.com

## বিহুগীতত প্ৰাপ্ত ঐতিহাসিক সমল



ড° পল্লৱিকা শৰ্মা

### প্ৰস্তাৱনা :

মানৱ জীৱনৰ ক্ৰমবিকাশৰ লগত অঙ্গাগীভাৱে জড়িত হৈ আছে কৰ্বণকেন্দ্ৰিক বিশ্বাস। আদিম কালত মানুহে জৈৱিক ক্ষুধা নিবাৰণৰ অৰ্থে নানাধৰণৰ সংগ্ৰামত লিপ্ত হোৱাৰ কথা ইতিহাসে আমাক জানিবলৈ দিয়ে। গছৰ বন্ধল পৰিধান, বনৰীয়া জীৱ-জন্তুৰ চিকাৰ, কেঁচা মঙহ ভক্ষণ, পৰ্বতৰ গুহা, গছৰ খোৰাং আদিত বাস কৰা আদিম মানৱে কৃষি-কৰ্ম কৰি বীজ উৎপাদন কৰালৈকে যথেষ্ট কষ্ট কৰিবলীয়া হৈছিল। খাদ্যৰ অন্বেষণ আৰু বাসস্থানৰ সন্ধানত স্থান পৰিৱৰ্তন কৰা মানুহে পৰৱৰ্তী সময়ত একত্ৰিত হৈ বসবাস কৰিবলৈ ল'লে, এনেকৈয়ে সমাজ সংগঠন হ'ল। সংগঠিত সমাজত বসবাস কৰা মানুহে কালক্ৰমত মানসিক উত্তৰণৰ বাবে ন ন প্ৰচেষ্টা চলাবলৈ ধৰিলে। “স্ত্ৰী-পুৰুষ নৃত্য-গীত আৰু আনুষ্ঠানিক মিলন পৃথিৱীৰ উৰ্বৰা শক্তি বঢ়াবৰ এক প্ৰাচীন ব্যৱস্থা।” এনেকৈয়ে উৰ্বৰতা বৃদ্ধিৰ উদ্দেশ্যেই কৃষিকেন্দ্ৰিক উৎসৱ-অনুষ্ঠানৰ জন্ম। কৃষিকেন্দ্ৰিক উৎসৱ-অনুষ্ঠানৰূপে পৰিচিত বিহু উদ্‌যাপন কৰাৰ আঁৰতো এনে এক ভাবনাই জড়িত হৈ আছে। বিহু অসমৰ বসন্তকালীন উৎসৱ। ভাৰতবৰ্ষৰ আন প্ৰান্তৰ লগতে উত্তৰ-পূৰ্বাঞ্চলতো বসন্তকালীন উৎসৱ নানা জাতি-জনগোষ্ঠীসমূহে পালন কৰে। মৌচুমী বায়ুৰ গতি পৰিৱৰ্তনৰ সৈতে বিহু পালনৰ এক বিশেষ সম্পৰ্ক আছে। ঋতু পৰিৱৰ্তনে প্ৰকৃতিতৈ আনি দিয়া বিচিত্ৰ প্ৰভাৱৰ সৈতে সহায়স্থান কৰিবলৈ আৰু উৰ্বৰতাকেন্দ্ৰিক লোকবিশ্বাসৰ বাবে বিহু উৎসৱৰ সূচনা হ'ল।

অসমীয়া লোকসাহিত্যৰ এক অন্যতম অংগ হৈছে বিহুগীত। অসমৰ শ্ৰমজীৱী জনগণৰ ইচ্ছা-আকাংক্ষা, হৰ্ষ-বিষাদ আদি বিচিত্ৰ ভাৱ-অনুভূতিৰ প্ৰকাশ ঘটিছে বিহুগীতৰ মাজেৰে। লোকজীৱনৰ শ্ৰম-হেঁপাহ আৰু জীৱিকাৰ মাজত অন্তৰ্নিহিত হৈ থকা আনন্দ-বেদনাৰ সজীৱ চিত্ৰ বিহুগীতৰ মাজেৰে প্ৰতিফলিত হৈ উঠিছে। বিহুগীতসমূহ ঘাইকৈ বঙালী বিহুৰ সময়ত নৃত্য পৰিৱেশনৰ কালত গোৱা হয়। বিহুগীত কেতিয়াৰ পৰা পৰিৱেশন কৰা হৈছিল সেই বিষয়ে সঠিক তথ্য পোৱা নাযায়। বিহুগীতক বিহুনাৰ, বনগীত, বনঘোষা আদি নামেৰেও জনা যায়। অসমৰ জনজীৱনৰ বিচিত্ৰ চিত্ৰ বিহুগীতৰ মাজেৰে প্ৰকাশি উঠা দেখিবলৈ পোৱা যায়।

সহকাৰী অধ্যাপিকা  
অসমীয়া বিভাগ  
দৰং মহাবিদ্যালয়, তেজপুৰ (অসম)  
ম'বাইল : ৯৮৬৪৬-০৬২৮৫



## Traditional Belief of Moran Tribe

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### Abstract

Moran is a very important community along with many other communities living in Assam since the ancient time. The evidence of Moran people can be traced back to the time when Ahom came to Assam. Moran society which is endowed with rich culture is seen preserving their culture through numerous traditional beliefs and are very conscious of preserving it. They are trying to protect it by preserving it as it is. But with the rapid change of time flexibility can be witness in the safeguard of their tradition. Through this research paper the traditional belief of the Moran tribe will be discussed. This research paper Traditional Belief of Moran Tribe has been prepared with a hope that it will add a new dimension in the field of research about the great Moran tribe and for this purpose descriptive method has been adopted.

### 0.0 Introduction:

Culture is diversified. It has a very wide scope. Culture is an integral part of human society. Social rules and regulations, oral form of literature, beliefs, manners, religious, non-religious faith etc. can be considered as folklore. Folklore can be classified in many parts. Generally folklore can be classified in four parts, these are *folk-literature, social folk custom, material culture and folk performing arts*. Social folk custom can be considered as one of the most important among all these.

Moran society has been following numerous folk beliefs since the ancient time. These are traditionally acquired belief. Different types of manners, rules and regulations etc. are followed by the people in Moran society. They are influenced by these beliefs, manners, traditional rules and regulations, festivals, recreation, folk medicine, folk religion which represents their society.

### 1.00 The Aim, Scope and Methodology of the research paper:

We can witness many tribal belief in the society of Moran tribe who are

living in Assam since the ancient time. Through this paper we can point their traditional living system, living in the backward areas, agricultural based society, own language, socio- economic and political backwardness. With the rapid change of time these social structures are of course taking a new shape. They are seen preserving their traditional beliefs through rules and regulations and through numerous norms followed by them and they are very conscious of it. Through this research paper the traditional belief of the Moran tribe will be discussed. This paper has been prepared with a hope that it will add a new dimension in the field of research about the great Moran tribe and for this purpose descriptive method has been adopted.

### 2.00

Among many others tribes of Assam, Moran is regarded as one of the noted tribe who have been living in Assam since ancient times. Moran's are living in Assam Since the arrival of Ahom in the Brahmaputra valley. They are called the 'Habungiya' or 'son of the soil' and were



# **The Roles, Importance and position of Female Gender in Assamese Society: analysis through the Assamese Proverbs**

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## **Abstract:**

ABSTRACT : The tradition which is transmitted orally is known as Folk Literature or Oral Literature. This tradition is transmitted orally basing on the collective memory of their elders. In the ancient Assam Oral Literature has been playing an important role in traditional Assamese society. The folk literature reflects the day to day life, the joys and sorrows of the common people. Assamese oral literature is very resourceful both in quantity and variety. The wealth of the oral literature of Assam is most impressive. Oral literature is mainly produce by the folk society. In fact, oral literature flourished and transmitted from one generation to other by word of mouth. It contains songs, tales, ballads, proverbs, sayings, riddles, folk speech etc. In this research paper an analysis is attempted about the oral literature of Assam and its various sub categories. In the present research paper we try to observe the characteristics of oral literature.

## **Keywords:**

Oral literature, folk songs, ballads, tales, proverbs, riddles etc.

## **INTRODUCTION:**

Assam is very rich in Oral literature. Oral literature is the primary sector for study to folklorematerials. Oral literature is also called „folk literature“ or „Verbal art“. W.R Bascom introduced the term „Verbal art“ first time and the term clearly point out the distinction of relations existing among myth, legend, folksongs, tales and folk speech etc. Sometimes a term “Expressive Literature is also used. Besides these terms there are other various designation which precisely help in understanding this particular type of folklore material. The term oral literature became popular only after R.M. Dorson used. The oral literature is transmitted orally basing on the collective memory from one generation to another generation. Assamese folk literature is very resourceful. Assam is in true sense, a meeting point of many communities, faiths and cultures. This state has always been the hub of cultural diversity owing to multiple ethnic and non-ethnic communities living herein. Therefore, the oral literature of Assam is very rich.

## **Aim of Study :**

This research paper aims to analysis the status of women in society by application of gender perspective as an analytical lens to the Assamese proverbs. In present time for the feminism revolutions some proverbs which are related to women domestic violence are not

used. And today's society is much more different from folk society. The research paper also

- ড° মোঃ মোবশেদুজ্জামান / ২৫
- (৫) ভূপেন হাজৰিকাৰ গীতত সমকালীন অসমৰ অস্থিৰ ৰাজনৈতিক অৱস্থাৰ চিত্ৰণ আৰু তেওঁৰ বৈপ্লৱিক মতাদৰ্শ  
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- (৯) 'ৰামধেনু'ৰ সম্পাদকীয় প্ৰবন্ধত প্ৰকাশিত চিন্তা-চেতনা  
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Dogo Rangsang Research Journal  
(A Bilingual Research Journal  
Indexed in UGC-CARE List)



ISSN : 2347-7180  
Vol. IX, Issue XV, January, 2022

## 'ৰামধেনু'ৰ সম্পাদকীয় প্ৰবন্ধত প্ৰকাশিত চিন্তা-চেতনা

● ড° গকুল কুমাৰ দাস  
সহকাৰী অধ্যাপক, অসমীয়া বিভাগ, দৰং মহাবিদ্যালয়, তেজপুৰ।  
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সংক্ষিপ্তস্বৰূপত উল্লেখ শতাব্দীত প্ৰাণ পাই উঠা অসমীয়া আলোচনীৰ ধাৰাটোৱে ডেবশ বছৰীয়া পৰিক্ৰমা অতিক্ৰম কৰি আজিৰ অৱস্থা লাভ কৰিছে। ধাৰাটোৱে এই সৌষ্ঠৱশালী ৰূপ লাভ কৰাত সময়ে সময়ে বিভিন্ন পত্ৰিক-আলোচনীয়ে অবিহনা যোগাই আহিছে। এই ক্ষেত্ৰত বিশেষভাৱে নাম ল'ব লাগিব বাঁহী, উষা, জয়ন্তী, আৰাহন, ৰামধেনু, প্ৰকাশ, গৰীয়সী আদি। অসমীয়া আলোচনীৰ শক্তিশালী ধাৰাটোক যামুচি ধৰি বখাৰ শুকত্বপূৰ্ণ ভূমিকা পালন কৰি আহিছে সংশ্লিষ্ট আলোচনীসমূহৰ সম্পাদকসকলে। এই সম্পাদকসকলে আলোচনীসমূহৰ সম্পাদকীয় প্ৰবন্ধৰ জৰিয়তে নিজস্ব ধ্যান-ধাৰণা, চিন্তা-চেতনাকো ব্যক্ত কৰাৰ প্ৰয়াস কৰিছে। স্বাভাৱিক কালত প্ৰকাশিত এখন আগশাৰীৰ আলোচনী 'ৰামধেনু'ৰ সম্পাদকীয় প্ৰবন্ধত প্ৰতিফলিত সম্পাদকৰ চিন্তা-চেতনাক এই অধ্যয়নৰ জৰিয়তে তুলি ধৰাৰ প্ৰয়াস কৰা হ'ব।

বীজ শব্দ : ৰামধেনু, সম্পাদকীয় প্ৰবন্ধ, চিন্তা-চেতনা।

### ০.০ অবতৰণিকা :

বিসমূহ আলোচনীয়ে অসমীয়া সাহিত্যত একোটা যুগৰ সৃষ্টি কৰিবলৈ সক্ষম হৈছিল সেইসমূহৰ ভিতৰত 'ৰামধেনু'ও আছিল অন্যতম। আধুনিক অসমীয়া সাহিত্যক প্ৰায় দুটা দশকজুৰি আৱৰি ৰখা আগশাৰীৰ আলোচনী হ'ল 'ৰামধেনু'। 'ৰামধেনু' জন্ম হৈছিল ইন্দ্ৰকমল বেজবৰুৱাৰ উদ্যোগত আৰু বিৰিকি কুমাৰ বৰুৱা-মহেশ্বৰ নেওগৰ সম্পাদনাত প্ৰকাশিত শিশু আলোচনী 'বংঘৰ'ৰ গৰ্ভত।<sup>১</sup> স্বাধীনতাৰ পৰৱৰ্তী সময়ত 'জয়ন্তী' আলোচনীৰ প্ৰভাৱ কমি অহাত এখন মননশীল আলোচনীৰ অভাৱ অনুভূত হয় আৰু এই অভাৱ পৰিপূৰ্ণ কৰি তোলাৰ বাবেই শিশু আলোচনী 'বংঘৰ'ৰ ঠাইত 'ৰামধেনু' নামেৰে এখন মাহেকীয়া আলোচনী উলিওৱাৰ সিদ্ধান্ত গ্ৰহণ কৰা হ'ল।<sup>২</sup> এই সিদ্ধান্ত অনুযায়ী ১৮৭২ শকৰ বহাগ মাহ (১৯৫০ চনৰ এপ্ৰিল)ৰ পৰা ইন্দ্ৰকমল বেজবৰুৱাৰ সম্পাদনাত 'ৰামধেনু'ৰ প্ৰকাশ আৰম্ভ হয়। তেওঁ মাত্ৰ পাঁচটা সংখ্যাতেই সম্পাদনা কৰে আৰু আহিন মাহত সম্পাদনাৰ দায়িত্ব প্ৰদান কৰা হয় মহেশ্বৰ নেওগক। নেওগেও প্ৰায় এবছৰকাল (১৯৭২ শকৰ আহিন মাহৰ পৰা ১৮৭৩ শকৰ আহিনলৈ) সুচাৰুৰূপে আলোচনীখন সম্পাদনা কৰে।<sup>৩</sup> মহেশ্বৰ নেওগৰ পিছত ১৮৭৩ শকৰ কাতি মাহৰ পৰা ১৮৭৩ শকৰে চ'ত মাহলৈ কীৰ্তিনাথ হাজৰিকাই 'ৰামধেনু'ৰ সম্পাদক পদ গ্ৰহণ কৰে। হাজৰিকাৰ পিছত 'ৰামধেনু'ৰ সম্পাদক হয় বীৰেন্দ্ৰ কুমাৰ ভট্টাচাৰ্য আৰু তেওঁ ১৮৭৪ শকৰ বহাগৰ পৰা ১৮৮৫ শকৰ বহাগলৈ সূদীৰ্ঘকাল আলোচনীখন সম্পাদনা কৰে। এই সময়ছোৱাতে ৰামধেনুৰে এক যুগপ্ৰস্তু আলোচনীৰ ৰূপ লাভ কৰিবলৈ সক্ষম হয়।<sup>৪</sup> ভট্টাচাৰ্যই 'ৰামধেনু'ৰ সম্পাদনা মেজ ত্যাগ কৰে ১৮৭৪ শকৰ ব'হাগত আৰু সেইসময়ৰ পৰা বামিকামোহন ভাগৱতী আলোচনীখনৰ সম্পাদক হয়। ১৯৬৭ খৃষ্টাব্দৰ এপ্ৰিল মাহত আলোচনীখনৰ প্ৰকাশক ইন্দ্ৰকমল বেজবৰুৱাৰ মৃত্যু হয়। প্ৰকাশকৰ মৃত্যুৰে 'ৰামধেনু'ৰ গতি ৰুদ্ধ কৰে আৰু

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হঠাৎ 'ৰামধেনু' বন্ধ হৈ পৰে। অবশ্যে পিছত বামিকামোহন ভাগৱতীৰ সম্পাদনাত ই ১৯৭৯ খৃষ্টাব্দৰ পৰা ১৯৮৩ খৃষ্টাব্দলৈ 'ৰামধেনু' পুনৰ প্ৰকাশিত হয়।<sup>৫</sup> এই পুনৰ প্ৰকাশকালত আলোচনীখনৰ প্ৰকাশক আৰু সহায়িকাৰী আছিল নীলকমল বেজবৰুৱা। পিছে এইবাৰো আলোচনীখনে দীৰ্ঘ আয়ুস লাভ নকৰিলে। বিশ শতিকাৰ শেষৰটো দশকত ১৯৯৫ খৃষ্টাব্দৰ জানুৱাৰী মাহত নীলকমল বেজবৰুৱাৰে সম্পাদনাত 'ৰামধেনু' আকৌ এবাৰ প্ৰকাশ হৈ ওলায় আৰু ১৯৯৬ খৃষ্টাব্দৰ আগষ্ট মাহলৈকে ওলাই আকৌ এবাৰ বন্ধ হৈ যায়।

### ০.১ অধ্যয়নৰ লক্ষ্য আৰু উদ্দেশ্য :

অসমীয়া আলোচনীৰ ধাৰাটোৱে ইতিমধ্যে ডেবশ বৰ্ষ অতিক্ৰম কৰিছে। এই ডেবশৰো অধিক বছৰ কটাবলৈ সম্পাদকীয়

- ড° গকুল কুমাৰ দাস / ১৮১
- (২৬) দক্ষিণ কামৰূপৰ পাতিৰাভাসকলৰ লোকখাদ্য
- মিডিয়া বাণী বাভা / ১৮৮
- (২৭) ভূপেন হাজৰিকাৰ গীত শ্ৰেণী-সংগ্ৰামৰ ছবি
- ড° দীপামণি বৰুৱা দাস / ১৯৪

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(A Bilingual Research Journal  
Indexed in UGC-CARE List)



ISSN : 2347-7180

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## উমাকান্ত শৰ্মাৰ 'এজাক মানুহ এখন অবণ্য'ত চাহ শ্ৰমিকৰ জীৱন আৰু সংগ্ৰামৰ চিত্ৰ

● ড° গকুল কুমাৰ দাস

সহকাৰী অধ্যাপক, অসমীয়া বিভাগ, দৰং মহাবিদ্যালয়, তেজপুৰ।  
e-mail: gakuldas07@gmail.com, ফোন : ৯৮৬৪১-৫৭০৫৯

সংক্ষিপ্তসূচা : অসমৰ সমাজ জীৱন আৰু অৰ্থনৈতিক জীৱনৰ সৈতে চাহ-শিল্পৰ এক ওতহপোত সম্পৰ্ক আছে। ঊনবিংশ শতাব্দীৰ প্ৰথম ভাগতে অসমত পৰীক্ষামূলকভাৱে চাহ বাগিচা খোলা হৈছিল আৰু সেই বাগিচা আজি অসমৰ ভিতৰতে এক বৃহৎ উদ্যোগত পৰিণত হৈছে। চাহৰ উৎপাদন আৰু কৃষি কৰ্মৰ লগত পোন প্ৰথমে অসমৰ থলুৱা শ্ৰমিকক নিযুক্ত কৰা হৈছিল যদিও ঊনবিংশ শতাব্দীৰ প্ৰায় মধ্যভাগৰ পৰা থলুৱা শ্ৰমিকৰ দ্বাৰা কাম কৰোৱা পৰম্পৰা বন্ধ হৈ পৰিল আৰু তাৰ সলনি ইষ্ট ইণ্ডিয়া কোম্পানীৰ চৰকাৰে পশ্চিমবংগ, বিহাৰ আদি ৰাজ্যৰ পৰা শ্ৰমিক আমদানি কৰিবলৈ ধৰিলে। এই আমদানিকৃত শ্ৰমিকসকলে পিছলৈ ক্ৰমশঃ অসমৰ মাটিত জীণ গ'ল আৰু অসমৰ সমাজ জীৱনৰ অংগ হৈ পৰিল। পৰৱৰ্তী সময়ত চাহ শ্ৰমিকসকলৰ জীৱন সংগ্ৰামক কেন্দ্ৰ কৰি অসমীয়া ভাষাত ৰচিত হ'ল ভালমান গল্প আৰু উপন্যাস। তেনে এখন উপন্যাস হ'ল উমাকান্ত শৰ্মাৰ 'এজাক মানুহ এখন অবণ্য'। এই উপন্যাসত প্ৰতিফলিত আমদানিকৃত চাহ শ্ৰমিক শ্ৰেণীৰ জীৱন সংগ্ৰাম আৰু তাৰ লগত সম্পৰ্কিত অন্যান্য দিশসমূহক এই অধ্যয়নৰ জৰিয়তে দাঙি ধৰাৰ প্ৰয়াস কৰা হ'ব।

বীজ শব্দ : চাহ শিল্প, চাহ শ্ৰমিক, জীৱন, সংগ্ৰাম।

### ০.০ অবতৰণিকা :

অসমৰ সমাজ আৰু অৰ্থনীতিৰ লগত ব্যাপকভাৱে সম্পৰ্কিত এক বিষয় হৈছে চাহশিল্প। অসমত চাহগছৰ আৱিৰ্ভাৱৰ সদৰ্ভত মতানৈক্য থাকিলেও এই কথা নিশ্চিত কৰা হৈছে যে— ১৮৩৫ চনতেই অসমৰ লখিমপুৰ জিলাত পৰীক্ষামূলকভাৱে চাহ বাগিচা খোলা হৈছিল। সেই সময়ৰপৰা ১৮৫২ চনলৈ পৰীক্ষামূলকভাৱে কেইবাখনো চাহবাগিচা খোলা হৈছিল যদিও সিবিলাকে ব্যৱসায়িক সফলতা লাভ কৰিব পৰা নাছিল। প্ৰকৃতভাৱত চাহশিল্পই ব্যৱসায়িকভাৱে সফলতা লাভ কৰিবলৈ আৰম্ভ কৰে ১৮৫২ চনৰ পিছৰপৰাহে। যেতিয়াই চাহশিল্পটো ব্যৱসায়িকভাৱে সফল হ'বলৈ ধৰিলে তেতিয়াই অসমত সংগঠিতভাৱে চাহ শ্ৰমিকৰ প্ৰয়োজনীয়তা আহি পৰে। ঊনবিংশ শতাব্দীৰ প্ৰথম ভাগৰ চাহ শ্ৰমিকৰ ইতিহাস অধ্যয়ন কৰিলে দেখা যাব যে ১৯৫২ চনৰ আগলৈকে অসমত গাৰো-মিকিৰ, লাৰুং, কছাৰী, ফুকি (মিজো), বঙালী, ত্ৰিপুৰী, খাচী আৰু বৰ্ণহিন্দু অসমীয়া সম্প্ৰদায়ৰ লোকে চাহ বাগিচাসমূহত মজুৰিৰ বিনিময়ত শ্ৰমিক হিচাপে কাম কৰিছিল। কিন্তু প্ৰাপ্ত তথা অনুযায়ী এইসকল লোকে বাগিচাত স্থায়ীভাৱে কাম কৰিবলৈ ইচ্ছা প্ৰকাশ কৰা নাছিল।<sup>১</sup> থলুৱা শ্ৰমিকৰ এনেধৰণৰ মানসিকতাৰ বাবে অসমৰ চাহ বাগিচাসমূহত তীব্ৰ শ্ৰমিক সংকট সৃষ্টি হৈছিল। তাৰ পৰিপ্ৰেক্ষিততেই চাহ বাগিচাৰ মালিকসকলে বহিঃৰাজ্যৰপৰা ব্যাপক হাৰত শ্ৰমিক আমদানিৰ পৰিকল্পনা হাতত লয়। ১৮৬৩ চনৰ পৰা এক আইন প্ৰস্তত কৰি সেই আইনৰ জৰিয়তে বাগিচাৰ মালিকসকলে ইষ্ট ইণ্ডিয়া

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কোম্পানীৰ চৰকাৰৰপৰা শ্ৰমিক আমদানিৰ বাবে অনুমতি লাভ কৰে।<sup>২</sup> তেতিয়াবেপৰাই স্বাধীনতাৰ প্ৰাক্‌কালীন সময়লৈকে পশ্চিমবংগ, বিহাৰ আদি ৰাজ্যৰপৰা ব্যাপক হাৰত অসমলৈ শ্ৰমিকৰ প্ৰব্ৰজন ঘটে। ভিন্ন প্ৰসংগত শ্ৰমিকৰ প্ৰব্ৰজনৰ পৰিসংখ্যা অমলেন্দু গুহই দাঙি ধৰিছে।<sup>৩</sup>

### ০.১ অধ্যয়নৰ লক্ষ্য আৰু উদ্দেশ্য :

অসমত চাহ-শ্ৰমিকৰ সংগ্ৰামৰ জীৱন পৰিক্ৰমাই ইতিমধ্যে ডেবশ বছৰ অতিক্ৰম কৰিছে। এই ডেবশ বছৰো অধিক কালৰ ভিতৰতে চাহ জনগোষ্ঠীয়ে তেওঁলোকৰ পূৰ্বপুৰুষৰ ভূমি পশ্চিমবংগ, বিহাৰ আদিৰ লগত সম্পূৰ্ণৰূপে সম্পৰ্ক হেৰুৱাইছে আৰু হাড়ে-হিমজুৰে অসমৰ মাটি-পানীৰ লগত বিলীন হৈ গৈছে। ভাবতৰ বিভিন্ন ঠাইৰ পৰা দলে দলে আহি আহি কাম কৰা কাম কৰিছিল অসমীয়া শ্ৰমিকসকলে। কিন্তু সেইসকলৰ পৰিপূৰণৰ ভূমিৰ সৈতে

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## Migration of Tea Tribe Community in Assam as Reflected in Assamese Novel

—Dr. Gakul Kumar Das

*The novel centres on protagonist Banha and his family. Banha belongs to the first generation of workers who had come from central India to work in the tea gardens of Assam. People belonging to very poor class of central India were brought to Assam under the patronage of tea garden owners and East India Company. They dreamt of a peaceful life in Assam which was free from Zamindari system. They even gave up their ancestral land, relationship with forefathers as well as their own people. Like Banha, the journeys of Bholu, Ramu, Gajananetc to Assam were harrowing. They were lured by the agents of tea garden owners and 'Sardars'. The journeys were tiresome. The train journeys of these labourers to Assam were beyond description.*

One of the biggest industries in Assam in the Eastern Part of India is the tea industry and it is closely associated with the society and culture of Assam. There are different opinions on the origin of tea plants in Assam, it has been established that the first tea garden in the state started in 1835. Till 1851, as part of the experiments, several tea gardens were set up, but none of these could face commercial gains. As soon as the tea industry started to get some profits, the need for the tea labourers emerged. Studies find that till 1852, the people from the local tribes were associated with the tea plantation. The reluctance of the local workers caused a crisis for the garden authorities. Therefore, they planned to bring tea labourers from outside the state. The history and struggle of the migration of the tea tribe community is reflected well in Assamese Novels.

**Key Words:** Tea Tribe, Migration, Struggle

The tea industry is closely associated with the society and culture of Assam. Though there are different opinions on the origin of tea plants in Assam, it has been established that the first tea garden in the state started in Lakhimpur district in 1835. Till 1852, as part of the experiments, several tea gardens were set up, but none of these could face commercial gains. As soon as the tea industry started to get some profits, the need for the tea labourers emerged. Studies find that till 1852, the people from the tribes like Garo-Mikar, Lalung, Kachari, Kuki (Mizo), Bengali, Tripuri, Khasi and upper class Hindus worked in the tea gardens as daily wage earners. But they didn't want to work permanently in the gardens. (Saha)

The reluctance of the local workers caused a crisis for the garden authorities. Therefore, they planned to bring tea labourers from outside the state. An act of the British government in 1863 allowed the estate owners to hire workers from different states. (Physical and Political Geography of the Province of Assam, 1892)

From this point of time till the independence, a large number of tea labourers migrated to Assam from states like West Bengal, Bihar. Amalendu Guha cited the statistics of the migration of labourers on various contexts. (Guha)

The migration of tea labourers to Assam and their assimilation with the local cities was instrumental in the development of greater Assamese society and culture. The life and struggle of tea garden workers are always difficult. The novel titled "Ejak Manuh Aaru Ekhan Aranya" describes the stories of migration struggles of these working class people.

It is pertinent to note a comment made by Guha (1964) that

**TRADITION AND TRANSFORMATION: ON THE BASIS OF CELEBRATED FESTIVALS IN GUWAHATI\***

BY

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**Abstract:**

A festival means delight, being gained and an artistic creation. It is an absolute element of folk-culture. The agriculturist celebrates the behavior, manners and customs of the society timely. Festivals are ceremonies celebrated in accordance with certain rules and regulations at a particular time. People organize festivals to celebrate the value of their hard work in the field. This festival takes people away from the flow of normal life and feels them to rejoice for a while. Every festival has a intimate relationship with the transformation of natural elements. In this reference, the following remark has given by Lila Gogoi is seriously considerable---

Utsaḥ mul utsa ananda. Bāhagḥ powar prāyax, asar ananda, maghḥ powar, pai xamḥrar ananda. Ei ananda prākḥritir ananda, ziwānōk upāśbdhi kōrar ananda. Ei anandi krisiziwi āxōmiyar ōntōar spāxā kōri ōnuprēōnar zōwar ane. (p.72)

Festivals that are celebrated for various reasons provide not only pleasure, but it also entertains people. It is an excellent procedure to entertain in relaxation time---the way many people work together for pleasure. Festivals teach people how to behave socially. It is a part of people's social life since very old times. The festivals celebrated at different times are closely associated with the human life, their existence, activities, culture etc. Culture is meta-morphed. Traditionally celebrated festivals that preceded a wide field of culture change with the passage of time.

Keywords: Tradition, Transformation, Festival celebrated in Guwahati.

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Received 11 Mar 2022, Accepted 10 Apr 2022, Published 30 Apr 2022

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**Main Theme:**

Tradition and its changes are complementing each other. Change is seen because tradition is prevalent and this tradition is created by human beings. People are again slaves to their own tastes. People's taste changes from time to time. So its transformation is a spontaneous process periodically. Assam is a confluence of various caste or tribes from old times. The customs, manners, etc, of different ethnic groups have created a tradition whose birth is unknown. But tradition is not always the same. The changing scenario of tradition is very clear in the Guwahati city which is located in the state of Assam.



**SABHA MAHOTSAB (FESTIVAL) CELEBRATED AT VARIOUS PLACES IN LOWER ASSAM  
(INCLUDING THE SPECIAL REFERENCE OF SARTHEBARI SABHA MAHOTSAB)**

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**Dr. Dibya Jyoti Sarma**

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**Diganta Das**

Research Scholar, Gauhati University

**Abstract :**

Festival ceremonies are the national host of a nation. It is a major division of social folk customs under folk culture. A Social folk custom is born when most of people in the society join in public celebrations and fun. The both festival and event term are generally applied to insinuate this folk practiced custom. Festival ceremonies are the spirit of a nation. Which highlight the unique characteristics of a nation, It also plays a major role to building the cultural unity. Sabha Mahotsab is a notable folk festival held at various places in Lower Assam specially in Nalbari, Barpeta and Kamrup districts. These Sabha have been going on since ancient times and made a special contribution to the mutual understanding, harmony and exchange the social functioning of the people of the respective places. Sabha Mahotsab have been celebrated in Barpeta district specially at Sarthebari, Chinadi, Kanimara, Chenga, Amrikhowa, Byashkuchi Villages, in Nalbari district specially at Makhibaha, Haribhanga, *Gandhaiya*, Chamata, Pipalibari, Paikan Dirua, Kothalmura, Jagara, Balisatra, Mugdi Villages and in Kamrup district specially at bamundi, Dorakohora, Balikuchi, Alisabha, Barpanara in Kamrup district etc.

The word 'Sabha' means Society i.e. different people of ethnic groups come together to formalize prayer of God, worship and Sacrificial alter. The Sabha Mahotsab creates not only the environment of cultural and religious programmes but also the exhibition of the commercial institution. Though the Sabha is mainly organized to lead the religious purposes but also takes the lead in strengthening Social bonds. Among the Sabha Mahotsabs of Lower Assam the 'Sarthebari Sabha Mahotsab' is unique which has been highlighting the unity of the people of the region. Our research paper provides the detail description of the Sabha Mahotsabs.

Keywords : Festival, Custom.

0.00

0.01 Introduction of Subject :

The Sabha Mahotsab creates peace and harmony in the society. The agronomist rural community has been publicly observing this Sabha Mahotsab (Festival) after harvesting. Though it is a religious festival, yet it signifies the equal importance in the cultural aspects, like the public sacrificial alter, *Bhagobot path* (religious book reading), religious procession and dance, song, acting, literature of the Sabha Mahotsab. It also created a

## **GIRLS' EDUCATION IN A MADRASA : NARRATIVES ON THE DRESS, CONDUCT AND FUTURE ASPIRATIONS**

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**ABSTRACT :** *Girls' education has always been a matter of intense debate in the South Asian subcontinent and has shaped ideas about community, nation, and anti-colonial resistance. In post-colonial discourses on education, debates about Muslim girls' education have resurfaced as a subject that calls for a methodologically nuanced and sensitive approach. In this paper, we examine varied perspectives on Muslim girls' education globally and in the South Asian context. We seek to specifically address the question of how to make sense of the educational experiences of Muslim girls in a Madrasa setting in India. The literature on girls' education in Madrasas located in India has revealed how the disciplinary measures shape girls' experiences and how they negotiate with the same. Drawing on the field materials collected from a coeducational Madrasa located in a village in Assam, we argue for an approach that is sensitive to the voice of the girls in their everyday context and that can bring out the power dynamics. In this paper, we focus on key themes that emerged from the analysis of girls' discussion of their life in Madrasa on matters of dress, popular culture, and aspirations for higher education.*

**Keywords :** *Code of conduct, Discipline, Dress, Girls' education, Madrasa, Muslim women*

## **NAGA SANNYASINS : IN SEARCH OF IDENTITY**

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**ABSTRACT :** *The history of Indian women is full of pioneers who have broken gender barriers, worked hard for their rights, and shown their leadership in politics, economics, education, science, law, literature, sports, etc. Her journey from the country's president to space is remarkable. Women are no longer considered unfit for the military or other defence forces. However, the traditional view Brahmanic texts offer 'women are innately impure' and do not have a natural inclination to dharma; therefore, women grapple with the religious placing. In encountering that conventional view, women have always found ascetic paths to answer their spiritual quests. A few years ago, Naga Sannyasin broke from tradition and formed an All-women akhara, believed to be the first in India. Their anticipation will end male domination of spiritual practices. The move will ensure sannyasins rise in the seers' hierarchy, and the subjugation of women in the akhara system run by men will end. Still, this akhara is facing criticism. Male sadhus claim the move goes against age-old customs. The present research paper discusses the legal position of the formation and recognition of All Women Akhara. Also, it focuses on the socio-cultural background of Naga Sannyasins and their struggle in the search for respect and identity.*

**Keywords :** *Akhara, Akhil Bhartiya Akhara Parishad (ABAP), Avadhootani, Female Theology, Naga, Sadhu, Sannyasin*



Research Article

## A checklist of lichens of Assam, India

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(Received: February 06, 2022; Revised: April 12, 2022; Accepted: April 13, 2022)

### ABSTRACT

Lichens not only play a major role in plant succession as pioneer species but also provide many ecosystem services. Various anthropogenic activities like habitat destruction, air pollution and over exploitation of lichens for economic uses seem to be the main threats for loss of lichen diversity. Hence, for *in situ* conservation of lichens, it is a prioritised need to document lichen species of a locality. Lichens of Assam are being extensively studied from a taxonomic point of view in recent years. An accurate and updated checklist of lichens is not available so far. Here we expand the knowledge of the lichen of Assam by critically surveyed the literatures and prepared an updated list of total 657 species of Assam.

**Key words:** Assam, biodiversity, checklist, conservation, lichenized Ascomycota, taxonomy

### INTRODUCTION

Lichens are well known as pioneer for establishing ecosystems and for many important ecosystem services they provide. Lichens are playing important role in monitoring pollution levels in developing areas. Nowadays, lichens are studied for their metabolic pathways that can sequester excess carbon as secondary compounds. The habitat loss, increasing air pollution, changes in the microclimatic conditions and uncontrolled harvest have become the major threats for loss of lichen diversity in India. Moreover, culture method of lichen proved to be uneconomical and re-introduction in to the field has been unsuccessful (Upreti and Nayaka, 2008). Hence, for conservation of lichens in the natural habitats, it is a prioritised need to document lichen species of a locality.

A good number of literatures on lichen diversity of various parts of Assam have been published but an updated and revised checklist of lichens of Assam is still lacking. This is why we critically surveyed the literatures on lichens of Assam and prepared an updated list of total 657 species of Assam. We believe that this list will be helpful to the researchers who are working in the field of Lichenology.

In Assam, Stirton (1881), a Scottish lichenologist, was the pioneer researcher who studied the lichens from tea plants and described 39 lichen species. Santesson (1952) reported a foliicolous species *Bullatina aspidota* (Vain.) Vězda & Poelt as *Gyalactidium aspidotum* (Vain.) R. Sant. and *Aulaxina antiseptata* R. Sant. from the state. Pant & Upreti (1993) reported *Diploclistes ramipodentis* (Nyl.) Zahlbr. from the state. Makhija and Patwardhan (1993) reported two species of lichens namely *Trypethelium rubrocinctum* Makhija & Patw. and *T. submitidusculum* Makhija & Patw. as new to science from the state. Divakar and Upreti (2005)

reported a good number of Parmelioid lichens from Assam. Rout *et al.* (2005) reported 24 species of lichens belonging to 12 genera and 8 families from different tree barks from NIT Campus, Silchar. Makhija and Adawadkar (2007) reported *Acanthothecis consocians* (Nyl.) Staiger & Kalb from the state. Makhija & Adawadkar (2007) recorded two species viz. *Graphis furca-ta* Fée and *G. malacodes* Nyl. from Assam which were new to India. Tewari and Upreti (2008) added *Pharygramme australiensis* Staiger to the lichen flora of India from the state. Das (2008) reported 68 species belonging to 12 genera and 11 families from Cachar district of Assam. Sharma and Makhija (2009) reported two species namely *Diorygma jangluhinii* (Mont. & Busch) Kalb, Staiger & Ellis and *D. pruinosum* (Eschwe.) Kalb, Staiger & Ellis new to Assam and India as well. Jagadeesh Ram *et al.* (2009) reported a new species *Herpothallon isidiatum* Jagad. Ram & G.P. Sinha and a new record *Herpothallon granulare* (Stipman) Aptroot & Lücking for India from the state. Rout *et al.* (2010) enumerated 55 species of lichen belonging to 15 families and 25 genera from Innerline Reserve Forest of Southern Assam. Singha (2011), during doctoral research work, reported 71 species belonging to 32 genera and 15 families growing on betel nut tree from the Cachar district. Out of the 71 species, 5 species and one genus were reported as new to India. *Phyllopsora confusa* Swinscow & Krog, *Phyllopsora isidiotyla* (Vain.) Riddle and *Phyllopsora nemoralis* Timdal & Krog were reported as new to the lichen biota of India from Assam (Mishra *et al.*, 2011). *Pissurella indica* B.O. Saharma, Khudilkar & Makhija was described as new to science by Sharma *et al.* (2012) from Assam. Rout *et al.* (2012) studied the epiphytic lichen flora occurring on betel nut palm tree growing in an abandoned tea garden area of southern part of Assam. A total of 37 lichen species belonging to 16 genera and 10 families were

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enumerated in their study. Das *et al.* (2013) reported 53 species belonging to 23 genera and 13 families from seventeen sites of Barak Valley. Daimari *et al.* (2014) studied the distribution of epiphytic lichens from three districts of Assam viz. Baksa, Kamrup and Sonitpur and enumerated 67 species belonging to 12 families and 24 genera. Of the total species, 41 lichen taxa were reported for the first time for Assam. Dey *et al.* (2015) reported 31 species belonging to 16 genera and 11 families of lichens from seven forest sites of Hojai sub-division of Nagaon district, Assam. Among the reported lichens, crustose and foliose lichens represented by 16 and 14 species respectively, while a single fruticose lichen *Ramalina hoxsei* Vain. was recorded for the first time from the area. Choudhury *et al.* (2016) reported 38 species of lichen belonging to 21 genera and 15 families from the archaeological monuments of Sonitpur district, out of which 6 species are new records for the state. Daimari *et al.* (2017) reported 25 species new to the lichen biota of Assam from Sonitpur district. These new records included 16 pyrenocarpous lichens with dominance of members from family Pyrenulaceae (11 spp.) followed by Physciaceae with five species. A total of 104 species of lichen were described by Dey (2016) from Nagaon district of Assam. Gupta and Sinha (2018) published a book in which they described a total of 300 lichen species based on own work and previous works on lichens of Assam such as Stirton (1881), Santesson (1952), Awasthi (1976), Patwardhan and Kulkarni (1977), Patwardhan and Nagarkar (1980), Nagarkar and Patwardhan (1981, 1982), Nagarkar *et al.* (1988), Makhija and Parwardhan (1993), Pant and Upreti (1993), Divakar and Upreti (2005), Rout *et al.* (2005, 2010), Awasthi (2007), Tewari and Upreti (2008), Mishra *et al.* (2011), Sharma *et al.* (2012), Das *et al.* (2013), Daimari *et al.* (2014), and Dey *et al.* (2015). Joshi *et al.* (2018) described *Ocellularia upreti* S. Joshi, Divakar, Lumbsch & Lücking as new to science from Cachar district. Gogoi *et al.* (2019) added 25 lichens to the lichen flora of Assam. Mishra *et al.* (2019) reported 98 lichens new to the lichen biota of Assam and a new record of lichen, *Mallothesia* *sp.*

Above mentioned reports suggested that after the publication of "Lichen flora of Assam" by Gupta and Sinha (2018) there are several explorations undertaken in different parts of the state and many more lichens are added to the list. These reports are scattered and there is a need for compilation of the same. The compilation resulted in a total of 657 species of lichen for the state of Assam.

### METHODOLOGY

The publications containing information about the lichens of Assam were critically investigated and used for compiling the checklist. The taxa identified only up to genus are not considered for listing. Nomenclatures of lichens were updated following index fungorum ([www.indexfungorum.org](http://www.indexfungorum.org)) and classification given by Wijayawardene *et al.* (2020) was followed to arrange the taxa within families.

### RESULTS AND DISCUSSION

A total of 657 species of lichen under 146 genera and 41 families are listed below. This list indicated that the family Graphidaceae is represented by highest number of taxa i.e. 148 species where genus *Graphis* alone counts 70 species. The family Pyrenulaceae also comprises of a large number of species (84 spp.) with *Pyrenula* representing 72 species. Synonyms of 63 species have been updated with current scientific names (Table 1).

District-wise, highest number of lichens has been enumerated from Cachar district (214 spp.) followed by Nagaon district (203 spp.), Sonitpur district (181 spp.) and Dima Hasao district (143 spp.) (Das, 2008; Singha, 2011; Mishra *et al.*, 2011, 2019; Daimari *et al.*, 2014; Dey, 2016; Gupta and Sinha, 2018; Gogoi *et al.*, 2019, 2020; Ngangom *et al.*, 2020; Behera *et al.*, 2021). Detailed study of lichen diversity in most of the district and protected areas of Assam is yet to be done.

The species are enlisted family-wise and the list follows the pattern: species name (in bold), locality and

**RESEARCH ARTICLE**

**Antimicrobial activity of Endolichenic fungi isolated from *Cryptothecia* sp. against some human test pathogens**

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**ABSTRACT:**

*Cryptothecia* sp. is a crustose lichen having varied medicinal properties. The present study aims to isolate and to determine the antimicrobial activity of endolichenic fungi from the surface sterilized lichen thallus of *Cryptothecia* sp. The isolation was done on three different media i.e., Potato Dextrose Agar (PDA), Malt Extract Agar (MEA) and Water Agar (WA) media. A total of 19 isolates of endolichenic fungi were recovered. The isolates were identified on the basis of colonial morphology and microscopic investigation. Dominant endolichenic fungus was *Monilinia* sp. (23.33%) followed by *Mycelia sterilia* (16.66%). Other fungal isolates were *Trichoderma* sp., *Penicillium* sp., *Aspergillus* sp. and *Dreschlera* sp. The fungal isolates were tested for antimicrobial activity by agar cup diffusion assay against clinically significant human pathogenic test organisms such as *Escherichia coli* (MTCC 443), *Candida albicans* (MTCC 227) and *Staphylococcus aureus* (MTCC 737) procured from IMTECH, Chandigarh. All the isolates exhibited antimicrobial activity against the test pathogens in varying degree. One isolate *Penicillium* sp., (CRP 3a) showed highest inhibition against all the pathogens. The present study indicated that *Cryptothecia* sp. harbours various endolichenic fungi with potent antimicrobial activity. Further detailed investigation of the compounds isolated from endolichenic fungi may lead to therapeutic applications as a new source of novel natural products which are helpful to the mankind.

**KEYWORDS:** Arunachal Pradesh, Colonizing frequency, lichen, *Penicillium* sp., secondary metabolites.

**INTRODUCTION:**

Lichen is a self-sustaining ecosystem formed by the interaction of an exhabitant fungus and an extracellular arrangement of one or more photosynthetic partners and an indeterminate number of other microscopic organisms<sup>1</sup>. Lichen requires sufficient moisture and temperature to grow and these parameters also provide suitable conditions for the growth of some fungi which lives inside the lichen tissues<sup>2</sup>. Those fungi are called as

Thus asymptomatic fungi can also be called as beneficial fungi. One such asymptomatic fungi are endolichenic fungi. Endolichenic fungi is a diverse group of microfungi which resides within the lichen tissues<sup>2-10</sup>. They mainly belongs to Ascomycetes and Pezizomycetes. Endolichenic fungi produces various kinds of secondary metabolites such as quinones, terpenoids, benzopyranoids, etc.<sup>3,11-12</sup>. These secondary metabolites exhibits antifungal, antibacterial,

## GC-MS And FTIR Analysis Of Endolichenic Fungus *Penicillium* Sp. Isolated From *Cryptothecia Striata* Of Arunachal Pradesh, India

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### ABSTRACT

In the present study GC-MS and FTIR analysis of an endolichenic fungus *Penicillium* sp. isolated from *Cryptothecia striata* was done to identify the bioactive compounds present in it. Our study indicated the presence of many functional groups as identified through FTIR analysis and GC-MS analysis of methanolic extract of *Penicillium* sp. (CRP 3a) shows the presence of eight compounds such as Phenol 3,5-Bis(1-1 Dimethyl ether), Pentanoic acid, 5-hydroxy-2,4-di-t-butyl phenyl esters, Pentanedioic acid, (2,4-Di-T-Butylphenyl ester), ethyl crysanthemate, Carissanol Dimethyl ether, Vanillin and Diethyl, 2,6 -Pyridine- dicarboxylate. Some of the compounds exhibited strong antimicrobial activity and it has been hypothesized that the antimicrobial activity of lichen might be due to the associated endolichenic fungi.

**Keywords-**Endolichenic fungus, bioactive compounds, GC-MS and FTIR

### INTRODUCTION

Lichen is a symbiotic association between fungi (mycobiont) and at least chlorophyll-containing photosynthetic organism (photobiont) such as microalga, a cyanobacterium etc (Lutzoni and Miadlikowska, 2009). In addition to the mycobiont, lichen is also a home to numerous cryptic microfungi which live in close association with the lichen thallus (Arnold et al. 2009). This group of fungi, which lives inside the lichen thallus, is called as endolichenic fungi. (Arnold et al. 2009). Endolichenic fungi doesn't cause any harm to the lichen thallus, they are thus asymptomatic in nature (Arnold 2001, 2007; Petrini 1991). Many works have been done to isolate endolichenic fungi from lichen thallus. It has been found that most of the endolichenic fungi belong to Ascomycetes, Pezizomycetes etc. (Arnold et al. 2009; Girlanda et al. 1997; Kannagara et al. 2009; Li et al. 2007; Petrini et al. 1990; Suryanarayanan et al. 2005; Tripathi and Joshi 2015; U'Ren et al. 2010, 2012). Endolichenic fungi possess strong antimicrobial, antibacterial, anticancerous, anti-

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inflammatory properties due to the presence of several bioactive compounds. Due to this reason research on endolichenic fungi is a highlighted area (Kellogg and Raja 2016; Suryanarayanan et al. 2017).

*Cryptothecia striata* is a crustose lichen which mainly grows on bark of trees, rocks, etc. Triterpenoids along with many important compounds have been extracted from *Cryptothecia* sp. which showed strong antimicrobial activity (Tuan et al., 2021, Devi et al. 2022). It has been hypothesized that the medicinal properties of lichens might be due to the associated endolichenic fungi. In the present study *Penicillium* sp. isolated from *Cryptothecia striata* was characterized with the help of GC-MS and FTIR analysis to identify the bioactive compounds present in it which might

Article

# The Generalized Odd Linear Exponential Family of Distributions with Applications to Reliability Theory

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**Abstract:** A new family of continuous distributions called the generalized odd linear exponential family is proposed. The probability density and cumulative distribution function are expressed as infinite linear mixtures of exponentiated-F distribution. Important statistical properties such as quantile function, moment generating function, distribution of order statistics, moments, mean deviations, asymptotes and the stress–strength model of the proposed family are investigated. The maximum likelihood estimation of the parameters is presented. Simulation is carried out for two of the mentioned sub-models to check the asymptotic behavior of the maximum likelihood estimates. Two real-life data sets are used to establish the credibility of the proposed model. This is achieved by conducting data fitting of two of its sub-models and then comparing the results with suitable competitive lifetime models to generate conclusive evidence.

**Keywords:** generalized odd linear distribution; hazard rate function; moments; residual analysis; maximum likelihood estimation; Monte Carlo simulation



**Citation:** Jamal, F.; Handique, L.; Ahmed, A.H.N.; Khan, S.; Shafiq, S.; Marzouk, W. The Generalized Odd Linear Exponential Family of Distributions with Applications to Reliability Theory. *Math. Comput. Appl.* **2022**, *27*, 55. <https://doi.org/10.3390/mca27040055>

Academic Editor: Sandra Ferreira

Received: 20 May 2022

Accepted: 21 June 2022

Published: 23 June 2022

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## 1. Introduction

Analysis of lifetime data is an important subject in many fields, including reliability, social sciences, biomedical, engineering and other fields. In practice, it has been observed that many phenomena do not follow any of the classical distributions; for this reason, many efforts have been made in the last few decades to introduce new generators or families of distributions that extend these classical distributions to provide considerable flexibility in modeling data in diverse spectrums. Many authors have suggested new generators or families in the literature, for example, and not exclusively: Marshall and Olkin (1997) [1] introduced the Marshall–Olkin family, Gupta et al. (1998) [2] introduced the exponentiated-G family, Eugene et al. (2002) [3] proposed the beta-G family, Cordeiro and Castro (2011) [4] suggested the Kumaraswamy-G family, Alexander et al. (2012) [5] presented the McDonald-G family, Alzaatreh et al. (2013) [6] proposed the transformed-transformer (T-X) family, Bourguignon et al. (2014) [7] presented the Weibull-G family, Tahir et al. (2015) [8] studied the odd generalized exponential-G family, Cordeiro et al. (2016) [9] discussed the Zografos Balakrishnan odd log-logistic family, Gomes-Silva et al. (2017) [10] presented the odd Lindley-G family, Alizadeh et al. (2017) [11] provided the Gompertz-G family and Jamal et al. (2017) [12] defined the odd Burr-III family, among others. For a clearer understanding of the odds ratio to define new G-classes, we motivate the readers to Khan et al. (2021) [13], in which the authors adopted a unique odd function to propose an alternate generalized odd generalized exponential-G family.



Thailand Statistician  
April 2022; 20(2): 308-324  
<http://statassoc.or.th>  
Contributed paper

## Beta Poisson-G Family of Distributions: Its Properties and Application with Failure Time Data

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Received: 26 November 2019

Revised: 24 May 2020

Accepted: 10 July 2020

### Abstract

Poisson-G family is extended to propose beta Poisson-G family of distribution. Useful expansions of the probability density function and the cumulative distribution function of the proposed family are derived as infinite mixtures of the Poisson-G distribution. Moment generating function, power moments, entropy, quantile function, skewness and kurtosis are investigated. Illustrative numerical computation of moments, skewness, kurtosis and entropy are tabulated for select parameter values. Estimation of model parameters by methods of maximum likelihood is discussed. A simulation experiment is carried out under varying sample size to assess the performance of estimation. Finally, suitability check of the proposed model in comparison to a few recently introduced ones is carried out by considering two life time data sets modeling.

**Keywords:** Beta generated family, Poisson-G family, maximum likelihood, AIC.

### 1. Introduction

Let  $r(t)$  be the probability density function (pdf) of a random variable  $T \in (\alpha, \beta)$  for  $-\infty \leq \alpha < \beta < \infty$  and let  $W[G(x)]$  be a function of the cumulative distribution function (cdf) of a random variable  $X$  such that  $W[G(x)]$  satisfies the following conditions

- (i)  $W[G(x)] \in [\alpha, \beta]$
- (ii)  $W[G(x)]$  is differentiable and monotonically non-decreasing, and (1)
- (iii)  $W[G(x)] \rightarrow \alpha$  as  $x \rightarrow -\infty$  and  $W[G(x)] \rightarrow \beta$  as  $x \rightarrow \infty$ .

Alzaatreh et al. (2013) defined the T-X family cdf by

$$F(x) = \int_{\alpha}^{W[G(x)]} r(t) dt = R\{W[G(x)]\}, \quad (2)$$

where  $W[G(x)]$  satisfies the conditions (1). The pdf corresponding to (2) is given by

*The Kumaraswamy Poisson-G Family  
of Distribution: Its Properties and  
Applications*

**Subrata Chakraborty, Laba Handique &  
Farrukh Jamal**

**Annals of Data Science**

ISSN 2198-5804

Ann. Data. Sci.

DOI 10.1007/s40745-020-00262-4



 Springer

# Understanding Farmer Producer Company (FPC) Ecosystem in Assam: Issues and Challenges

Journal of Asian and African Studies

1–12

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DOI: 10.1177/00219096221120921

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## Abstract

The agriculture sector, which continues to be pivotal to sustainable growth and development, has been recently mobilising farmers into member-owned producer organisations, or Farmer Producer Companies (FPCs) to enhance production, productivity and profitability of agriculturists, especially the small and marginal farmers in the country. The FPCs, which have been brought in for improved transparency and access to the input and output market with higher negotiating powers leading to sustainability of the small and marginal farmers, are said to provide higher legitimacy and credibility in the immediate business environment. Though Assam too is not behind in forming FPCs, challenges and issues abound. Majority of these FPCs are in the nascent stage of their operations with shareholder membership ranging from more than 500 farmers to over 1500 farmers. It is also seen that from capacity building to taking up business operations, many issues need to be addressed in these FPCs. These FPCs are in need of support in technical handholding and provision of adequate capital and infrastructure facilities including market linkages for sustaining their business operations. The present paper tries exploring and understanding the ecosystem of the FPCs in Assam, which are focussing on small and marginal farmers, and delving into the issues and challenges faced by the FPCs in the state and the possible ways out.

**JEL Classification:** Q13

## Keywords

Farmer Producer Company, issues and challenges, Assam

## Biochemical changes due to pathogenesis in French beans (*Phaseolus vulgaris* L.) infected by *Rhizoctonia solani* Kuhn

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French Bean (*Phaseolus vulgaris* L.) belongs to the family Fabaceae and is native to South America. French bean has evolved from wild growing vine distributed in the high lands of Middle America and Andes. This important legume crop is grown for its dry grain and tender pods in North-Western India. This off-season crop can be successfully raised under Punjab conditions during winter season which fetches higher price in the market and economical to the farmers when there is no availability of green pods from high altitude. It is widely cultivated in tropics, sub-tropics and temperate regions. When bean plant infected by fungal, bacterial or any other pathogen, different alterations are observed. The present study was carried out in the department of Botany, Darrang college to compare the biochemical changes occurring in bean plants growing in normal soil, sterilized soil and sterilized soil mixed with fungus *Rhizoctonia solani*.

**Keywords:** French bean, *Rhizoctonia solani*, Fabaceae, Biochemical analysis.

### INTRODUCTION

French bean also known as kidney bean or snap bean or fine bean, is grown for tender green pods for fresh consumption as well as for dry seeds which are used as pulse. The dried beans are rich in protein and are closely compared with meat. This vegetable not only plays a vital role in nourishment of human population, but also improves soil fertility to a great extent by virtue of being highly nitrogen fixing crop (Meena, 2017). During cultivation of french bean crops, these are infected with several diseases of fungal, bacterial and viral nature by different pathogens which not only reduces the yield but also impair the quality of the produce. Amongst different diseases of bean plants such as Rust, angular leaf spot, root rot, bacterial blight, powdery mildew and downy mildew, *Rhizoctonia* rot disease of beans caused by *Rhizoctonia solani* is the most common fungal disease. Various symptoms such as linear or circular reddish brown sunken lesions with a brown to reddish brown border develop in the stem and roots of french bean, which later leads to biochemical alterations in bean plants (Scwartz, 2012). Our present work deals with the detection of amino acids, proteins, phenols and reducing sugar content present in *Rhizoctonia*

infected french bean leaves growing on normal soil, sterilized soil and sterilized soil mixed with *Rhizoctonia* inoculum.

### MATERIALS AND METHODS

#### Collection of Plant Material

French bean seeds are collected from local market of Tezpur, Assam and are brought to the laboratory for further investigation. A total of 45 seeds are sown separately and are water sprayed on regular interval. Germination is reported after 10 days. It has been noticed that out of 45 seeds, 24 seeds are germinated, and 21 remain dormant and 2 of them are infected.

#### Culturing of pathogen

Infected French bean plants are tested for the pathogens. The infected plant tissues are surface sterilized in three treatments of 1 min each - first solution was 0.5% NaOCl, second was 70% ethanol and third one was sterilized dH<sub>2</sub>O. Surface sterilized plant tissues are then inoculated in PDA media plated supplemented with streptomycin sulphate to avoid any bacterial contamination. Plated are then incubated until the growth of pathogen is observed.

DOI:- <https://doi.org/10.32381/JPSR.2023.39.02.6>

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### Identification of the pathogen

Fungi are observed under microscope following standard identification manuals. Pure culture of the fungi are prepared and stored in the deep freezer. Further to determine the observed fungi is the causal organism of the rot disease in fungi, Koch postulation is carried out in accordance

biochemical analysis.

The amino acid was estimated by following the method of Izmailov and Schreiber, 1938. The protein content was estimated by following the method of Dunn, 1994. Phenol content was determined using spectroscopic method of Ainsworth and Gillespie (2007). Sugar content (DNSA) were estimated by



REVIEW ARTICLE

**Neem as a Potential Biopesticide and Biofertilizer - A Review**

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**ABSTRACT:**

Rapid growing human population has pressurized farmers to produce food in a larger scale. Agrochemicals have enabled in the duplicate food production. However, surveys have documented in the contamination and impacts of agrochemicals in the soil. Thus there must be a shift from agrochemicals to organic pesticide and fertilizer, which will ultimately, preserves the natural fertility of soil and is also safe to the human kind. There are many botanicals which can be used as organic pesticide and fertilizers, among which neem is on the top of the botanicals. Neem (*Azadirachta indica* A. Juss) belongs to Meliaceae family, is a tropical evergreen tree, often referred to as "Tree of 21<sup>st</sup> century". All parts of the plant particularly bark, leaves and root extracts were found effective against many pests and insects thus they possess biopesticidal activity. The presence of azadirachtin, a chemical compound obtained from neem acts as potential biopesticides. It inhibits their feeding ability, disrupts their growth and reproduction. Neem plant can also be used as biofertilizers, neem seed extract acts as a organic manure and thus control many pathogens. Neem is considered to be easily accessible, eco-friendly, biodegradable and cheap. Thus this review highlighted the importance of neem that ensures us to use it as biopesticide and biofertilizer.

**KEYWORDS:** Agrochemicals, Botanicals, Biodegradable, Azadirachtin, Biopesticide and Biofertiliser.

**INTRODUCTION:**

Pesticides has become a major component in large scale food production<sup>1</sup>. The increase in the world population has direct impact on food production as a result there is a more dependence on chemical pesticides. Overuse of chemical pesticides has hazardous effect on both biotic and abiotic factors<sup>2</sup>. During the last few decades it has been observed that pesticides residues did spread in the environment and contaminate terrestrial ecosystem as well as aquatic ecosystem<sup>3,4</sup>. According to a report presented by world health organization (WHO) and United Nation environment Programme (UNEP) around 200,000 deaths and about three million people pesticide poisoning has been reported in developing countries<sup>5,6</sup>. The increase in the use of chemical pesticide has resulted in unpredicted environmental issues, pest insurgence and health hazards on soil and plant which are ecologically unacceptable activity<sup>7</sup>.

An alternative method is to shift our concern from chemical, synthetic pesticide to organic, safe, and non-toxic pesticides<sup>8</sup>. Biopesticides are naturally derived formulation for the control of pest in an eco-friendly manner<sup>9</sup>. There is no definite definition of biopesticides. They are generally produced through the bio-products of microbes and plants and thus are very much safe to the environment<sup>10</sup>. Biopesticides possess considerable benefits to the farmers as well as to the environment. World is producing about 3000 tons of biopesticides every year which is rapidly increasing in a significant rate. India has a vast diversity of biopesticides<sup>9</sup>. Among all the biopesticides, Neem (*Azadirachta indica*) has emerged as a reliable biopesticides<sup>11</sup>. Neem is on the top list of botanicals used as biopesticides in the world<sup>12</sup>.

**NEEM (*Azadirachta indica*):**

Neem tree (*Azadirachta indica* A. Juss) belongs to the family Meliaceae, is an evergreen tropical tree native to India and Burma<sup>13</sup>. It is also grown in most of the parts

Review Article


## Nutritional composition of small indigenous species of fishes of Northeast India: A systematic review

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### Article Info

<https://doi.org/10.31018/jans.v15i2.4490>

Received: February 15, 2023

Revised: May 11, 2023

Accepted: May 21, 2023

### How to Cite

Pegu, A. *et al.* (2023). Nutritional composition of small indigenous species of fishes of Northeast India: A systematic review. *Journal of Applied and Natural Science*, 15(2), 649 - 662. <https://doi.org/10.31018/jans.v15i2.4490>

### Abstract

Northeast India has various water bodies including the tributaries of the Brahmaputra and Barak river systems, wetlands, lakes and beels. These water bodies support the diversity of many fish species. Seasonal changes in the number of fish species in the SIS category were also observed and they are most abundant during the winter and least abundant during the monsoon season. Many researchers collected fish data from Assam's rivers and wetlands, particularly small indigenous species (SIS). Small Indigenous Species (SIS) of fish are a vital and conveniently accessible source of rare protein, vitamins, and minerals in traditional diets. The present study aimed to review Assam's small indigenous fish species and their nutritional worth. The sources of the review article were Google Scholar, Web of Science, ScienceDirect, and PubMed for SIS nutrition composition, fish nutritional profile, and fish proximate composition. Northeast India's rural inhabitants get their sustenance from fish SIS. The SIS of Northeast India fish species contain proteins, lipids, vitamins, minerals, and vital macro- and micronutrients. The protein content of SIS range from 12.49% to 18.30% (12.49–18.30g/100 g), lipid content from 0.7% to 19.63% (0.7–19.63g/100 g), moisture content from 65.88% to 82.8% (65.88–82.8g/100 g), and ash level from 2% to 6.8% (2–6.8g/100 g). This review suggests SIS has adequate nutritional benefits because it is an excellent source of proteins, lipids, vitamins, minerals, and omega-3 fatty acids necessary for optimal health. Northeast India's impoverished region might achieve their nutritional demands by eating more SIS of fish.

**Keywords:** Nutritional profile, Northeast India, Proximate composition, SIS fish

### INTRODUCTION

Fish is a nutritious diet high in micronutrients, high-quality animal proteins, and polyunsaturated fatty acids, particularly omega-3 eicosapentaenoic and docosahexaenoic acids. Moreover, compared to other sources of animal proteins, fish is more readily available and less expensive in tropical nations (Mohanty *et al.*, 2019; Mohanty *et al.*, 2022; Sinha *et al.*, 2022). More than half of

India's population eats fish, and in certain areas, such as Assam, Arunachal Pradesh, Goa, Kerala, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Sikkim, Tripura, and West Bengal more than 90% of the population eats fish (Sankar *et al.*, 2010; Debnath *et al.*, 2014; Sobczak *et al.*, 2021). Fish contain proteins and nitrogenous substances other than protein, minerals, iodine, selenium, taurine, vitamin D, and a small quantity of carbohydrates (Chen *et al.*, 2007; Sankar *et al.*, 2010;

# Insects as food: its hurdles against the opportunities

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## ABSTRACT

The hazards of rearing insects and using them in food production, especially as food ingredients are not well understood. The lack of awareness of food safety in many countries will continue to impede the growth of edible insect production and consumption in specific markets. Chemical, biological, and allergy risks are the three types of potential food safety threats and these aspects, in particular the appropriate selection of high-quality, risk-free feed substrate, must be assessed and regulated in order to increase the food safety of edible insects. This can only be done under controlled conditions as instead of wild harvesting. The possibilities and problems of using insects as food are explored here based on accessible data from scientific research.

**Key words :** Dietary, edible insects, entomophagy, food and feed, insect products.

## INTRODUCTION

Over the last 400 million years, evolution has resulted in a diverse range of arthropod species that have effectively adapted to their natural settings in a variety of habitats. On Earth, there are around 1 million insect species that have been identified, with millions more believed to exist. Only 5000 kinds of insects, on the other hand, can be considered harmful to humans, crops, and cattle alike. Among all arthropods, insects are the most effective in terms of surviving and adjusting to their ecological environments. This is because of their ability to exist in and adapt to many habitats, their ability to consume a variety of various types and grades of food, their high reproductive capacity, and their ability to flee from their predators swiftly (Kumar, 2001). As a result, insects play both a beneficial and a detrimental function in human life. Although all insects are not dangerous, certain of them are capable of ruining our crops as pests and spreading diseases as vectors, even though all insects are not dangerous. The vast majority of insects are non-lethal and beneficial to humankind in a variety of ways, according to experts. Insects are considered to be extremely nutritious, as they are high in protein, good fats, iron, and calcium, and low in carbohydrates (Murefu *et al.*, 2019). Because of its nutritive,

environmental, and economic benefits, insects form a food group. A greater emphasis on edible insects is being placed on them as part of a worldwide food security plan. When compared to other conventional food categories, insects have higher protein content and are more efficient producers. There is a forecast increase in future protein consumption, yet the supply of food is falling. In addition, it was acknowledged that the worldwide market for insect farming grew and led to food, materials, and pharmaceutical applications for development (van Thielen *et al.*, 2019). Despite the various advantages in terms of practicality, many disadvantages are remaining in the consumption of insect foods. The purpose of this article is to examine the hurdles in insects as a food source.

*Why insects should be used as food :* There are three basic reasons for considering the promotion of insects as food: health, environmental, and livelihood considerations. In many parts of the world, insects are considered to be a traditional element of the diet of many people. Insects are a nutritious and healthy alternative to traditional meats such as chicken, cattle, hog, and fish. A wide number of bug species are high in protein, lipids, calcium, iron, and zinc, as well as other nutrients. The vast majority of animals emit greenhouse gases, and in comparison, to them, edible insects generate significantly fewer greenhouse gases

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## Prospects of Probiotics and Fish Growth-promoting Bacteria in Aquaculture: A Review

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### ABSTRACT

Modern aquaculture faces significant obstacles including a deficiency in sources of protein in the feed, vulnerability to infections, and quality degradation during growing and storage, despite being the sector with the highest growth rate. Beneficial bacterial species shield aquatic animals from infection or stop product deterioration, and bacterial biomass is thought to be a potential source of protein for animal feed. This review focuses on the nutritional, anti-pathogenic, and immunoregulatory functions of these bacteria in relation to aquatic products. Additionally, we examine the connection between host immunity, beneficial bacteria, and gut microbiota, along with recent advances in our understanding of host immunity and microbial mutualism. This analysis emphasizes specific microbial metabolites, bacterial components, and the immune system. The actions of probiotics in aquatic animals have garnered significant research attention in recent years. Various findings, with the potential to be both academically innovative and practically helpful, have emerged. The positive effects of beneficial bacteria on aquatic organisms have sparked extensive research, wide-ranging use in aquaculture, and innovative applications. Future improvements to current practices will require the development of novel applications and related mechanistic research.

**Keywords:** Probiotics, Growth-promotion, Fish, Vaccine, Immunoregulation.

### Article History

Article # 23-502

Received: 31-Aug-2023

Revised: 28-Sep-2023

Accepted: 11-Oct-2023

### INTRODUCTION

The aquaculture industry was developed and is currently the fastest-growing to meet the increasing demand for fish protein and represents one-third of world fisheries production (FAO, 2020). With the increasing population, the demand for aquatic food has also increased, and this can be fulfilled by the multibillion-dollar, rapidly expanding aquaculture industry. Of the total production, 63 percent (112 million metric tons) was harvested in marine waters (70 percent from capture fisheries and 30 percent from aquaculture) and 37 percent (66 million metric tons) in inland waters (83 percent from aquaculture and 17 percent from capture fisheries) (FAO, 2022). All over the world, per year, the fish production industry has been gradually growing at a standard compounded rate of 9.2% since 1970 (El-Saadony et al., 2021). The aquaculture industry has partly compensated for the reduction of capture fisheries, and many reports show that it will be the future weapon for getting rid of this problem (El-Saadony et al., 2021). By 2050, aquaculture production is anticipated to double, allowing it to meet demand while relieving the strain on wild fishing (Yukgehnaish et al., 2020). According to projections by the United Nations Food and Agriculture Organization, farm-raised fish will contribute two-thirds of the world's consumption of seafood by the year 2030 (Thorpe and Castillo, 2018).

The major constraint is the presence of pathogenic microorganisms. Disease caused by this harmful microbiota creates challenges for farmers and finally impacts net production. Although various kinds of vaccines are being developed by experts, they are not the universal solution. Therefore, the management of disease in aquaculture became a very crucial problem for farmers. Later, to solve this problem, antibiotics are used as a traditional strategy for a long period of time. According to many scientific reports, antibiotics are able to control many disease-causing bacteria and can improve fish health in aquaculture practices (El-Saadony et al., 2021). But, as we know, each coin has two sides. Likewise, everything has two effects. Antibiotics kill some beneficial bacteria, which are inhabitants of the fish gastrointestinal tract. However, it also caused fish products to acquire antibiotic residues that are unsafe for human consumption (WHO, 2006). These concerns, along with the detrimental impact of products and residual antibiotics on human health, led the European Union and the United States to impose prohibitions on the use of antibiotics (Kesarcodi-Watson et al., 2008).

With the ban on antibiotics, there was a need for a new management strategy for fish health. To fulfill this need, fishery scientists have conducted much research and they came to an unbeatable conclusion on the use of probiotics. Later, this new idea has received much more attention and has been recognized as a natural disease controller and a good growth-promoting agent for fish in aquaculture

**Cite this Article as:** Kalita R, Pegu A and Baruah C, 2023. Prospects of probiotics and fish growth-promoting bacteria in aquaculture: a review. International Journal of Agriculture and Biosciences 2023 12(4): 234-244. <https://doi.org/10.47278/ijab/2023.070>



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## EDITORIAL

### Ecosystem enhancement through conservation of natural enemies

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Natural enemies, also known as bio-agents, are organisms that restrict insect populations, reducing the insects' ability to survive. Weeds, insects, plant pathogens, and other pests can all be controlled using natural enemies. However, the approaches and chemicals employed vary depending on the type of insects. Natural enemies are essential for reducing the numbers of potential pests. Insecticides destroying the natural enemies of prospective insects, has been proved through several studies (Deka *et al.*, 2020). However, when a non-toxic practice for removing an extensive pest comes to light, the number of secondary pest outbreaks and the environmental damage they cause usually get reduced. This also helps natural enemies survive and reduce the need for broad spectrum synthetic insecticides. Ecological frameworks support a diverse range of plants and animals. However, there are many risks associated with pesticide usage (Mukherjee, 2016). Natural enemies and pollinators are frequently and more likely to be affected or destroyed by pesticides than the pest itself since they are more vulnerable to them. Because of the widespread use of chemical pesticides in agricultural ecosystems, majority of the pests tend to develop tolerance to them.

Sustainable agronomic practices can establish appropriate habitats in disturbed agro-ecosystems that supply food and shelter to pollinators and other natural enemies of insect pests. Examples of these practices include managing field margins and mid-field strips with carefully chosen flower plants, cover crops, economically important plants, uncultivated areas, headlands, and hedges (Tscharnkte *et al.*, 2007).

**The conservation of natural enemies:** In order to maintain and enhance bio-control agent populations, conservation techniques are essential. The following conservation techniques can be used:

**1. Crop Rotation and Diversification:** Crop rotation and diversification can help to foster a diversified community of natural enemies. Pests specific to monocrops can be prevented by alternating crops, reducing their accumulation and allowing natural enemies to flourish. Diverse cropping systems also provide a diverse set of resources, such as alternative hosts /prey, that supports a diverse set of natural enemies (Sarkar *et al.*, 2020).

**2. Habitat Management:** It is essential to create and maintain suitable habitats for natural enemies. This includes planting a variety of perennial plants that provide food, shelter, and alternate hosts for natural enemies.

Incorporating nectar and pollen-producing flowering plants can attract helpful insects such as parasitic wasps and predatory beetles. Reduced pesticide use in the area is also necessary to safeguard natural enemies (Sarkar *et al.*, 2020).

**3. Minimizing Pesticide Use:** Pesticides can directly or indirectly kill natural enemies by reducing their hosts or disturbing their activity. IPM approaches encourage cautious and targeted use of pesticides while reducing their influence on natural enemies. Pesticides that are selective and low in toxicity can be used, and their application should be timed to minimize their impact on natural enemies (Deka *et al.*, 2020).

**4. Conservation Biological Control:** This method involves deliberately releasing natural enemies into agricultural or regulated habitats in order to increase their populations. It is essential to identify and release the most effective natural enemies of the target pests at appropriate times and locations. Conservation biological control can aid in the establishment and maintenance of beneficial insect populations besides improving pest control efficiency (Sarkar *et al.*, 2019).

**5. Provision of Alternative Resources:** Supplemental food and shelter sources can help natural enemies survive when their prey or hosts are scarce. Planting flowering plants can supply nectar, pollen, and shelter for natural enemies, increasing their survival and reproductive potential (Sarkar *et al.*, 2020).

**6. Education and Awareness:** It is essential to increase awareness among farmers, landowners, and the general public about the relevance of natural enemies and the benefits of protecting them. Educating stakeholders on the importance of natural enemies in pest management and encouraging ecologically friendly techniques can help to increase support for conservation initiatives (Mukherjee *et al.*, 2019). These conservation strategies seek to establish an environment that encourages the presence and effectiveness of natural enemies in pest management. The use of chemical pesticides can be decreased by following these measures, encouraging sustainable and environmentally sound pest management practices.

Various arthropod pests have a substantial impact on crop production and productivity in majority of agro-ecosystems. Pesticides were mostly used by farmers to control insect populations on various crops. Pesticides

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## The emergence of nanovaccines as a new paradigm in virological vaccinology: a review

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Academic Editor: Marc H.V. Van Regenmortel, Medical University of Vienna, Austria

Received: February 7, 2023 Accepted: June 20, 2023 Published: August 31, 2023

Cite this article: Baruah C, Das P, Devi P, Saikia PM, Deka B. The emergence of nanovaccines as a new paradigm in virological vaccinology: a review. *Explor Immunol.* 2023;3:361–83. <https://doi.org/10.37349/ei.2023.00107>

### Abstract

Vaccination has made an enormous contribution to global health. Treatment resistance for infectious diseases is growing quickly, and chemotherapeutic toxicity in cancer means that vaccines must be made right away to save humanity. But subunit vaccinations alone don't give enough strong and long-lasting protection against infections that can kill. Nanoparticle (NP)-based delivery vehicles, such as dendrimers, liposomes, micelles, virosomes, nanogels, and microemulsions, offer interesting ways to get around the problems with traditional vaccine adjuvants. The nanovaccines (50–250 nm in size) are most efficient in terms of tissue targeting, staying in the bloodstream for a long time. Nanovaccines can improve antigen presentation, targeted delivery, stimulation of the body's innate immune system, and a strong T-cell response without putting people at risk. This can help fight infectious diseases and cancers. Also, nanovaccines can be very helpful for making cancer treatments that use immunotherapy. So, this review highlights the various types of NPs used in the techniques that have worked in the new paradigm in viral vaccinology for infectious diseases. It gives a full rundown of the current NP-based vaccines, their potential as adjuvants, and the ways they can be delivered to cells. In the future, the best nanovaccines will try to be more logically designed, have more antigens in them, be fully functionalized, and be given to the right people.

### Keywords

Adjuvant, cancer, infection, nanoparticle, nanovaccine, non-neutralizing antibody, neutralizing antibody

### Introduction

Infectious diseases still worry people all over the world the most. Conventional ways of getting immune responses from vaccines don't work well enough to control new and re-emerging pathogens. Nanoparticle

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# Studies on Seasonal Variation of Water Quality Parameters of River Mara Bharali in Sonitpur District of Assam

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10.18805/ag.D-5706

## ABSTRACT

**Background:** Freshwater is not only a finite resource but also essential for agriculture, industry and even human existence. The present investigation on seasonal water quality parameters was conducted in the remnants of old channel of river Jia Bharali called as Mara Bharali at Tezpur in the Sonitpur district of Assam from December, 2017 to November, 2020.

**Methods:** Five sampling stations were selected that covers a stretch of 16.5 km. Physico-chemical parameters were determined seasonally by following the standard methods of APHA (1998) and Trivedy *et al.*, 1987. The statistical analyses of the data were done by one way ANOVA using Statistical Package for Social Scientists.

**Result:** TDS in monsoon in all the locations remained lowest (171.33±3.059 mg/L at MB2) and highest in winter (320.11±2.441 mg/L at MB3). The pH value is within the permissible limit except for site MB4 during the winter and post monsoon when the values were 6.38±0.146 and 6.44±0.039 respectively. Maximum DO of 7.878±0.074 mg/L was observed at site MB1 during the winter season and minimum DO of 5.444±0.047 mg/L was observed at site MB4 during the monsoon season. BOD was recorded below the tolerance limit of 3 mg/L in all sampling stations.

**Key words:** Biological oxygen demand, Dissolved oxygen, Mara Bharali river, One way ANOVA, Water quality parameters.

## INTRODUCTION

Rivers are considered as the pillars of human civilization all over the world. The presence of irrigated agriculture, towns, cities and industrial sites along the river bank shows the inextricable dependence of human races on riverine ecosystem. Tropical floodplains play a significant role in providing highly productive ecosystem services (Pettit *et al.*, 2011), vital to a range of ecosystem processes (Hamilton 2002). The deteriorating water quality affects man, animals and plant life with far-reaching consequences. In India, due to tremendous urbanization and industrialization, the problem of water pollution has assumed an alarming situation and about 70% of rivers in India are polluted. In the last few decades, there has been increasingly greater emphasis on the deterioration of water quality of Indian rivers (Jindal and Sharma, 2011; Matta *et al.*, 2020). The destruction of natural habitats and the presence of environmental pollutants may affect the ecological balance of every ecosystem (Begon *et al.*, 2009). Dwivedi and Pandey (2002) reported that industrial waste water, sewage and municipal wastes are being continuously added to water which affect the physicochemical quality of water and also making them unfit for even use of livestock and other organisms. All these impurities result in degradation of water quality, like bad taste, colour, odour, turbidity, hardness, corrosiveness, staining and frothing (Saha *et al.*, 2017).

## MATERIALS AND METHODS

### Description of study area

The present investigation was conducted in the remnants of old channel of Jia Bharali called as Mara Bharali at Tezpur

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**How to cite this article:** Das, A. and Biswas, S.P. (2023). Studies on Seasonal Variation of Water Quality Parameters of River Mara Bharali in Sonitpur District of Assam. *Agricultural Science Digest*, 43(3): 327-333. doi: 10.18805/ag.D-5706

Submitted: 11-11-2022 Accepted: 15-02-2023 Online: 16-03-2023

in the Sonitpur district of Assam during the period from December, 2017 to November, 2020. The 05 sampling stations were demarcated as MB1 (Pumpani village, N-26°45'10.52" and E-92°50'07.93"), MB2 (Amlopam village, N-26°41'16.84" and E-92°48'58.88"), MB3 (Dolaban village, N-26°40'00.65" and E-92°49'43.64"), MB4 (Porowa Bridge, N-26°39'10.05" and E-92°47'49.28") and MB5 (Mailhan, N-26°37'05.69" and E-92°49'34.34") that covers a stretch of about 16.5 km (Fig 1).

### Collection of water samples for analysis of physicochemical parameters

The samples were collected in plastic container from a depth of 5-10 cm below the surface water at each sampling sites. The physicochemical characteristics of water like temperature, pH, transparency, conductivity, dissolved oxygen (DO), biochemical oxygen demand (BOD), total dissolved solids (TDS), total alkalinity, total hardness and calcium were determined seasonally by following the

## EDITORIAL

# Better Management Practices (BMP) towards a Human-Wildlife Co-existence

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Over the last few decades, increasing human population, infrastructure development, and land-based economic development in many tropical countries in Asia have significantly reduced the area and quality of forests. Lim *et al.* (2017) and Chen *et al.* (2023) reported that forest conversion into plantations and infrastructure development are the main triggers of forest degradation and deforestation in Southeast Asia. This high rate of forest degradation and deforestation has caused a decline in wildlife populations and increased human-wildlife conflict (Borah *et al.*, 2020; Horgan & Kudavidanage, 2021). The intensity of human-wildlife conflict, which continues to increase from time to time, also results in economic losses for local communities living around forest areas, such as causing damage to agricultural crops, loss of livestock, crop failure, damage to house buildings, and can even cause fatalities of both in humans and wildlife (Subedi *et al.*, 2020; Sulistyono *et al.*, 2022). More specifically, negative interactions involving endangered protected wildlife, such as tigers, occur more often in forest areas adjacent to villages with low densities of prey (Lubis *et al.*, 2020). Interactions between humans and wildlife that cause losses will foster negative perceptions in the community of the presence of wildlife around their settlements, such as wildlife being considered as pests or enemies, which will ultimately reduce community support for wildlife conservation efforts. Looking at this phenomenon, there is a need for innovative efforts that can balance the interests of regional economic development, with social and environmental interests, especially the conservation of endangered protected wildlife.

Better Management Practices (BMP) are a practical guideline on how to improve management practices of a land-based business area in the context of preserving protected endangered wildlife (Sunarto *et al.*, 2008), as a vehicle for achieving a responsible and sustainable product. BMP for wildlife conservation have been widely studied, developed, as well as implemented in the oil palm sector for two decades ago in several Southeast Asian countries, such as Indonesia (Bateman *et al.*, 2010), India (Borah *et al.*, 2020), Malaysia (Ghani, 2020; Othman *et al.*, 2022), and in the Philippines (Tanalgo *et al.*, 2021). In fact, Chong & Norwana (2005) with the support of WWF-Malaysia have created a BMP document for mitigating and managing human-elephant conflicts in and around oil palm plantations in Indonesia and Malaysia. Likewise, its application in the industrial plantation forest sectors (Sunarto *et al.*, 2008; Wong *et al.*, 2022) and mining (OCSF, 2009), is starting to be encouraged in line with current market demands for products that have the label "green and sustainable".

Sunarto *et al.* (2008) stated that several BMP

components that can be developed to support the conservation of protected endangered wildlife in all land-based industrial sectors, include identifying and managing HCV (High Conservation Value) areas, mitigating human-wildlife conflicts, restoration and habitat protection, implementing land clearing practices without burning, integrated pest control, as well as minimizing and utilizing waste. On oil palm plantations in Malaysia, which are managed by the largest groups of certified sustainable palm oil producers in the world, they use various methods to implement BMP to mitigate human-elephant conflict, including electric fencing, cropping fences (crop-guarding), patrolling, elephant-proof trenching, improved fencing design, translocation, culling, elephant drive, conservation research and conservation awareness (Ghani., 2020). Furthermore, the result of study stated that the potential for coexistence with elephants could occur in plantations with oil palm trees over six years old, but in some other plantations human-elephant conflicts that result in plantation damage occur in areas where old oil palm trees grow. Meanwhile, BMP for mitigating human-elephant conflict implemented in Indonesia generally uses the MP2CE (monitoring, preventing, planting, controlling, and education) method, where this BMP is used as a tool used by stakeholders, especially land-based companies and local communities, to encourage efforts to protect and manage elephants in an integrated and sustainable manner (Sukmantoro & Syahrir, 2017).

As an example, a group of the world's largest pulp and paper companies operating in Indonesia, for the last 10 years they have been implementing various efforts and approaches to prevent and minimize human-wildlife conflict, including by managing protected areas as well as HCV and HCS (High Carbon Stock) areas and regular snare-trap removal, maintaining the integrity of natural forests through preventing illegal logging and encroachment, ensuring the availability of food sources including prey for carnivores, periodic monitoring wildlife presence, carrying out continuous awareness and education programmes, establishing and operating wildlife conflict mitigation team, as well as implementing community empowerment programmes to prevent human-wildlife conflict. All of these activities coordinated with relevant government agencies and with assistance from wildlife conservation fora and NGOs in encouraging ground cooperation between parties at the landscape level. However, human-wildlife conflicts in concession areas still occur. Efforts to mitigate and reduce human-wildlife conflict require the involvement of all stakeholders, both those directly and indirectly affected (IUCN, 2023). Even though there is still much

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## Tuning magnetic properties of FePtCo ternary alloy thin films for magnetic storage device application

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### ARTICLE INFO

#### Article history:

Received 1 February 2023

Received in revised form 14 April 2023

Accepted 25 April 2023

Available online 26 April 2023

#### Keywords:

FePtCo thin films  
Magnetic anisotropy  
Effective anisotropy constant  
Magnetron sputtering  
Annealing  
Cu-underlayer

### ABSTRACT

FePtCo ternary alloy films have been grown on Si-substrate by co-sputtering of Co with FePt under three conditions i.e., as-deposited, in-situ annealed, and with Cu-underlayer using a DC magnetron sputtering. The film surface roughness, crystal structure, and magnetic properties of these films were investigated. The average surface roughness ( $S_a$  and  $R_a$ ) of these films deposited under three deposition conditions slightly varies in the range of 0.41–2.48 nm with the increase of Co content. The XRD results show that all the films crystallize in a close-packed FCC structure. The lattice parameters and average crystallite size decrease with an increase in Co concentration for all deposited conditions. The magnetic measurement indicates that the as-deposited films exhibit low coercivity and excellent in-plane magnetic anisotropy with a large effective anisotropy energy in the range of  $1.22 \times 10^6$  –  $1.88 \times 10^7$  erg/cc. The increase of Co content in as-deposited FePtCo films leads to a reduction in the saturation magnetization ( $M_s$ ) and  $K_{eff}$  by promoting anti-ferromagnetic interaction with FePt sublattice. However, the annealing and insertion of a 2 nm Cu-underlayer further help to enhance the ferromagnetic nature and as a result, the value of  $M_s$  and  $K_{eff}$  is enhanced with an increase of Co content.

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### 1. Introduction

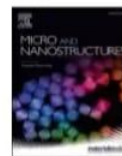
Recently thin films of metallic multilayers and rare-earth transition metal alloys have drawn the considerable interest to the scientific community for their potential application in magnetic storage media [1–10]. For decades,  $L1_0$  ordered FePt thin films have drawn the attention of researchers remarkably because of their potential applications in high density heat assisted magnetic recording (HAMR) media due to their large magnetic anisotropy energy density [11–14]. Under normal deposition condition, FePt films are usually grown in disordered FCC structure [15,16] which has low magnetic anisotropy energy density with easy axis along the film plane and possesses soft magnetic properties [12]. However, for application in perpendicular magnetic recording technology, the FePt film must be fully transformed from disordered FCC to  $L1_0$  phase. The  $L1_0$  ordered FCT structure can be achieved either by post-annealing of as-deposited films at temperatures above 450 °C [16–21] or by depositing the films at elevated substrate

temperature (in-situ annealing) above 500°C [22–25]. It was observed that upon annealing of the films, the FCC changes to  $L1_0$  ordered with easy axis tilted 35° away from the film plane, which can be further tuned in direction perpendicular to film plane [15,16]. Several investigations on FePt alloy films, FePt/Ag bilayer films, and FePtAg ternary alloy thin films have been reported due to their potential application to replace present conventional CoCrPt-based storage media [26,27]. For application in high areal density ( $\sim$  Tb/in<sup>2</sup>) recording media, FePt-based films should have high magnetocrystalline anisotropy energy, high saturation magnetization ( $M_s$ ) and beyond room temperature Curie temperature [28]. The material properties like magnetic anisotropy, curie temperature, structural ordering temperature, and crystallographic orientation of FePt alloy film can be manipulated by adding third elements such as Au, Ag, Cr, Mn, Cu, Ni, etc. [13,22,26,29–33]. It was further reported that the base pressure of the deposition chamber also plays a significant role in lowering of ordering temperature of FePt alloy thin films [34]. Several theoretical studies have been performed based on first principle calculations on doping of third elements such as Mn to FePt by replacing Fe with [35,36]. However, their results showed that anisotropy constant and coercivity decrease with an increase in Mn content and also increased antiferromagnetic interaction. Doping of

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<https://doi.org/10.1016/j.jalcom.2023.170313>  
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## Influence of surface roughness on magnetic properties of CoTbNi ternary alloy films

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### ARTICLE INFO

#### Keywords:

Ternary alloy  
Thin films  
Ferromagnetism  
Surface roughness  
Rare earth transition metal

### ABSTRACT

Rare earth-transition metal (RE-TM) amorphous alloys films with promising tunable perpendicular magnetic anisotropy are projected to be exploited for magnetic recording media and spintronic applications. Here variation of magnetic property of thin films of  $\text{Co}_{0.63}\text{Tb}_{0.11}\text{Ni}_{0.26}$ ,  $\text{Co}_{0.41}\text{Tb}_{0.14}\text{Ni}_{0.45}$  and  $\text{Co}_{0.32}\text{Tb}_{0.08}\text{Ni}_{0.60}$  ternary alloy fabricated on Si-substrate using dc magnetron sputtering at room temperature were studied. The x-ray diffraction pattern data confirms the amorphous nature of these alloy films. The average surface roughness ( $S_a$  and  $R_a$ ) of the films is found to vary significantly with Ni content of the films. The room temperature field dependent magnetization measurement shows the room temperature ferromagnetism. The saturation magnetization and coercivity of the M-H curves are found to vary with Ni content as well as surface roughness of the films. However, the nature of variation of saturation magnetization and coercive field is in accordance with variation of surface roughness, indicating that film surface roughness play a vital role in tuning the magnetic properties of these thin films. Such tunable magnetic properties of these amorphous films make them good candidate for magnetic storage media applications.

### 1. Introduction

Since the last decades, intense research has been carried out on magnetic materials for various practical applications like magnetic memories, spintronics, GMR spin-valve system for read/write head, micro-actuator, etc. Permalloys have been known to be the best iron group thin films for application in magnetic recording systems and microelectromechanical systems with high saturation field and low coercivity [1–5]. Various CoFe and CoNi-based ternary alloy films like TbCoFe [6], CoFeCu [2], CoFeNi [7,8], CoFeP [9], CoFeSnP [9] and multilayers such as Co/Pt, Co/Ni, Co-Tb [10–18], etc. Have been intensely investigated. For such applications, soft magnetic materials with high saturation field and low coercivity are desired to beat the dramatic increase of the areal density of recording media and for better performance. Recently amorphous rare-earth transition-metal (RE-TM) alloys have attracted the attention of researchers

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<https://doi.org/10.1016/j.micrna.2022.207491>

Received 13 June 2022; Received in revised form 17 December 2022; Accepted 19 December 2022

Available online 20 December 2022

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**A STUDY ON THE IMPACT OF COVID-19 IN THE HOME-BASED ENTERPRISES (HBES) IN SONITPUR DISTRICT OF ASSAM, INDIA: RECOVERY & CONTINUITY**

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**ABSTRACT:**

The Novel Coronavirus (Covid-19) acute respiratory outbreak crisis spread to over 200 countries worldwide including Asia, Europe, America, and Australia, which began in Wuhan, China in December 2019. The World Health Organisation (WHO) classified this outbreak as a pandemic due to an increase in human-to-human infection. Therefore, many countries imposed travel restrictions and movement controls. These restrictions during the pandemic directly affected small businesses more than their larger counterparts. Due to the closure of numerous supporting industries like retail and transportation, most of the entrepreneurs experienced business cancellation or closure as well as a decrease in income. In India lockdown started on March 22, 2020, for more than three months. During the Financial Year 2020-21, 67 percent of MSMEs were temporarily shut-down for a minimum of three months due to the pandemic and 50 percent of units witnessed a decline in their revenues in 2020-21 as MSME Minister Narayan Rane addressed Lok Sabha in question hours on February 3, 2021. Moreover, 5,907 MSMEs were shut during the financial year 2020-21 and 2021-22 due to the pandemic as per the government data. The recovery and continuation of this sector are of utmost importance for the survival of the nation. Home-based Enterprises belong to micro-enterprises since heavy industries are not allowed to establish themselves along with homes or in residential areas by government regulations and fulfill the norms of the micro-enterprises as per the revised classification applicable w.e.f. July 1, 2020, of the MSME Act 2006. This paper is based on primary as well as secondary data. The primary data were collected immediately after the pandemic from 120 Home-based enterprises of Sonitpur district of Assam.

**Keywords:** Home-based Enterprises (HBES). Micro enterprises, Covid-19 pandemic.

**1. INTRODUCTION:**

The COVID-19 pandemic outbreak had a significant impact on the global economy. It was crucial to research the effects of various policies to examine the pandemic's long-term effects on economic growth. The Novel Coronavirus (Covid-19) acute respiratory outbreak crisis spread to over 200 countries worldwide including Asia, Europe, America, and Australia, which began in Wuhan, China in December 2019. The World Health Organisation (WHO) classified this outbreak as a pandemic due to an increase in human-to-human infection (Qiu, Rutherford, Mao, & Chu, 2017), which has resulted in over 200,000 deaths in the three months since the outbreak began (WHO, 2020). It was observed that movement restriction is the best method for controlling the spread of infectious diseases such as coronavirus (Chinazzi et al, 2020; Sohrabi et al, 2020; Smith & Freedman, 2020). Many countries imposed travel restrictions and movement controls. These restrictions during the pandemic directly affected India's small businesses more than their larger counterparts. Due to the closure of numerous supporting industries like retail and transportation, most of the entrepreneurs experienced business cancellation or closure as well as a decrease in income. In India, the honourable Prime Minister Smt. Narendra Modi called a 14-hour voluntary lockdown on March 22, 2020, which was known as the "Janata Curfew" for the first time due to the COVID-19 pandemic. After three days, i.e. from March 25, 2020, a nationwide lockdown across India was imposed till April 14, 2020, and that was further extended to May 3, 2020, and then to June 7, 2020. In order to manage the situation, the lockdown was once again extended until May 31, 2020. More than three months of complete lockdown in the country totally collapsed the MSME sector. It has disrupted the operation of several important sectors,



## মুঞ্জী প্ৰেমচন্দৰ 'নিৰ্মলা' উপন্যাসৰ নিৰ্মলা আৰু বীণা বৰুৱাৰ 'জীৱনৰ বাটত' উপন্যাসৰ তগৰ : এটি তুলনামূলক অধ্যয়ন

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সংক্ষিপ্তসাৰ : মুঞ্জী প্ৰেমচন্দ আৰু বীণা বৰুৱা (বিবিষ্ণু কুমাৰ বৰুৱা) দুয়ো গৰাকী ভাৰতীয় সাহিত্যৰ প্ৰতিষ্ঠিত আৰু জনপ্ৰিয় ঔপন্যাসিক। প্ৰেমচন্দে হিন্দী ভাষাত আৰু বিবিষ্ণু কুমাৰ বৰুৱাই অসমীয়া ভাষাত সাহিত্য চৰ্চা কৰি উপন্যাস আৰু চুটিগল্প ক্ষেত্ৰখন সমৃদ্ধশালী কৰি গৈছে। আলোচ্য গৱেষণা গ্ৰন্থত তুলনামূলক দৃষ্টিভঙ্গীৰে মুঞ্জী প্ৰেমচন্দৰ 'নিৰ্মলা' উপন্যাসৰ নিৰ্মলা আৰু বীণা বৰুৱাৰ 'জীৱনৰ বাটত' উপন্যাসৰ তগৰ চৰিত্ৰ দুটাৰ সামগ্ৰিক দিশৰ প্ৰণালীবদ্ধ বিচাৰ-বিশ্লেষণ দাঙি ধৰাৰ প্ৰয়াস কৰা হৈছে। তগৰ আৰু নিৰ্মলা চৰিত্ৰ দুটা ভাৰতীয় উপন্যাস সাহিত্যৰে উল্লেখনীয় সৃষ্টি। এই চৰিত্ৰ দুটি অধ্যয়নে তৎকালীন ভাৰতীয় সমাজত নাৰীৰ স্থান কি তাৰ উমান দিয়ে। দুয়োটা চৰিত্ৰৰ জীৱন পৰিক্ৰমা বহু ঘাত-প্ৰতিঘাতেৰে পৰিপূৰ্ণ; যিবোৰ ভাৰতীয় পুৰুষপ্ৰধান সমাজ ব্যৱস্থাত নাৰীৰ ক্ষেত্ৰত সুলভ। নাৰী জীৱনৰ এই ঘাত-প্ৰতিঘাতসমূহ দুয়োৰে মাজত বহুখিনিত মিল আৰু বহু ক্ষেত্ৰত অমিল স্পষ্ট। ঔপন্যাসিকদ্বয়ে চৰিত্ৰ দুটা দুই ভিন্ন দৃষ্টিভঙ্গীৰে অঙ্কন কৰিলেও চৰিত্ৰ দুটাৰ মাজত আচৰিত ধৰণে সাদৃশ্য পৰিলক্ষিত হয়। পুৰুষপ্ৰধান সমাজখনত অৰ্থলোভে (যৌতুক) নাৰীক বিভিন্ন সময়ত বিভিন্ন ধৰণে সমস্যাতে পেলাইছে। তাৰ উমান এই চৰিত্ৰ দুটাৰ জীৱন পৰিক্ৰমাৰ পৰাই পাওঁ। প্ৰেমচন্দে নিৰ্মলা চৰিত্ৰটি অঙ্কন কৰিছে উত্তৰ ভাৰতৰ হিন্দী বলয়ৰ সমাজ ব্যৱস্থাৰ আধাৰত আৰু তগৰক অঙ্কন কৰা হৈছে অসমীয়া সমাজ ব্যৱস্থাৰ পৰিবেশত। নিৰ্মলা আৰু তগৰে সন্মুখীন হোৱা ভিন্ন পৰিস্থিতিত সিহঁতৰ মানসিক ক্ৰিয়া-প্ৰতিক্ৰিয়া, চিন্তা-চেতনা, কাম-কাজসমূহৰ মাজত মিল-অমিলসমূহৰ বিচাৰ-বিশ্লেষণৰ প্ৰয়োজনীয়তা উপলব্ধি কৰিয়েই বিষয়টি নিৰ্বাচন কৰা হৈছে।

বীজ শব্দ : প্ৰেমচন্দ, নিৰ্মলা, যৌতুক, বীণা বৰুৱা, জীৱনৰ বাটত, তগৰ।

### অৱতৰণিকা :

হিন্দী সাহিত্য কাননত প্ৰেমচন্দৰ স্থান একক। প্ৰেমচন্দৰ ১৫খন উপন্যাস, ৮০০তকৈ অধিক চুটিগল্প আৰু অধিকৈখন নাট্য সাহিত্যৰ চানেকিৰে হিন্দী সাহিত্যৰ পেৰা সমৃদ্ধশালী কৰে। পৰাধীন ভাৰতৰ পুৰুষ-প্ৰধান সমাজখনে নাৰীক হেয় দৃষ্টিৰে চাই নিজৰ বহুতীয়া কৰি ৰাখিছিল। ঔপন্যাসিকৰ সমসাময়িক সমাজত নাৰীক উপলক্ষ কৰি উপলভ্য বক্তব্যৰ ব্যৱহাৰ আছিল লক্ষণীয়। নাৰীয়ে সততে ভুগিব লগা হৈছিল পুৰুষ-শাসিত সমাজৰ নিৰ্যাতন, পুৰুষৰ শাসন। ঔপন্যাসিকে এইসমূহৰ জীয়া-বাস্তৱ ছবি 'নিৰ্মলা'ত নিৰ্মলা চৰিত্ৰৰ আধাৰত উপস্থাপন কৰিছে। ন-কৈ বিকশিত হোৱা মধ্যবিত্ত লোকৰ সুযোগ-সন্ধানী চৰিত্ৰও 'নিৰ্মলা'ত অঙ্কিত হৈছে।

বীণা বৰুৱাৰ 'জীৱনৰ বাটত'ত অসমীয়া কথা-সাহিত্যৰ পেৰাৰ অমূল্য সম্পদ। তগৰ দুৰ্ভাগিনী নাৰী। অসমীয়া ভাষাসমূহৰে কমলাকান্তই তৰুণী তগৰৰ আকাঙ্ক্ষা চূৰমাৰ কৰি তাইৰ যি 'সৰ্বনাশ' কৰিলে, ভাটী বয়সতো

**A COMPARATIVE STUDY BETWEEN MADHABEVA'S  
'KAKUTI' AND SUPPLICATION OF TUKARAM AND RAVIDAS**

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**ABSTRACT**

Bhakti movement was at peak in medieval period. Started in seventh century Indian Bhakti movement came up in true phase in 15<sup>th</sup> decade. Efforts from various dignitaries like Tukaram in Maharashtra middle India, Ramanada-Kabir and Kabir's disciple Ravidas from North India, Bidyapati from Mithila, Chaitanya from West Bengal and Sankardeva-Madhabdeva in North-East India strengthen the base of Bhakti movement. Considering adoration as the prime way to achieve God worshiper dedicate themselves completely. But this self supplication or dedication is different for every worshiper. Tukaram and Ravidas acquired self-supplication as the major source for worship; whereas Madhabdeva who is also known as 'Chota Ata' used 'Kakuti' based on 'Dasya Bhakti' as major component for worshiping God. This research paper will focus on how Madhabdeva believed in 'Dasya Bhakti' to worship God through Kakuti on contrary to Tukaram and Ravidas's supplications with some examples.

**Key words:** Tukaram, Ravidas, Madhabdeva, Supplication (*Atmanibedon*), Kakuti.

**INTRODUCTION**

With the expansion of Bhakti movement in entire India during 15<sup>th</sup> decade ample amount of religious writings were created in regional languages. And similarity can be discovered among these poets as they share a common philosophical base and subject. However presence of liberty can also be noticed in the poems. In the discussion similarity between some poems of Indian poets and Madhabdeva's one of the best poem 'Kakuti' is being conversed briefly.

One thing must be mentioned here that we have studied poems of Tukaram and Ravidas in translated English form, therefore the paper includes translated version of the poems.

**SCOPE AND EXPLANATION**

In the medieval Indian religious field Bhakti movement attained heights in every aspect. Bhakti movement started by Alawars in South India in 7<sup>th</sup>-8<sup>th</sup> century expanded to other parts in a short span. In 14<sup>th</sup> and 15<sup>th</sup> century with the efforts from Ramananda, Kabir, Ballavacharya, Dadudayal in North India Bhakti movement extended to India in a stronger manner. In this period Bhakti movement became popular under the leadership of Sankardeva in Middle and North-East India. Under the strong headship of Tukaram in middle India, in western India Ravidas and in Assam Sankardeva-Madhabdeva Bhakti movement proliferated. Through the writings of Tukaram and Ravidas they have expressed their devotion towards God on the other hand in the writings of Madhabdeva plea towards God is expressed.

**SIGNIFICANCE OF THE STUDY:**

Tukaram, Ravidas and Madhavdev are all spiritual gurus in India. They surrendered themselves to God and sought the path of self-liberation. The main purpose of this paper is to study how pleading or self-surrender is expressed in the works of the three poets under discussion.

**METHODOLOGY:**

The present research paper we follows the comparative approach in order to achieve the intended objectives

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## The Folk songs of the Tea Tribes of Assam: An Aesthetic Study

—Dr. Gakul Kumar Das

*The Folksongs incorporates the saga of the ever changing social structure and culminates in the present scenario. They therefore are the poignant ethos of the communities, relating their sentiments and highlighting their lives.*

### Abstract:

The British had brought these people from various states of India and reinstated them in the hazy states of Assam over a period of about one hundred years. Irrespective of caste, creed or languages these people were habituated in the various lines in the tea gardens of Assam. This resulted in a strong bond of brotherhood and there was an emergence of a unique culture initiated by fraternal ties. There was no specificity in the culture tapestry of the tea tribes; it was an intricate weave of the culture and traditions of the different sects leading to a composite and variegated culture of the Tea Tribes of Assam.

Art & culture and the lifestyle of any community are the essence of the heritage of that particular community. The social infrastructure of a community nourishing the culture and enable it to progress and flourish. My topic of discussion is the "Folksongs of the Tea Tribes of Assam: An Aesthetic Study". Instead of a detailed exodus on the life and culture of the Tea Tribes, I have endeavored to focus on the folksongs, an integral part of any community, and discuss on their intricacies and nuances.

### Songs of the soul

Folksongs indeed are songs of the soul! Emerging from the core of the heart, they summarized the deep values of human sentiments and emotions and are verbally handed down from one to another and do not have any formal lyrics. They are beyond the bounds of literacy and the songs pulsate with the tales of common illiterate village folks, their lives and thoughts.

joys and agonies. Folk songs may vary from region to region, or even, in a broader sense, country to country, yet the essence is always similar, for every folks songs reflect the jubilation & pathos of the common man. These are unique, verbally composed, which are handed down from one to another, maybe through generations. They may be sung through the ages or composed on the spur of moment.

The Folksongs incorporates the saga of the ever changing social structure and culminates in the present scenario. They therefore are the poignant ethos of the

শব্দ সংযোজন : রতিকাঁত কলিতা

আবরণ পৃষ্ঠ :

অসম ৰাষ্ট্ৰভাষা প্ৰচাৰ সমিতি কী ওৱৰ সে মঁওী ডাঁ. ধীৰেদা কুমাৰ শঙ্কীয়া দ্বাৰা সৰাহঘাট ফটো টাছপ্স প্ৰা.লি., ইন্ডিন্টিয়ল ইন্সটেট, গুৱাহাটী-781021 মঁ মুদিত, প্ৰকাশিত এঁব প্ৰসারিত।

সৰ্বাধিকাৰ : অসম ৰাষ্ট্ৰভাষা প্ৰচাৰ সমিতি, গুৱাহাটী-32

'দ্বিভাষী ৰাষ্ট্ৰসেৱক' মঁ প্ৰকাশিত ৰচনাওঁ কে বিচাৰেঁ সে অসম ৰাষ্ট্ৰভাষা প্ৰচাৰ সমিতি কা সহমত হীনা আবৰশ্যক নহী হৈ। প্ৰকাশিত সামগ্ৰী কে উপযোগ হেতু প্ৰকাশক কী অনুমতি আবৰশ্যক হৈ। সৰ্বী কানুনী বিৱাৰ্দেঁ কা নিপটৰা গুৱাহাটী ন্যায়ালয় কে অধীনস্থ হীয়া।

ISSN 2321-4945  
UGC CARE Listed Journal  
RNI NO. ASSBH/2009/31008

প্ৰবন্ধ

## মামনি ৰয়ছমৰ 'পৰশু পাতৰৰ নাদ' আৰু আৰ. কে. নাৰায়ণৰ 'ইঞ্জিন ট্ৰাব'ল' : এটি তুলনামূলক আলোচনা



ড° গকুল কুমাৰ দাস

অৱতৰনিকা :

সাম্প্ৰতিক সাহিত্যক্ষেত্ৰত তুলনামূলক সাহিত্যৰ দৃষ্টিভংগী অতি ব্যাপক আৰু বিশ্বমানৰ বুলি বিবেচনা কৰা হৈছে। সাহিত্যৰ মানদণ্ডক তুলনামূলক বিচাৰে উচ্চ পৰ্যায়লৈ পৰ্যবসিত কৰা দেখা হৈছে। এই ধৰণৰ বিচাৰে সমাজ, সাহিত্য বা সংস্কৃতিৰ স্বকীয় বৈশিষ্ট্যসমূহ নিকপণ কৰাত সহায় কৰে। ভাৰতীয় সাহিত্যৰ বিভিন্ন প্ৰাদেশিক পৰিমণ্ডলত চুটিগল্পৰে প্ৰসিদ্ধি লাভ কৰা সাহিত্যিকসকলৰ ভিতৰত মামনি ৰয়ছম গোস্বামী আৰু আৰ. কে. নাৰায়ণ অন্যতম। নিজস্ব ষ্টাইল আৰু বিষয়েৰে গল্পসমূহক দুয়োজন গল্পকাৰে স্বকীয়তা প্ৰদান কৰিবলৈ সক্ষম হৈছে। মামনি ৰয়ছম গোস্বামীয়ে ৰচনা কৰা 'পৰশু পাতৰৰ নাদ' আৰু আৰ. কে. নাৰায়ণৰ 'ইঞ্জিন ট্ৰাব'ল' শিৰোনামৰ গল্প দুটাৰ তুলনামূলক আলোচনাৰ জৰিয়তে গল্পকাৰ দুগৰাকীৰ গল্পৰ বিশেষত্বসমূহ বিচাৰ কৰিব পৰা যায়। ইয়াৰ উপৰি দুয়োটা গল্পৰ অন্তৰ্নিহিত তত্ত্ব, সাদৃশ্য, বক্তব্য বিষয়সমূহ আৰু গল্পকাৰৰ দৃষ্টিভংগীৰ সন্দৰ্ভতো তুলনামূলক বিচাৰৰ জৰিয়তে আলোচনা কৰিব পাৰি।

মামনি ৰয়ছম গোস্বামীৰ গল্প - চমু আলোকপাত :

মামনি ৰয়ছম গোস্বামী অসমৰ সাহিত্যাকাশৰ এটা উজ্বল নক্ষত্ৰ। চুটিগল্পৰে সাহিত্য জীৱন আৰম্ভ কৰা মামনি ৰয়ছমে গল্পৰ সমানুপাতিকভাৱে উপন্যাস ৰচনাৰ জৰিয়তেও খ্যাতি অৰ্জন কৰিছে।

মামনি ৰয়ছমৰ গল্পসমূহ গভীৰ অন্তৰ্দৃষ্টি সম্পন্ন। জীৱনৰ সঞ্চিত অভিজ্ঞতাসমূহ একত্ৰিত কৰি তেওঁ গল্পত ৰূপদান কৰিছে। জীৱনৰ যাত-প্ৰতিঘাত, দুঃখ-যত্না, জীৱনৰ অৰ্থহীনতা আদি তেওঁ গল্পৰ জৰিয়তে প্ৰকাশ কৰিবলৈ সমৰ্থ হৈছে। সময়ে সময়ে তেওঁৰ গল্পত প্ৰতিবাদী নাবীসত্তাই মূৰ দাঙি উঠিছে। কেতিয়াবা আকৌ দৰিদ্ৰ, নিঃস্ব, শ্ৰমজীৱী মানুহৰ জীৱন-যত্না তেওঁ অতি সাৰ্থক ৰূপত অংকন কৰিছে। মামনি ৰয়ছমৰ শ্ৰেষ্ঠ গল্পসমূহৰ ভিতৰত 'পৰশু পাতৰৰ নাদ', 'উদং ৰাকচ',

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## शोध आलेख : इंदिरा गोस्वामी के उपन्यासों में मानवतावाद / डॉ. गकुल कुमार दास

सम्पादक, अपनी माटी © रविवाट, दिसंबर 31, 2023

### इंदिरा गोस्वामी के उपन्यासों में मानवतावाद (तीन उपन्यासों के विशेष उल्लेख के साथ)

- डॉ. गकुल कुमार दास



**शोध सार :** साहित्य में मानवतावाद एक शाश्वत विषय है। साहित्य में मानवतावाद को युगों-युगों से व्यक्त किया गया है। इसमें असमिया साहित्य में भी कोई कमी नहीं है। आधुनिक असमिया साहित्य की प्रणेता और ज्ञानपीठ पुरस्कार विजेता इंदिरा गोस्वामी ने अपनी कहानियों और उपन्यासों के माध्यम से आधुनिक भारतीय साहित्य को गतिशीलता प्रदान की है। इंदिरा गोस्वामी ने मामले धरा तरूवाल, दताल हातीर उये खुवा आउदा, तेज आरु धुल्लिरे धुखरित पृष्ठा सहित कुल बारह असमिया उपन्यास लिखे हैं। इंदिरा गोस्वामी के उपन्यासों के अध्ययन से पता चलता है कि उनकी उपन्यासों के विषय वस्तु अलग है। विषय वस्तु की अभिव्यक्ति बहुत रोचक है उनके उपन्यास मानवतावाद के दर्शन से प्रेरित हैं और यथार्थवाद में विश्वास रखते हैं। उनके उपन्यास मानवता का ज्वलंत चित्र प्रस्तुत करते हैं। प्रस्तावित आलोचना में इंदिरा गोस्वामी के तीन उपन्यास जैसे- मामले धरा तरूवाल (अंग्रेजी अनुवाद- The Rusted Sword and Two Other Novels), दताल हातीर उये खुवा आउदा(अंग्रेजी अनुवाद- The Moth Eaten Howdah of a Tusker), तेज आरु धुल्लिरे धुखरित पृष्ठा (अंग्रेजी अनुवाद- Pages Stained With Blood) में प्रतिबिंबित मानवतावाद पर चर्चा करने का प्रयास किया गया है।

**बीज शब्द :** शाश्वत विषय, असमिया उपन्यास, असमिया साहित्य, मानवतावाद, प्रत्यक्ष अनुभव, उपेक्षित वर्ग, यथार्थवाद, हास्य, मानवता के चित्र, अभिव्यक्तियाँ।

**मूल आलेख :** मानवतावाद को नवजागरण के समयउत्पन्न होने वाले साहित्य और ललित कलादर्शन का एक शैली कहा जाता है। मानवतावाद का अर्थ है लोगों में विश्वास रखना। आधुनिक साहित्य की यथार्थवादी शैली तथा उपन्यास साहित्य जिस धारा पर आधारित है, वास्तविक जीवन पर आधारित इस शैली को मानवतावादी साहित्य का एक विशेष अंग मानी जाती है। भारतीय समाज-साहित्य तथा ध्यान धारणाओं में मानवतावाद का स्थान सदैव रहा है। लेकिन अंग्रेजों के आगमन के बाद इसका स्थान अधिक उँचा हुआ है। भारतीय समाज व्यवस्था में धर्म के नाम पर, ईश्वर के नाम पर मानवताको दबाया गया है। लेकिन नवजागरण के बाद मानवतावाद भारतीय साहित्य में निहित हो पाया है। इंदिरा गोस्वामीमानवतावादी धारा के दर्शन से प्रेरित होने वाली तथा यथार्थवाद में विश्वास रखने वाली एक असाधारण प्रतिभा सम्पन्न लेखिका हैं।

ज्ञानपीठ पुरस्कार विजेता साहित्यिक इंदिरा गोस्वामी उर्फ मामनि रायसोस गोस्वामी युद्धोत्तर आधुनिक युग के एक प्रमुख उपन्यासकार हैं। उन्हें असम में मामनि रायसोम गोस्वामी के नाम जाना जाता है तथा अखिल भारतीय मंच पर इंदिरा गोस्वामी के नाम से जाना जाता है। उनके उपन्यास पारंपरिक उपन्यास हैं- विषयवस्तु नवीनता का है, चरित्र का नहीं। मानसिक जगत के सुंदर वर्णन और अनूठी शैली के लिए उनके उपन्यासों को काफी पसंद किया जाता है। इंदिरा गोस्वामीअसमिया साहित्य के मौलिक लेखकों में से एक हैं। उनकी साहित्य की विषय-वस्तु विशिष्ट है, अभिव्यक्ति शैली निर्भीक है। साहित्य में प्रत्यक्ष अनुभव की छाप, समाज के उपेक्षित वर्गों के प्रति सहानुभूति स्पष्ट होती है। गोस्वामी ने सन 1972 में 'चेनाबार सोत'उपन्यास के माध्यम से उपन्यास जगत में खुद को प्रतिष्ठा किया। इसके बाद उन्होंने 'नीलकंठी ब्रज', 'अहिरन', 'मामरे धरा तरूवाल', 'दतालहातीर उये खुवा हाओदा', 'जखमी यात्री', 'उदयभानुर चरित्र', 'तेज आरु धुल्लिरे घुसरित पृष्ठा', 'दाषरतिर खुज', 'चित्रमस्तार मानुहुतु', 'थेफ्राखी तहसीलदारर तामर तरूवाल' नाम का बारह उपन्यासों का रचना किया। इन उपन्यासों के माध्यम से उन्होंने जो कहानियाँ और पात्रों का सृजन किया, वह अन्य उपन्यासकारों के लिए दुर्लभ हैं। गोस्वामी के उपन्यास पारंपरिक उपन्यास नहीं हैं। 20 साल की उम्र में ही कहानी की रचना करके उन्होंने खुद को प्रतिष्ठापित किया। उनके उपन्यासों में प्रत्यक्ष अनुभव, विस्तृत विवरण के प्रति जागरूकता और समाज के उपेक्षित वर्गों के प्रति सहानुभूति स्पष्ट रूप से प्रतिफलित होती है। पारंपरिक समाज द्वारा धर्म के नाम पर महिलाओं को वंचना करना तथा अवसादग्रस्तक्रोध को व्यक्त करना ही उनके उपन्यासों का मूल विषयवस्तु है। असमिया साहित्य में अन्यतम शक्तिशाली महिला पात्रों को उनके उपन्यासों में मुख्य रूप मिला है। उनके उपन्यासों में मानवता की तस्वीर खूबसूरती से झलकती है।

इंदिरा गोस्वामीअसमिया साहित्य के अलावा अखिल भारतीय साहित्य जगत में भी सबसे सफल और सर्वश्रेष्ठ लेखकों में से एक हैं। असमिया में बारह उपन्यासों की रचना करने वाली उनकी उपन्यासों का अंग्रेजी और हिंदी भाषा में भी अनुवाद किया गया है। गोस्वामी के बारह उपन्यासों में से 'मामरे धरा तरूवाल', 'दताल



**A STUDY ON THE IMPACT OF COVID-19 IN THE HOME-BASED ENTERPRISES (HBES) IN SONITPUR DISTRICT OF ASSAM, INDIA: RECOVERY & CONTINUITY**

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**ABSTRACT:**

The Novel Coronavirus (Covid-19) acute respiratory outbreak crisis spread to over 200 countries worldwide including Asia, Europe, America, and Australia, which began in Wuhan, China in December 2019. The World Health Organisation (WHO) classified this outbreak as a pandemic due to an increase in human-to-human infection. Therefore, many countries imposed travel restrictions and movement controls. These restrictions during the pandemic directly affected small businesses more than their larger counterparts. Due to the closure of numerous supporting industries like retail and transportation, most of the entrepreneurs experienced business cancellation or closure as well as a decrease in income. In India lockdown started on March 22, 2020, for more than three months. During the Financial Year 2020-21, 67 percent of MSMEs were temporarily shut-down for a minimum of three months due to the pandemic and 50 percent of units witnessed a decline in their revenues in 2020-21 as MSME Minister Narayan Rane addressed Lok Sabha in question hours on February 3, 2021. Moreover, 5,907 MSMEs were shut during the financial year 2020-21 and 2021-22 due to the pandemic as per the government data. The recovery and continuation of this sector are of utmost importance for the survival of the nation. Home-based Enterprises belong to micro-enterprises since heavy industries are not allowed to establish themselves along with homes or in residential areas by government regulations and fulfill the norms of the micro-enterprises as per the revised classification applicable w.e.f. July 1, 2020, of the MSMED Act 2006. This paper is based on primary as well as secondary data. The primary data were collected immediately after the pandemic from 120 Home-based enterprises of Sonitpur district of Assam.

**Keywords:** Home-based Enterprises (HBES). Micro enterprises, Covid-19 pandemic.

**1. INTRODUCTION:**

The COVID-19 pandemic outbreak had a significant impact on the global economy. It was crucial to research the effects of various policies to examine the pandemic's long-term effects on economic growth. The Novel Coronavirus (Covid-19) acute respiratory outbreak crisis spread to over 200 countries worldwide including Asia, Europe, America, and Australia, which began in Wuhan, China in December 2019. The World Health Organisation (WHO) classified this outbreak as a pandemic due to an increase in human-to-human infection (Qiu, Rutherford, Mao, & Chu, 2017), which has resulted in over 200,000 deaths in the three months since the outbreak began (WHO, 2020). It was observed that movement restriction is the best method for controlling the spread of infectious diseases such as coronavirus (Chinazzi et al, 2020; Sohrabi et al, 2020; Smith & Freedman, 2020). Many countries imposed travel restrictions and movement controls. These restrictions during the pandemic directly affected India's small businesses more than their larger counterparts. Due to the closure of numerous supporting industries like retail and transportation, most of the entrepreneurs experienced business cancellation or closure as well as a decrease in income. In India, the honourable Prime Minister Sjt. Narendra Modi called a 14-hour voluntary lockdown on March 22, 2020, which was known as the "Janata Curfew" for the first time due to the COVID-19 pandemic. After three days, i.e. from March 25, 2020, a nationwide lockdown across India was imposed till April 14, 2020, and that was further extended to May 3, 2020, and then to June 7, 2020. In order to manage the situation, the lockdown was once again extended until May 31, 2020. More than three months of complete lockdown in the country totally collapsed the MSME sector. It has disrupted the operation of several important sectors,

## The Big Three of Financial Literacy: Analyzing its Influences on Financial Wellbeing

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**Keywords:** financial literacy, the big three, factor analysis, influence, financial wellbeing.

### Abstract

This study attempts to identify the key components of financial literacy and its constituent factors, and to examine influences of people's financial literacy on their financial well-being. The study is mainly based on the primary data collected from 384 randomized samples from the Indian state of Assam. Data analysis was carried out using statistical techniques such as factor analysis, regression analysis, and correlation analysis. A thorough review of the empirical literature, and findings of the present study reveal three major components- "financial knowledge, financial behavior, and financial attitude" -that constitute people's financial literacy, which are coined as "the big three of financial literacy." Financial literacy and its three major components are found to have strong and significant influences on people's financial well-being. It is concluded that an increase in people's financial literacy results in an increase in their financial well-being, and vice versa.

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Published  
2023-07-05

Issue  
[Vol. 17 No. 2 \(2023\): Summer 2023](#)

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## Measuring Financial Health and Performance of the Oil and Natural Gas Companies in India



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Price: ₹ 500

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**Keywords:**

Financial analysis, listed companies, oil and natural gas sector.

**JEL Codes:**

G30, L25, M41.

### Abstract

The study attempted to investigate the financial health and financial performance of the oil and natural gas companies in India. Financial health was measured using the Altman Z-score model, and financial performance was evaluated through the return on equity (ROE). Conclusions were drawn based on the data collected from five randomly selected oil and natural gas companies listed on India's leading stock exchanges. The findings highlighted financial health and performance distinctions between public and private sector companies, rooted in resource allocation and capacity utilisation variances. Nevertheless, the study established a robust and statistically significant positive correlation between financial health and performance. It was concluded that enhanced financial health corresponds to elevated financial performance and vice versa.

### Description

Indian J Econ Dev, 2023, 19(4), 873-879  
<https://doi.org/10.35716/IJED-22475>

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## KEYWORDS



## Reflection of Bodo Society and Folklore in the novel 'Sanmwkhangari Lamajwng' by Katindra Swargiary

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**Abstract:** *This paper aims to study and identify the various aspects of Bodo society and folklore as reflected in Katindra Swargiary's Bodo social novel "Sanmwkhangari Lamajwng." It is also an attempt to analyze and critically examine the significance of social practices and folklore elements reflected in the novel in the contemporary Bodo society. Literature is an expression of society or a reflection of human life experiences, which carries human activities of a particular society in the form of novels, poems, short stories, drama and essays, and displays it to the people of the world like a mirror of society. Folklore is one of the main elements of society, which involves the entire social life events of the people. The novel "Sanmwkhangari Lamajwng" (first published in 2002) is based on the socio-cultural life of the Bodos settling in the neighbouring areas of Salbari under the Baksa district of the state of Assam. In this novel, the traditions, customs, rituals, festivals, socio-cultural practices and folklore elements are reflected beautifully. The aspects of society and folklore are essential and effective tools for understanding the social and cultural context of an ethnic group or a community. Therefore, the present study shall help in terms of understanding, documenting and preserving the socio-religious and cultural practices and folklore elements of the Bodo community.*

**Key words:** *Katindra Swargiary, Bodo society, Customs, Festivals, Cultural habits, folklore.*

### 1. Introduction:

The Bodos are one of the major ethnic groups of North East India. The term 'Bodo' represents both the language and the community. The Bodos are the early settlers of Assam in

North East India and are scattered in almost all the areas of Assam and some parts of North East India, West Bengal, and some adjoining international areas like Bangladesh, Nepal and Bhutan (Brahma, 2012:3). Like many other communities of Assam, the Bodos have their own language, literature, cultural heritage, society and folklore, which have established the Bodos as a distinct community. The Bodo social structure is primarily patriarchal, with a few elements of matriarchal characteristics (Bhattacharya, 2007:16). Lineage is also traced through the patrilineal kinship system. Agriculture is the main source of their livelihood.

A society is a collection of people who share similar customs, rituals, festivals, ceremonies and culture. Folklore is a body of expressive cultural activities shared and passed down from generation to generation within a particular group of people. It encompasses all elements of social activity, such as customs, traditions, folk songs, folktales, folk crafts, food habits, folk costumes, rituals, festivals, beliefs, folk religion, folk medicine, singing, dancing, etc. Folklore and literature are inevitable elements of society. The elements of folklore are social products and are transmitted by the people. Literature is the product and process of the elite groups of society. The main purpose of literature is to revitalize and influence our thinking process. The writers aim to portray the realities of society through different genres of literature, such as novels, poetry, stories, dramas, etc. Literature encourages us to think carefully about social problems, and it sometimes offers us solutions to those problems. It also helps us to document the thoughts and feelings of brilliant minds.

Though society, folklore and literature are three distinct classes with their own identities, these three disciplines are interlinked and influence each other in one way or another. The traditional bearers preserve the folklore materials in their memories and transmit them to the next generations in society. Folklore may be found in its proper form of development through the individuals in society. Society is dependent on a group of people, folklore depends on the people in a society, and literature is dependent on a society that represents both society and folklore components. Literature serves as a mirror to society, which depicts real-life experiences and social interactions of people. Though literature is the product and process of the elite groups of society, the aspects of folklore and society do creep into it for various reasons. Literature represents human activities in that society. Therefore, we cannot deny that folklore and society are present in literature. Without folklore elements of any society, no literature can be found in proper form and development. Through literature, one can learn about folklore and aspects of society and folklore in their pieces of writing.

### 2. Objectives:

The main aims and objectives of the present research paper are-

□ To study and identify different aspects of Bodo society and folklore as reflected in the select novel "Sanmwkhangari Lamajwng" by Katindra Swargiary.

## **The Concept of Sāṃkhya Trigūṇa: An Analytical Study from Psychological Perspective**

**Mridusmita Bharadwaj**

### **Abstract**

Philosophy is an elusive and prevalent branch of knowledge. The various systems of Indian philosophy provide ideas regarding knowledge of truth. Despite the differences of ideas, the Indian philosophical systems aim to get the liberation. Psychological discipline plays an important role to get detached from the worldly attachment and therefore, Upanisads, the Yogasūtra, the Sāṃkhyasūtra, the Bhagavad Gita and the schools of Buddhism and Jainism raise the importance of psychological discipline. In ancient period there was no independent branch of knowledge of Psychology but the Indian philosophical thinkers had developed highly systematic views regarding mind and its management. The present research paper tries to analyse the concept of Sāṃkhya Trigūṇa from Psychological Perspective. The relation between the Sāṃkhya Trigūṇa and Psychological behaviour of an individual is tried to explain in this research paper.

**Key words:** Trigūṇa, Psychological behaviour, Philosophy, Sāṃkhya.

Indian philosophy is considered as the most important achievement of Indian thought. The practical and theoretical activities of India revolve around the spiritual connectivity that is only rendered to us by means of philosophy. In Indian philosophy, spiritual aspiration is regarded as the superior to everything else. Indian system of philosophy can be divided into two divisions- Nāstika i.e., Heterodox and Āstika i.e., Orthodox. The Nāstika philosophy is three in number- Cārvāka, Bauddha and Jaina. They are called as Nāstika

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because they do not believe in the authority of the Vedas. Again, Āstika philosophies are six in number viz. Sāṃkhya, Yoga, Nyāya, Vaiśeṣika, Mīmāṃsā and Vedānta. In modern Indian languages Āstika and Nāstika generally mean 'theist' and 'atheist' respectively. As Satishchandra Chatterjee and Dhirendramohan Datta discuss in their book entitled 'An Introduction to Indian Philosophy' the

# A Note on the Shiva Sculpture at Gosainjuri Changmaji Mikir Pathar, Assam

Sweta Mahanta

## Abstract

The Kapili Jamuna valley which formed the early Devaka kingdom of ancient Assam abounds in archaeological wealth. Many temple and structural remains including sculptural art has been found in the region. One such site is Gosainjuri Changmaji Mikir Pathar situated in the newly formed district of Hojai in Assam. A Shiva image is found at the site inside a modern temple premise. A Shiva linga and some structural remains have also been found at the site. This paper examines the artistic features of the Shiva image which portrays the distinct art of the Kapili Jamuna valley. The overtly masculine figure along with its benevolent form which the sculpture depicts is a rarity which is not found elsewhere in the region and the discussion seeks to address this aspect.

**Keywords:** Kapili Jamuna valley, Shiva, sculpture, art, masculinity

## Introduction

The Kapili Jumana valley of ancient Assam, located on the south bank of the Brahmaputra river covers the present districts of Nagaon, Marigaon and the newly formed Hojai districts. The earliest reference to the Kapili Jumana valley as the Kingdom of Devaka is found in the Allahabad Pillar Inscription of the Gupta ruler Samudragupta datable to the fourth century CE. In the inscription, the king of the kingdom of Devaka along with the ruler of the kingdom of Kamarupa paid allegiance to the Gupta monarch as tributary monarchs. However, at a later period both Kamarupa and the kingdom of Devaka or Doboka broke off from the Gupta yoke. According to R.M. Nath, in 428 CE when the Gupta ruler Kumaragupta was ruling in north India, a king of the Kapili Valley sent an embassy to China.<sup>1</sup> The sending of embassy to China indicates the acquiring of independence by the kingdom of Deboka probably by the second quarter of the fifth century CE. Many archaeological remains in the form of sculptures, temple remains and other material remains adorn the sites of Jogijan, Mikir, Doboka, Rajabari, Gachtal, Mahadeo-sal and others affirming a flourishing civilization in the area. By the first half of the sixth century CE, the Kapili Jamuna Valley was incorporated into the kingdom of Kamarupa during the reign of the Varman ruler, Bhutivarman or Mahabhatavarman. The sixth century CE. Barganga Rock Inscription records the establishment of a religious *asrama* at Daboka by Avaguna,<sup>2</sup> the officer placed in charge of the newly acquired territory of Kapili Jumana Valley by the Varman ruler Bhutivarman. From then on, the kingdom of Davaka became a part of the kingdom of Kamarupa and continued to remain so during the rule of the Salatambha and the Pala dynasties of Kamarupa. Copper plate grants of land to the Brahmanas of the Kapili Jumana Valley are found to be issued by the Salastambha and Pala rulers.

Amongst the numerous sculptural and structural remains found in the Kapili Jumana valley, the archaeological remains at Gosainjuri Changmaji Mikir Pathar are worth mentioning. There exist three temple mounds belonging to the tenth-eleventh CE. There are ruins of temple structures like carved lintels, gables and pillars. There also exists an image of Visṇu carved in stone, almost 1.20 metres in height. A Shivalinga within a Yonipitha, and an image of Lakshmi are also found at the temple complex. These sculptural arts found in the temple complex however exhibit features which show that it belonged to c. 1000-1100 CE. and was part of the ancient Devaka kingdom. About 200 metres to the south of it one can also find an image of Shiva carved in stone inside a modern-day temple premise. This paper tries to look into the artistic aspects of this Shiva sculpture at Gosainjuri Changmaji Mikir Pathar situated about eight kilometres away from Hojai town. A field survey was conducted for the purpose of documenting the remains at the site. The local people were also consulted to during the preliminary investigation to understand the history of the site. The paper is an attempt to portray the sculpture in the light of the field visit conducted.

*Art and Architecture of the Nāmghars of Assam :  
An Epitome of Bhakti Culture*

Sweta Mahanta

**Abstract**

The lamp of *Bhakti* was lighted in Assam by Sri Srimanta Sankaradeva. His simple teachings of love and devotion as the ultimate way to reach the divine earned him followers from all walks of life. Sankaradeva started propagating his teachings in the nāmghar or kīrtana ghar built for the purpose of recitation of the lord's name by his followers. The art and architecture of the Nāmghar is in itself an essence of showcasing bhakti culture and tradition. Through this paper an attempt has been made to trace this aspect of design and simplistic art form found in the construction of the *Nāmghars* and how it goes hand in hand with the *Bhakti* tradition attributing simplicity in life and worship.

**Key Words:** Nāmghar, Monikut, Singhāsana, Art, Architecture.

In the 15th century, the Bhakti Movement advocating love for God and absolute surrender to the Divine as a means of obtaining salvation became a popular reform movement in India. Its roots can be traced to the South Indian Nayanar and Alvar saints who advocated *bhakti* as a means of enjoying divine bliss irrespective of caste and creed between 7th to 10th centuries C.E. It spread northwards from Tamil Nadu through Karnataka and Maharashtra, and gained acceptance in fifteenth century Bengal and North India. It emerged as a localised expression and notion of divinity and embodied the conservative and the liberal, as well as the revivalist and reformist trends. It contained both conformism and dissent.<sup>1</sup> Ramanujan, Kabir, Chaitanya, Guru Nanak are some of the prominent *Bhakti* philosophers to name a few.



## Role Of Panchayati Raj Institution In Eradication Of Poverty: A Case Study From Kamrup District, Assam (India)

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### Abstract

In order to build a more flourishing, identical and secure world by 2030 Seventeen Global Goals has been put forwarded by the United Nations in the year 2015. Among these 17 goals one of the goals is focused on poverty eradication from global society. This is very crucial for society as various socio-economic problems are directly or indirectly linked up with this social phenomenon. In the particular case of India, during the last two decades, the national authorities have implemented several poverty alleviation programs among the poor. The objective of these programs is to improve their standard of living. For this purpose, constitutionally sanctioned local govt. system i.e. Panchayati Raj Institution (PRI) is a crucial driving force for visioning, planning, developing implementation and monitoring the various govt. welfare schemes at the grassroots level. The current study is focused on the roles that play by PRI in achieving the first goal of SDGs in a village from the influence zone of Assam's capital city Guwahati through case study. For that both primary and secondary data base are used to draw the conclusion. Along with the govt.'s efforts it's the duty of local people also to cooperate in implementing and proper maintenance of the various poverty alleviation schemes in the study area.



### Article History

Received: 18 October  
2022  
Accepted: 23 March 2023

### Keywords

Program implementation;  
Poverty Eradication;  
Panchayati Raj Institution  
(PRI);  
Sustainable Development  
Goals (SDGs).

### Introduction

Environment refers to the surrounding conditions including both living and non-living things. The rapid anthropogenic activities increasingly degrade the quality of environment in the recent times. The environmental experts, governmental authorities, NGO's and educational institutions involved in the matter of conservation of environment has already come forward to think over the

issue relating to environmental degradation and introduced various policies. However, this is not sufficient enough, proper summarization, monitoring, reporting, developing and implementation are necessary to ensure the healthy state of the planet earth for future generation. For this purpose, 'environmental degradation calls for a sound management system which in turn is indispensable for sustainable development'.<sup>6</sup> As a dynamic

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Doi: <http://dx.doi.org/10.12944/CWE.18.1.30>



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## RESEARCH PAPER

OPEN ACCESS

## Development of pisciculture as a source of livelihood: A case study in no. 4 Borghuli Village of Nagaon District, Assam (India)

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**Key words:** Riverine, Pisciculture, Fishery, Livelihood

<http://dx.doi.org/10.12692/ijb/22.3.12-23>

Article published on March 04, 2023

### Abstract

Being a riverine state, the rearing of fish is a crucial economic activity in the land of Assam. Its rich water resources in the form of wetlands, beels, ponds, tanks, extensive two major river systems the Brahmaputra and the Barak can be a focal point for the development of pisciculture. Fisheries have a great economic value due to its contribution towards strengthening the local economy by providing immense employment opportunities for unemployed youths. In this regard, a geographical attempt is made through this paper to study about the development of pisciculture with special reference to economic and livelihood pattern of the fishermen of No.4 Borghuli village of Nagaon district. GIS and GPS techniques are used to observe the various factors that affecting the development of pisciculture in the study area. An estimated 50% dwellers engaged in the pisciculture is a positive sign towards socio-economic development of the study region. Along with its favourable factors if the study area gets the benefits of the Govt.'s schemes in proper way then there is no second thought that it will become a hub of fish production in near future within the state of Assam.

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## Development of pisciculture as a source of livelihood: A case study in no. 4 Borghuli Village of Nagaon District, Assam (India)

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Cite this: DOI: 10.1039/d3md00347g

## Mitochondria-targeted biotin-conjugated BODIPYs for cancer imaging and therapy†

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S. Asha Nair<sup>\*c</sup> and Pranjal Gogoi<sup>b,\*ab</sup>Received 18th July 2023,  
Accepted 21st September 2023

DOI: 10.1039/d3md00347g

rsc.li/medchem

Two BODIPY–biotin conjugates **KDP1** and **KDP2** are designed and synthesized for targeted PDT applications. Both have good absorption with a high molar absorption coefficient and decent singlet oxygen generation quantum yields. The photosensitizers **KDP1** and **KDP2** were found to be localized in the mitochondria with excellent phototoxicity of up to 18.7 nM in MDA-MB-231 breast cancer cells. The cell death predominantly proceeded through the apoptosis pathway via ROS production.

### 1. Introduction

Targeted cancer therapy has emerged as a promising approach to cancer treatment, offering potential for more effective and personalized treatments with lower side effects.<sup>1,2</sup> In recent years, PDT has shown great potential as a targeted therapy for several types of cancers, including skin cancer, lung cancer, and prostate cancer. Researchers have been constantly developing new photosensitizers with improved properties, such as better targeting and faster clearance from the body, to enhance the effectiveness of PDT.<sup>2–12</sup>

Boron-dipyrromethene (BODIPY) is a highly fluorescent dye that has been widely utilized in biology and biochemistry for numerous years.<sup>13–15</sup> This versatile dye boasts several advantages, including a high quantum yield, high stability, and broad absorption and emission spectra. As a result, they are suitable for various fluorescence-based applications such as imaging,<sup>16</sup> fluorescence probes and sensors,<sup>17–21</sup> and dye-sensitized solar cells.<sup>22,23</sup> In the last few decades, BODIPYs have been known to be capable in PDT applications; however, their singlet oxygen generation is considerably low until it's conjugated with nanomaterials. Recent advancements in BODIPY's applications include the creation of functionalized

derivatives for targeted therapy. BODIPYs have been conjugated to various targeting moieties like epidermal growth factor receptor (EGFR) targeting peptides,<sup>24</sup> nuclear localization sequences (NLSs),<sup>25</sup> carbohydrates,<sup>26,27</sup> biotin-nano-self-assemblies<sup>9</sup> and polymeric micelles.<sup>28</sup> These conjugates have shown potential for precise detection and localization, but their PDT efficacy is still low (in the  $\mu\text{M}$  range). Among the targeting moieties, biotin has gained enormous attention recently due to its application in various fields.<sup>29</sup> Biotin receptors are abundant in numerous cancer cell lines, including ovarian (Ov2008, ID8), mastocytoma (P815), renal (RENCA, RD0995), colon (Colo-26), leukemia (L1210FR), breast (4T1, JC, MMT06056) and lung (M109);<sup>30</sup> which have led to their use for PDT applications.<sup>9,31–40</sup>

Very recently, our group has developed two aza-BODIPY–biotin conjugates for PDT of cancer with good selectivity to cancerous cells.<sup>41</sup> In consideration of our previous work, to enhance the efficacy of our sensitizer, we choose BODIPY for conjugation due to its high molar extinction intensity and smaller size with our targeting unit biotin, which can have a much better impact on PDT treatment. So, in this work, we synthesized BODIPY–biotin conjugates **KDP1** and **KDP2** with acceptable photophysical and excellent photobiological properties.

### 2. Results and discussion

#### Synthesis and characterization

BODIPY–biotin conjugates **KDP1** and **KDP2** were synthesized using the synthetic route, as shown in Scheme 1. Initially, 4-hydroxybenzaldehyde **1a** was treated with propargyl bromide in the presence of a base to give **2a**. Propargylated aldehyde **2a** was treated with 2,4-dimethyl pyrrole, followed by a series of reactions to have **3**.<sup>42</sup> Compound **3** was then iodinated with NIS to give **4**, which was finally clicked with azide-functionalized biotin to afford our target BODIPY–

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† Electronic supplementary information (ESI) available: Experimental data including experimental procedures for the synthesis of core BODIPY and BODIPY–biotin conjugates, hydrophobic–hydrophilic characteristic tests, DLS profile, singlet oxygen generation efficacy using DPBF, phototoxicity of compound **4**, copies of <sup>1</sup>H and <sup>13</sup>C NMR spectra, HRMS spectra, and HPLC chromatograms of **KDP1** & **KDP2**. See DOI: <https://doi.org/10.1039/d3md00347g>