

The Photocurrent and Spectral Response of a Proposed $p^+p n n^+$ Silicon Solar Cell

Ashim Kumar Biswas^{*†}, Sayantan Biswas^{*}, Amitabha Sinha^{*}

^{*}Department of Physics, University of Kalyani, Kalyani-741235, West Bengal, India.

(kumanshibiswas@gmail.com, sayan.solar@gmail.com, asinha333@gmail.com)

[†]Corresponding Author; A. K. Biswas, Department of Physics, Nabadwip Vidyasagar College, Nabadwip, Nadia - 741302, West Bengal, India, Tel: + 91 9531631423, kumanshibiswas@gmail.com

Received: 24.05.2017 Accepted: 31.05.2017

Abstract-In this paper an analytical work has been carried out on a $p^+p n n^+$ structure photovoltaic cell in which a low- high junction is present in the front as well as the rear side of the device. The expressions for photocurrent and spectral response of this solar cell structure have been obtained and their variations with different device parameters and wavelength of incident light have been shown graphically. It is observed from theoretical considerations that this structure gives improved performance over previous silicon solar cell structures.

Keywords Si solar cell; high-low junction; front surface field; photocurrent; spectral response.

1. Introduction

After the first silicon solar cell was developed [1], lot of research work have been made to improve the performance of these cells, the most recent one being quantum dot and quantum well solar cells [2-9]. Now a day solar cells have become a strong contender for generation of energy. Their applications in various aspect, and analytical and experimental studies have been reported by researchers [10-13]. The first major improvement in the efficiency of a conventional solar cell was obtained by incorporating a low-high junction at its back which gave the $n^+ p p^+$ structure [14]. This $p p^+$ junction gave rise to a back surface field and the device was called a back surface field (BSF) solar cell. Theoretical studies on these BSF solar cells were performed and the improvement in the efficiency was attributed to the reduction in the back surface recombination in these cells [15, 16]. It was then suggested that a low-high junction may be incorporated at the front surface of the solar cell to give rise to $n^+ n p$ structure [17-19]. This high-low junction emitter structure gave increased open-circuit voltage and short-circuit current. Further theoretical investigations on the front-surface -field (FSF) solar cells were carried out and it was shown that a low-high junction had the significant role to

collect light generated current [20]. The role and function of front- surface-field on an $n^+ n p$ GaAs solar cell has been reported recently [21] in which a high-low junction factor F_{h-l} has been introduced. F_{h-l} determines the effective carrier collection of the low-high junction. Dark current generating in a solar cell has an important contribution in calculating the overall efficiency of such device. Its experimental and analytical studies has been discussed in [22, 23] based on different cell parameters including doping effects. In our present work we have assumed a $p^+ p n n^+$ solar cell structure that has low-high junction at both the front and the rear surfaces giving rise to front surface field (FSF) as well as back surface field (BSF). A complete analytical study for this proposed new structure has been carried out.

2. Analysis

Silicon solar cell considered in this study is highlighted in Fig. 1. The front and rear parts of this $p^+ p n n^+$ structure are formed with a $p^+ p$ and an $n n^+$ low-high junctions respectively. The thicknesses of the quasi-neutral p^+ , p , n and n^+ layers considered for this cell are W_{p^+} , W_p , W_n and W_{n^+} respectively. W_g , W_d and W_b are

Theoretical study on the performance of $\text{In}_x\text{Ga}_{1-x}\text{As}/\text{GaAs}$ *p-i-n* quantum dot solar cell considering real cubic dots

Sayantana Biswas,* Ashim Kumar Biswas, and Amitabha Sinha
University of Kalyani, Department of Physics, Kalyani, West Bengal, India

Abstract. Quantum dot solar cells (QDSC) have been extensively studied by various researchers for the last 15 years as they have much higher conversion efficiency and it is capable of producing higher short-circuit current density in comparison with the conventional crystalline solar cells. A theoretical study was carried out on the $\text{In}_x\text{Ga}_{1-x}\text{As}/\text{GaAs}$ *p-i-n* QDSC considering absorption spectra of real cubic quantum dots embedded in the intrinsic region. We incorporated the absorption coefficient of the cubic quantum dot ensemble considering finite potential barriers; additionally, here, we considered the nonuniform size distribution described by the Gaussian function. The contributions of the photocurrent density from different regions of the cell were investigated. The photocurrent density of the intrinsic region was studied by varying the height of the quantum dots and by varying the size dispersion factor. Also, the total short-circuit current density and the power conversion efficiency of such photovoltaic devices were calculated, and some significant results were obtained. © 2018 Society of Photo-Optical Instrumentation Engineers (SPIE) [DOI: 10.1117/1.JNP.12.016020]

Keywords: quantum dot solar cell; cubic quantum dot; dot size; size dispersion factor; power conversion efficiency.

Paper 17075 received May 29, 2017; accepted for publication Feb. 20, 2018; published online Mar. 13, 2018.

1 Introduction

With the advancement of nanotechnology, nanoscale devices have grabbed the attention of researchers, engineers, and scientists for their better performance and applications. Therefore, inevitably significant improvements in the performance of low-dimensional devices, such as quantum well, quantum wire, and quantum dot solar cells (QDSCs), have been obtained. Aroutiounian et al.¹ proposed the concept of QDSC as a scheme to increase the solar cell efficiency. After that, several research works, both theoretical and experimental, have been reported on such photovoltaic devices. Nozik² discussed the hot carrier and impact ionization solar cells and considered three QD solar cell configurations. The generation-recombination processes taking place in the active region of a *p-i-n* structure embedded with QDs have also been investigated,³ and it has been shown that, to produce maximum photocurrent, an optimum number QD layers have to be incorporated within *i*-region. A theoretical study on QDSCs was carried out by Nasr.⁴ The effect of internal electric field on InAs/GaAs QDSCs was investigated by Kasamatsu et al.⁵ An experimental study on temperature dependence of dark current properties of $\text{InGaAs}/\text{GaAs}$ QDSCs was performed by Lu et al.⁶ Weng et al.⁷ proposed an innovative description to provide a quantitative basis to enhance the conversion efficiency of InAs/GaAs QDSCs. Recently, the spectral response of a GaAs-InAs QDSC was investigated by Biswas et al.⁸ and Biswas and Sinha⁹ considering ideal cubic dots.

In this paper, we investigated the photocurrent density of the different regions of an $\text{In}_x\text{Ga}_{1-x}\text{As}/\text{GaAs}$ QDSC, and we obtained the photocurrent density of the intrinsic region for different values of the quantum dot height and size dispersion factor considering absorption

*Address all correspondence to: Sayantan Biswas, E-mail: sayan.solar@gmail.com

Chaitanya Mahaprabhu and Contemporary Politics in Bengal

Akhil Sarkar

Assistant Professor of History, Nabadwip Vidyasagar College

Asia is pre-eminently the greatest spiritual continent in the world and in Asia; India stands foremost in respect of spirituality. The world takes time to absorb great ideas and teaching: in fact, their greatness may be measured, almost; by the time it takes other to appreciate them. Perhaps this is the price of prophetic vision. A sensitive conscience foresees, others wait for events and in the time lag underestimate the vision. This also happened to Chaitanya Mahaprabhu the social and religious innovator; though as a spiritual leader he becomes a power in his lifetime. Because Chaitanya Mahaprabhu was the creator of love religious movement and through most of its active phases its unsurpassable controller and director, he lives in most Indian hearts in the role model of religious liberator. So the creative leadership is exercising the task to change the traditional role from commander to coach from manager to mentor, from director to delegator and from one who demands respect to one who facilitates self-respect.¹ About the time when Sri Chaitanya appeared, Bengal had nearly lost its independence. The rulers were a Mohamedan, and though the Hindus succeeded, from time, in occupying the throne, they were obliged to embrace Mahomedanism in order to retain their sovereignty. Hossain ascended the throne of Bengal under the title of Hossain Shah in 1498 A.D. Gour (now in ruins), near Rajmehal, was the then capital of Bengal. The Muslim sovereigns normally administered the affairs of the state through the Kajis or Governors. Nabadwip, popularly called Nadia, situated in the banks of the Bhagirathi. Nabadwip is the holy and the most sacred city of Bengal it is also one of the consisting of nine islands called Naba-dwipa, like Antardvip, Simantadvip, Godrumadvip, Madhyadvip, Rudradvip, Koladvip, Ritadvip, Jahnudvip, Modadrumadvip. In Mayapura, now the heart of Nabadwip and it was the greatest spiritual and cultural heritage in Bengal. The district of Nadia had then a world-wide reputation as the Centre of poetry, literature, Nyaya, art, and above all, philosophy of all kinds. In this light Nabadwip Dham is the most significant religious site and place in the eyes of Vaishnava followers and the Chaitanya Mahaprabhu is the transcendental love and knowledge.

Advances in the Asymmetric Synthesis of Bridged and Fused Bicyclic Acetals

Smritilekha Bera ✉, Bhaskar Chatterjee, Dhananjay Mondal

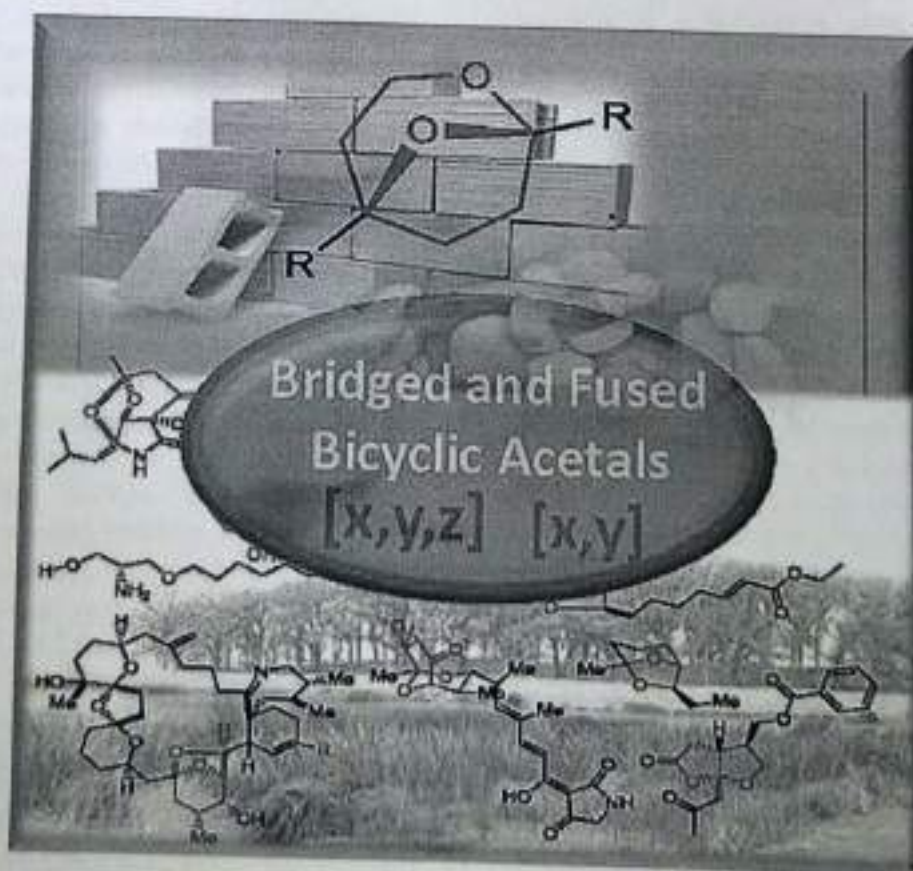
First published: 14 September 2018

<https://doi.org/10.1002/ejoc.201800904>

Citations: 16

Abstract

This review article highlights the asymmetric synthesis of conformationally rigid fused $[x,y]$ and bridged $[x,y,z]$ bicyclic acetals to construct complex natural and unnatural molecules of biological and synthetic interest. For these rigid molecular frameworks, the stereoselective cyclization and C–C bond formation has been widely explored.



Multi-Index Bi-Criterion Transportation Problem: A Fuzzy Approach

Dr. Samiran Senapati

Department of Mathematics, Nabadwip Vidyasagar College, Nadia, West Bengal, India
samiransenapati@yahoo.co.in

Abstract—This paper represents a non linear bi-criterion generalized multi-index transportation problem (BGMTP) is considered. The generalized transportation problem (GTP) arises in many real-life applications. It has the form of a classical transportation problem, with the additional assumption that the quantities of goods change during the transportation process. Here the fuzzy constraints are used in the demand and in the budget. An efficient new solution procedure is developed keeping the budget as the first priority. All efficient time-cost trade-off pairs are obtained. D_1 -distance is calculated to each trade-off pair from the ideal solution. Finally optimum solution is reached by using D_1 -distance.

Keywords— Time-cost trade-off pair, D_1 -distance, ideal solution, membership function, priority.

1. INTRODUCTION

The cost minimizing classical multi-index transportation problems play important role in practical problems. The cost minimizing classical multi-index transportation problems have been studied by several authors [14, 15, 16, 17] etc. Some times there may exist emergency situation eg police services, time services, hospital management etc. where time of transportation is of greater importance than cost of transportation. In this situation, it is to be noted that the cost as well as time play prominent roles to obtain the best decision. Here the two aspects (ie cost and time) are conflicting in nature. In general one can not simultaneously minimize both of them Bi-criterion transportation problem have been studied by several authors [3, 4, 8, 17, 11] etc.

There are many business problems, industrial problems, machine assignment problems, routing problems, etc. that have the characteristic in common with generalized transportation problem that have been studied by several authors [1, 2, 4, 5, 9, 10, 14] etc.

In real world situation, most of the intimations are imprecise in nature involving vagueness or to say fuzziness. Precise mathematical model are not enough to tackle all

practical problems. Fuzzy set theory was developed for solving the imprecise problems in the field of artificial intelligence. To tackle this situation fuzzy set theory are used. In this field area pioneer work came from Bellman and Zadeh [6]. Fuzzy transportation problem have been studied by several authors [12, 18, 19, 20, 21, 23, 24] etc.

The importance of fuzzy generalized multi-index transportation problem is increasing in a great deal but the method for finding time-cost trade-off pair in a bi-criterion fuzzy generalized multi-index transportation problem has been paid less attention. In this paper, we have developed a new algorithm to find time-cost trade-off pair of bi-criterion fuzzy generalized multi-index transportation problem. Thereafter an optimum time-cost trade-off pair has been obtained.

Problem Formulation:


Let there be m -origins, n -destinations and q -products in a bi-criterion generalized multi-index fuzzy transportation problem.

Let,

- x_{jk} = the amount of the k -th type of product transported from the i -th origin to the j -th destination,
 t_{jk} = the time of transporting the k -th type of product from the i -th origin to the j -th destination which is independent of amount of commodity transported so long as $x_{jk} > 0$,
 r_{ijk} = the cost involved in transporting per unit of the k -th type of product from the i -th origin to the j -th destination,
 a_i = number of units available at origin i ,
 b_j = number of units required at the destination j ,
 c_k = requirements of the number of units of the k -th type of product and
 d_{ijk}^1, d_{ijk}^2 = positive constants rather than unity, due to

Original Paper | Published: 12 September 2018

The spin filtering effect and negative differential behavior of the graphene-pentalene-graphene molecular junction: a theoretical analysis

Barnali Bhattacharya, Rajkumar Mondal & Utpal Sarkar 

Journal of Molecular Modeling 24, Article number: 278 (2018)

327 Accesses | 2 Citations | [Metrics](#)

Abstract

Density functional theory (DFT) combined with nonequilibrium Green's function (NEGF) formalism are used to investigate the effects of substitutional doping by nitrogen and sulfur on transport properties of AGNR-pentalene-AGNR nanojunction. A considerable spin filtering capability in a wide bias range is observed for all systems, which may have potential application in spintronics devices. Moreover, all model devices exhibit a negative differential effect with considerable peak-to-valley ratio. Thus, our findings provide a way to produce multifunctional spintronic devices based on nitrogen and sulfur doped pentalene-AGNR nanojunctions. The underlying mechanism for this interesting behavior was exposed by analyzing the transmission



Role of Apolipoprotein E, Cathepsin D, and Brain-Derived Neurotrophic Factor in Parkinson's Disease: A Study from Eastern India

Prosenjit Pal¹ · Tamal Sadhukhan¹ · Subhadip Chakraborty¹ · Sriparna Sadhukhan¹ · Arindam Biswas¹ · Shyamal K. Das² · Kunal Ray³ · Jharna Ray¹

Received: 21 October 2018 / Accepted: 17 May 2019
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Abstract

Parkinson's disease (PD) is a progressive neurodegenerative disease with complex etiology. Both genetic and environmental factors play significant role. Apart from candidate genes, some modifier genes have been reported to be associated with the altered risk of PD. Previous studies have identified *Apolipoprotein E (APOE)*, *Cathepsin D (CTSD)*, and *Brain-Derived Neurotrophic Factor (BDNF)* as key players of neurodegenerative pathways with their variants associated with different neurodegenerative diseases. Hence, this study aims to identify the potential role of these modifier genes in the pathogenesis of PD among Eastern Indian PD patients. A case-control study was performed using 302 clinically diagnosed PD patients and 304 ethnically matched controls. Promoter SNPs of *APOE* (rs449647, rs405509) and *BDNF* (rs56164415), and coding SNPs of *APOE* (rs429358, rs7412 resulting in $\epsilon 2$, $\epsilon 3$, and $\epsilon 4$ alleles), *CTSD* (rs17571), and *BDNF* (rs6265) were analyzed by PCR-RFLP and bidirectional sequencing. The effect of rs56164415 on BDNF expression was characterized by Luciferase assay. *APOE* $\epsilon 4$ allele was significantly overrepresented (p value = 0.0003) among PD patients, whereas $\epsilon 3$ allele was predominant in the control population. The promoter haplotype (A-rs449647, G-rs405509) of *APOE* was preponderant among female PD patients posing risk. No association was found for *CTSD* polymorphism. The 'T/T' genotype of *BDNF* rs56164415 was overrepresented (p -value = 0.02) among early onset PD patients. Expression of BDNF for the 'T/T' variant was significantly lower (p -value = 0.012) than the 'C/C' variant, suggesting a possible role in PD pathogenesis. This study suggests that *APOE* and *BDNF* may serve as modifier loci among eastern Indian PD patients.

Keywords *APOE* · *CTSD* · *BDNF* · Parkinson's disease · Luciferase assay

Introduction

Parkinson's disease (PD) is one of the most common neurodegenerative disorders characterized by the selective loss of dopaminergic neurons in substantia nigra pars compacta,

resulting in reduced dopamine level in the striatum. PD is mostly sporadic, and its complex etiology may involve an interaction between multiple genetic and environmental risk factors. So far 23 PD-related loci and 19 pathogenic genes have been identified (Deng et al. 2018). Our previous studies on eastern Indian PD patients have identified a few pathogenic variants among the candidate genes, such as, *PARKIN*, *PINK1*, and *DJ-1* (Biswas et al. 2006, 2010; Sadhukhan et al. 2012). In addition to the candidate genes, many modifier genes have been reported to be associated with the pathogenesis of PD (Das et al. 2009, 2012; Sadhukhan et al. 2018; Bras et al. 2015).

Among the different pathways involved in neurodegeneration, dysfunctional mitochondrial and proteasomal degradation systems have been established for PD pathogenesis. Apolipoprotein E (*APOE*) plays a significant role in brain lipid transport and maintenance of synaptic plasticity and is associated with various kinds of neuropathological

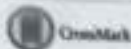
Electronic supplementary material The online version of this article (<https://doi.org/10.1007/s12017-019-08548-4>) contains supplementary material, which is available to authorized users.

✉ Jharna Ray
jharnaray@gmail.com

- ¹ S. N. Pradhan Centre for Neurosciences, University of Calcutta, Kolkata, West Bengal, India
- ² Bangur Institute of Neurosciences, Kolkata, West Bengal, India
- ³ ATGC Diagnostics Private Limited, Kolkata, West Bengal, India

Published online: 28 May 2019

Springer



PAPER

Mechanics of tissue competition: interfaces stabilize coexistence

Nirmalendu Ganai^{1,2,3}, Tobias Büscher^{1,2} , Gerhard Gompper¹  and Jens Elgeti¹ ¹ Theoretical Soft Matter and Biophysics, Institute of Complex Systems, Forschungszentrum Jülich and JARA, D-52425 Jülich, Germany² Department of Physics, Nalabwip Vidyasagar College, Nalabwip, Nadia 741302, India³ These authors contributed equally to this work.

E-mail: j.elgeti@fzjuelich.de

Keywords: tissue competition, tissue growth, homeostatic pressure, particle-based simulations

OPEN ACCESS

RECEIVED

3 March 2019

REVISED

25 April 2019

ACCEPTED FOR PUBLICATION

28 May 2019

PUBLISHED

12 June 2019

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**Abstract**

Mechanical forces influence the dynamics of growing tissues. Computer simulations are employed to study the importance of interfacial effects in tissue competition. It was speculated previously that mechanical pressure determines the competition, where the determining quantity is the homeostatic pressure—the pressure where division and apoptosis balance; the tissue with the higher homeostatic pressure overwhelms the other. In contrast, we find that a weaker tissue can persist in stable coexistence with a stronger tissue, if adhesion between them is small enough. An analytic continuum description can quantitatively describe the underlying mechanism and reproduce the resulting pressures and cell-number fractions. Furthermore, simulations reveal a variety of coexisting structures, ranging from spherical inclusions to a bicontinuous state.

1. Introduction

Mechanical forces influence the growth of cells and tissues in several ways, via mechanotransduction [1] or mechanical feedback as regulator of growth and shape [2, 3]. This occurs in systems ranging from plants adapting their growth patterns to mechanical loads [4, 5], all the way to tumors responding in their growth to the pressure of the embedding medium [6–8]. Cells have been shown to differentiate according to substrate stiffness [9], and divide according to mechanical stress and strain [10–16]. Spheroids of many cells, grown in elastic gels [17–19] or shells [20, 21], or even in suspension with osmotic stress [22–25], show strong dependence of growth on the properties of the embedding medium.

Given the evidence of the effect of mechanical stress on growth, it seems clear that mechanics should also influence tissue competition, such as the competition between different mutants in the imaginal wing disk of *Drosophila* [26, 27], or clonal expansion in multistep cancerogenesis [28, 29]. Several theoretical studies support and quantify this idea for both, competition [2] and size determination [30] in the wing, and tumor growth [8, 31].

A tissue grown in a finite compartment exerts a certain pressure onto its surrounding. When reaching a steady state—the homeostatic state—this is the homeostatic pressure P_H . Under an external pressure P below P_H , the tissue grows; whereas it shrinks if the pressure is above it. This can be formulated as a linear expansion of the bulk growth rate k_b around the homeostatic pressure [31],

$$k_b = \kappa(P_H - P) \quad (1)$$

with the pressure response factor κ . To study the role of pressure on growth, cell-culture experiments and computer simulations have been developed to explore this effect [22–24, 32–34]. While confirming the general picture—that mechanical pressure reduces growth—these experiments and simulations have revealed that tissues preferentially divide at the surface, even to the extent that they die (on average) in the bulk and sustain a finite size only by surface growth. While consideration of nutrient transport may be necessary for quantitative description of certain experiments [35, 36], mechanics alone already results in enhanced surface growth, and matches other experiments [33]. For tissue competition in general, and metastatic inefficiency in particular, it has been argued that metastases need to reach a critical size, below which the Laplace pressure from the interfacial tension exceeds the homeostatic pressure difference, and the metastasis disappears [31].

2019
Jan - Dec

Ayurveda Repackaged: An Entry into the Global Market through Advertisements in Bengal, 1950-1970

Sutapa Saha Mitra

Abstract

The present paper proposes to relocate Ayurveda in the global scenario along with a changed consumer perception of Ayurveda in the twentieth century and traces the use of advertisements by the companies producing Ayurvedic products to reclaim "its lost glory" between 1950s-1970s. Here the term 'relocate' has been used in the sense to provide exact position to Ayurveda by contrasting its previous status and present scenario and the term 'packaging' is used in the limited sense of changing perception through advertisements and not the material packaging of products.

Keywords: advertisements, swadeshi, ayurveda, medicine, marketing

Ayurveda or the science of longevity has traced its origin since the post-vedic period (1000-500 BCE) primarily aiming at elimination of diseases and leading a healthy and happy life. (Mukhopadhyay, 2004). Ayurveda has always remained a matter of concern and has passed through phases successfully dealing with the physical ailments maintaining an equilibrium in the physical and mental state of health.

Nonequilibrium Biophysical Processes Influence the Large-Scale Architecture of the Cell Nucleus

Ankit Agrawal,^{1,2} Nimalendu Ganai,³ Surajit Sengupta,⁴ and Gautam I. Menon^{1,2,6,*}

¹Computational Biology Group, The Institute of Mathematical Sciences, Taramani, Chennai, India; ²Homi Bhabha National Institute, Mumbai, India; ³Department of Physics, Nabadwip Vidyasagar College, Nabadwip, Nadia, India; ⁴TIFR Centre for Interdisciplinary Sciences, Serilingampally Mandal, Ranga Reddy District, Hyderabad, India; and ⁵Department of Physics, Ashoka University, Rajiv Gandhi Education City, National Capital Region P.O. Rai, Sonapat, India

ABSTRACT Model approaches to nuclear architecture have traditionally ignored the biophysical consequences of ATP-fueled active processes acting on chromatin. However, transcription-coupled activity is a source of stochastic forces that are substantially larger than the Brownian forces present at physiological temperatures. Here, we describe an approach to large-scale nuclear architecture in metazoans that incorporates cell-type-specific active processes. The model predicts the statistics of positional distributions, shapes, and overlaps of each chromosome. Simulations of the model reproduce common organizing principles underlying large-scale nuclear architecture across human cell nuclei in interphase. These include the differential positioning of euchromatin and heterochromatin, the territorial organization of chromosomes (including both gene-density-based and size-based chromosome radial positioning schemes), the nonrandom locations of chromosome territories, and the shape statistics of individual chromosomes. We propose that the biophysical consequences of the distribution of transcriptional activity across chromosomes should be central to any chromosome positioning code.

SIGNIFICANCE Biophysical models of nuclear architecture should be capable of predicting distribution functions for the gene density and center of mass of individual chromosomes obtained in chromosome painting experiments. However, models thus far have failed in this respect, also yielding little intuition for the fundamental biophysical principles responsible for large-scale chromatin organization. We describe a first-principles approach to large-scale nuclear architecture in metazoans that incorporates energy-consuming "active" processes acting on chromatin. Our computer simulations reproduce, within a combined framework, a number of common organizing principles underlying large-scale nuclear architecture across human cell nuclei in interphase that have so far resisted explanation.

INTRODUCTION

Chromosomes are not distributed at random within the interphase nucleus, an observation that is central to our current understanding of large-scale nuclear architecture in the interphase nuclei of metazoans (1–3). Gene-rich, more open, early-replicating euchromatin regions are typically distributed more centrally than gene-poor, relatively more compact, late-replicating heterochromatin (2). Chromosomes are organized territorially, with each being segmented into relatively more (A) and less (B) active compartments that are then further subdivided into topologically

associated domains (4–6). In humans, gene-rich chromosome 19, containing a large number of housekeeping genes, is distributed more centrally across several cell types than the similarly sized but gene-poor chromosome 18 (7,8). This observation generalizes to a gene-density-based radial positioning schema for all chromosomes (9).

Gene-rich regions within chromosomes tend to orient toward the nuclear center, with expressed alleles often found further from the nuclear envelope than ones that are not expressed (9,10). In some human cell types, chromosomes appear to be positioned by size, with the centers of mass of smaller chromosomes disposed more centrally than those of larger ones (11–13). In female cells, the two X chromosomes are differentially positioned, with the more compact, inactive X chromosome found somewhat closer to the nuclear envelope than the active one (14,15). Actively transcribed chromosomes tend to have rougher, more elliptical

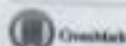
Submitted September 9, 2019, and accepted for publication November 11, 2019.

*Correspondence: menon@imsc.res.in

Editor: Anatoly Kolomeisky.

<https://doi.org/10.1016/j.bpj.2019.11.017>

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PAPER

Tissue evolution: mechanical interplay of adhesion, pressure, and heterogeneity

OPEN ACCESS

RECEIVED

15 October 2019

REVISED

8 January 2020

ACCEPTED FOR PUBLICATION




10 February 2020

PUBLISHED

25 March 2020

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Tobias Büscher¹ , Nirmalendu Ganai^{1,2}, Gerhard Gompper¹  and Jens Elgeti¹ ¹ Theoretical Soft Matter and Biophysics, Institute of Complex Systems and Institute for Advanced Simulation, Forschungszentrum Jülich, D-52425, Jülich, Germany² Department of Physics, Nabadwip Vidyasagar College, Nabadwip, Nadia 741302, IndiaE-mail: j.elgeti@fz-juelich.de**Keywords:** tumor heterogeneity, tumorigenesis, tissue competition, homeostatic pressure, evolution

Supplementary material for this article is available online

Abstract

The evolution of various competing cell types in tissues, and the resulting persistent tissue population, is studied numerically and analytically in a particle-based model of active tissues. Mutations change the properties of cells in various ways, including their mechanical properties. Each mutation results in an advantage or disadvantage to grow in the competition between different cell types. While changes in signaling processes and biochemistry play an important role, we focus on changes in the mechanical properties by studying the result of variation of growth force and adhesive cross-interactions between cell types. For independent mutations of growth force and adhesion strength, the tissue evolves towards cell types with high growth force and low internal adhesion strength, as both increase the homeostatic pressure. Motivated by biological evidence, we postulate a coupling between both parameters, such that an increased growth force comes at the cost of a higher internal adhesion strength or vice versa. This tradeoff controls the evolution of the tissue, ranging from unidirectional evolution to very heterogeneous and dynamic populations. The special case of two competing cell types reveals three distinct parameter regimes: two in which one cell type outcompetes the other, and one in which both cell types coexist in a highly mixed state. Interestingly, a single mutated cell alone suffices to reach the mixed state, while a finite mutation rate affects the results only weakly. Finally, the coupling between changes in growth force and adhesion strength reveals a mechanical explanation for the evolution towards intra-tumor heterogeneity, in which multiple species coexist even under a constant evolutionary pressure.

1. Introduction

Mutations change the cell fitness and thus its chance to survive and proliferate [1]. Advantageous mutations are more likely to persist due to natural selection, which drives the evolution of a tissue towards fitter cells [2]. Cancer represents an example of evolution on a short time scale [3]. Furthermore, cancer is a multistep process, i.e. several mutations are needed for a tumor in order to develop and become malignant [4]. Hence, tumorigenesis might be expected to happen in a serial manner, i.e. a cell acquiring a 'beneficial' mutation and taking over the whole tissue. After some time, a daughter cell acquires another mutation and again takes over. Interestingly, however, tumors do not consist of a single cell type, but instead several subpopulations coexist within the same tumor. This is called intra-tumor heterogeneity [5].

Each mutation changes certain biochemical properties of a cell. This ranges from malfunction in the error correction machinery during DNA replication and disruptions in signaling pathways to epigenetic changes in the expression level of certain proteins [1, 6, 7]. All these changes can also affect the mechanical properties of the mutated cell, e.g. mutated cells which express less adhesion proteins might be able to detach from the primary tumor more easily [8], a necessary step for the formation of metastases. However, the metastatic process seems to

উদ্ভিদে শতাধিক বংশাণু তথা ভারতবর্ষে যে নান্যায়ন খেটু তা পাণ্ডাভা
 পক্ষের ফলশ্রুতি হিসাবে বিবেচিত হয়। যদিও বর্তমান পানিছড়িত এই পিণ্ড
 কমানের জাগতিক উদ্ভিদাধারের পক্ষ পরিত মা, বহু তা অজ্ঞানের স্মরণ জীবনে
 জনস্ব স্বকট সৃষ্টি করায়। তবে এই পাণ্ডাভা তথা ইংগোলি পিণ্ডা উদ্ভিদে
 শতাধিক বংশাণু থেকে বিশ শতাধিক বংশাণু পর্যন্ত ১০০ বহু ধর অধারের সমাজকে
 সৃষ্টি করেছে। অর্থাৎ এই পিণ্ডা প্রবর্তনের জন্য স্নায়ুধারের যে অবদান তা এই
 স্নায়ুর মাধ্যমে সীমাবদ্ধ।

স্নায়ুধারের যে আধুনিক পিণ্ডা প্রবর্তন উদ্ভেদী হয়েছিল, তাই উদ্ভেদের
 বৈশিষ্ট্য হলে, যাতি উর বিজ্ঞান সৃষ্টি বিবরণ বা স্থলিক উদ্ভেদের প্রমাণ করে সত্য
 অর্জন করবে। বিভিন্ন স্থানে বা অধিকার নির্ধারণ জাতি, ধর্ম, বর্ণ, পিণ্ড বা
 স্নায়ুধারের বিবরণ করা হবে 'না। ভারতীয় সীমার বিভিন্ন স্থান ও স্থানীয়
 উদ্ভেদের উদ্ভেদিত করার জন্য স্নায়ুধারের অবদান বিরাট।

ইউরোপের ইতিহাসে বিদ্যমান পিণ্ডাধারের (স্নায়ুর) আগে জেনেটিক (নব্যায়ন)
 এডেইন্স, পিণ্ডা প্রবর্তনের ক্ষেত্রে উদ্ভেদী উদ্ভেদিত। নব্যায়নধারের আগে স্নায়ুধার
 ধর্ম ও স্থলিক উদ্ভেদের স্নায়ুধারের ধর্ম কমেছিল। পশুপালি আধুনিক পিণ্ডা
 ও স্থলিক উদ্ভেদের স্নায়ুধারের নব্যায়নধারের প্রমাণ এডেইন্সে। জেনেটিক
 নব্যায়নধারের পিণ্ডা। উদ্ভেদে পিণ্ডাধারের পিণ্ডাধার, ইর জেনেটিক, পিণ্ডাধার, এই
 নব্যায়নধারের স্নায়ুধারের ধর্ম অর্থাৎ, বহুধারের ও স্নায়ুধারের স্নায়ুধার তা
 সৃষ্টি করে দেয়। পিণ্ডা স্নায়ুধারের পিণ্ডাধারের এই নব্যায়নধারের উদ্ভেদিত।

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**মিলেট : অব্যেজিত এক প্রাচীন
 খাদ্যশস্যের উদ্ভাষন
 ড. স্বাভাটী মিশ (বুর)**

সারসংক্ষেপ :
 বর্তমান বিশ্ব মিলেট বিভিন্ন সর্দির অধিকার হিসাবে পরিগণিত হয়।
 অনেকগুলি খাদ্যশস্যের একে মিলেট বলা হয়। অন্য থেকে গা ১০০০০
 বছর আগে উদ্ভেদিত গাণ শস্য হিসাবে মিলেটের ব্যবহার প্রায় ৫০০।
 বর্তমানে এটি এশিয়া (বিশেষত ভারতবর্ষ) এবং আফ্রিকা (বিশেষত নাইজেরিয়া,
 নাইজের) প্রধান অধিক পরিমাণে (১৫%) উৎপাদিত হয়। উষ্ণ ও উষ্ণ আর্দ্রতা
 অধিকার হিসাবে মিলেট উৎপাদিত হতে পারে। কৃষকদের কাছে এর গুরুত্ব
 ক্রমবর্ধমান। এটির উৎপাদনকে বেরন বর নামের জেনেটিক সৃষ্টি করে
 সৃষ্টি হই এবং প্রচুর পরিমাণে জাটের সৃষ্টি করে, উদ্ভেদিত, খনিজ পদার্থের
 উৎপাদিত বর্তমান। পুরো শস্য হিসাবে গাণ্ডা এর স্নায়ুধারের স্নায়ুধারের
 জাটের খাদ্যশস্য হিসাবে পরিগণিত হতে চলেছে। FAO আনুমানী ২০২০ সালতে
 'অন্তর্জাতিক মিলেট বর্ষ' হিসাবে ঘোষণা করেছে।

মূলপত্র :

মিলেট, FAO, জাতিসংঘ, নাইজের, নাইজের সর্দির উদ্ভেদিত।

উদ্ভাষন :

বর্তমান বিশ্ব মিলেট বিভিন্ন সর্দির খাদ্যশস্য হিসাবে পরিগণিত হয়— গাণ,
 গাণ, সৃষ্টি করেই। মিলেট পিণ্ডাধারের একটি খাদ্যশস্যের নাম গাণ, অনেকগুলি
 খাদ্যশস্যের একে মিলেট বলা হয়। স্নায়ুধারের পিণ্ডাধারের স্নায়ুধারের
 স্নায়ুধারের একটি খাদ্যশস্যের নাম 'মিলেট' হিসাবে অথবা 'স্নায়ুধারের পিণ্ডাধারের'
 বলা হয়। গাণ্ডা ১০ জাটের স্নায়ুধারের যে স্নায়ুধারের মিলেট গাণ করা হয় সেগুলি মিলেটের
 উদ্ভেদিত গাণ্ডা হয়—

জাটের খাদ্যশস্যের নাম	স্বাভাটী	স্নায়ুধারের নাম
গাণ	গাণ	
১. স্নায়ুধার (Sorghum)	গাণ্ডা	Sorghum bicolor
২. স্নায়ুধার মিলেট (Fussall millet)	গাণ্ডা	Setaria italica

INTEGRATED MANAGEMENT OF SOME IMPORTANT ON-FIELD DISEASES OF MUNGBEAN: A REVIEW

Dr. Swati Das (Sur)

Assistant Professor of Botany

Nabadwip Vidyasagar College, Nabadwip, Nadia, West Bengal

ABSTRACT : Mungbean is one of the most important pulses. A number of insects, bacteria, fungi and viruses infect mungbean and are responsible for a large extent of low yields. One or a few strategies are insufficient to minimise crop loss and reducing severity of diseases. Here comes integrated disease management in which all possible strategies are put to use in a scientific and organised way. Identification of markers associated with major gene responsible for resistance is a prerequisite in modern breeding. Screening for resistance from worldwide genotypes and use of molecular markers to search genes or QTL is perhaps the most promising way to combat biotic stress. Gene pyramiding is effective to develop varieties with resistance against a number of diverse pathogens. In recent times RNAi technology has been proved to be effective to decipher many aspects of biotic stress. This knowledge may provide us with new solutions against these diseases.

Key Words: Mungbean, integrated disease management, QTL, resistant variety, biotic stress

INTRODUCTION : Mungbean (*Vigna radiata* (L) Wilczek, family: Leguminosae/ Fabaceae) is one of the most important pulses that meet the need of plant protein in diet. Approximately 3.4 mega hecter land is utilised for mungbean production, with total production of 1.71 metric tonnes of grain. In India the productivity of mungbean is 498kg/ha [1] [2]. This crop is adversely affected by a number of biotic and abiotic stresses, which are responsible for a large extent of low yields. A number of insects, bacteria, fungi and viruses infect mungbean. The most important, considering the severity and loss, are mungbean yellow mosaic virus (MYMV) predominantly transmitted by the white fly *Bemisia tabaci*, the powdery mildew causing fungus *Erysiphe polygoni* and bacterium *Pseudomonas savastanoi* pv. *phaseolicola* causing haloblight. (Swaminathan *et al.*, 2012) [3].

'এবং মত্ৰয়া' -বিশ্ববিদ্যালয় মঞ্জুরী আয়োগ (UGC-CARE)

অনুমোদিত তালিকার অন্তর্ভুক্ত ।

পত্রিকা ক্রমিক নং-৯৬ (ভারতীয় ভাষার ১১৪টির মধ্যে),

বাংলা, কলা বিভাগের পত্রিকা ক্রমিক নং-৩২ ।

এবং মত্ৰয়া

(বাংলা ভাষা, সাহিত্য ও গবেষণাধর্মী মাসিক পত্রিকা)

২২ তম বর্ষ, ১২০ সংখ্যা

এপ্রিল, ২০২০

সম্পাদক

ড. মদনমোহন বেরা

যোগাযোগ :

ড. মদনমোহন বেরা, সম্পাদক ।

গোলকুঁয়াচক, পোস্ট-মেদিনীপুর, ৭২১১০১, জেলা-প.মেদিনীপুর, প.বঙ্গ ।

মো.-৯১৫৩১৭৭৬৫৩

কে কে. প্রকাশন

ভারতের সামাজিক সুরক্ষানীতি

এবং প্রভিডেন্ট ফান্ড

ড. তপন কুমার সামন্ত

রাজতন্ত্রের অবসান ঘটে যাবে থেকে গণতন্ত্র প্রতিষ্ঠা হয়েছে সেই থেকে সামাজিক সুরক্ষার ক্ষেত্রে একটি দিশার সন্ধান পাওয়া গেছে। রাজার মর্জির উপরে নির্ভরশীল না থেকে সামাজিক সুরক্ষার বিয়য়টি আইনে পর্যবসিত হয়েছে। শুধুমাত্র অবসরপ্রাপ্তদের আর্থিক সুরক্ষা ছাড়াও সামাজিক সুরক্ষার ক্ষেত্রে আরও বহু বিষয়কে অন্তর্গত করা হয়েছে— যেমন, অসংগঠিত ক্ষেত্রের সুরক্ষা, নারীর ক্ষমতায়ন (Women Empowerment), শিশু সুরক্ষা ইত্যাদি। কিন্তু মূল বিয়য়টি অবশ্যই অর্থ সংক্রান্ত। সেই অতিপ্রয়োজনীয় আর্থিক সুরক্ষা প্রদানের স্বার্থে ১৯৫২ সালে প্রতিষ্ঠিত হয়েছিল Employees Provident Fund Organisation বা EPFO.

যেকোন কর্মচারীর ক্ষেত্রে তার মূল বেতন এবং মহার্ঘ ভাতার সমষ্টির থেকে একটি অংশ বাধ্যতামূলকভাবে জমা করা হয় প্রভিডেন্ট ফান্ডে। সাধারণভাবে এই বাধ্যতামূলক জমার হার ১২%, কিন্তু কিছু কিছু সংস্থার ক্ষেত্রে এটা ১০% হারে করা হয়। কর্মচারীর সামান হারে তাঁর সংস্থাকেও ওই খাতে ১২% জমা করা বাধ্যতামূলক। সেক্ষেত্রে সংস্থার জমার একটি অংশ Employees Pension Fund বা EPS এ জমা হয়। EPS এর জমার ক্ষেত্রে মূল বেতনকে মাসিক ১৫০০০ টাকা ধরে নিয়ে তার ৮.৩৩% অর্থাৎ সর্বাধিক ১২৫০ টাকা জমা করা হয়। ধরা যাক, কোন কর্মচারীর মূল বেতন ১০০০০ টাকা প্রতি মাসে এবং মহার্ঘ ভাতাও ১০০০০ টাকা প্রতি মাসে। এই হিসেবে তাঁর প্রতি মাসে Provident Fund বাবদ প্রদেয় টাকা হবে $12\% \times (100000 + 100000)$ অর্থাৎ ২৪০০ টাকা। তাঁর সংস্থাও ওই ২৪০০ টাকার সমান অর্থ জমা করবে যার মধ্যে ১২৫০ টাকা জমা হবে EPS-এ আর বাকী ১১৫০ টাকা জমা হবে Provident Fund-এ।

যদি কোন কর্মচারীর ক্ষেত্রে মোট বেতনকে বিভিন্ন খাতে অর্থাৎ মূল বেতন, মহার্ঘ ভাতা, বাড়িভাড়া ভাতা ইত্যাদিতে বিভক্ত না করা যায়, অর্থাৎ কিনা যদি তাঁকে Consolidated Pay হিসেবে তাঁর সংস্থা একটি সমষ্টিগত টাকা বেতন হিসেবে দেয়, সেক্ষেত্রে ঐ মোট প্রাপ্য টাকার ওপরে উপরিউক্ত হিসেবে Provident Fund জমা করতে হবে। অবসর গ্রহণের পরে সেই কর্মচারী তাঁর কর্মজীবনে সম্বয় করা এই অর্থ সুদে-আসলে ফেরত পেতে থাকেন এবং আর্থিক সুরক্ষা পান।

আর EPS খাতে কোনো কর্মচারীর নামে যে টাকা জমা হয় তা হলো

PIMT

Journal of Research

Volume-12, No.-2

(January-March) 2020

ISSN No: 2278-7925

UGC Care Listed Journal

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Published By

Punjab Institute of Management & Technology

MUTUAL FUNDS FOR INDIAN CORPORATES

Tapan Kumar Samanta*

*Assistant Professor Stage-III of Commerce, Nabadwip Vidyasagar College

ABSTRACT

The paper is targeted towards the exploration of ideas to generate extra returns for the corporate organisations from reserve funds through viable alternatives of bank deposits, like, from Mutual Funds. The analysis contains the use of tools like Alpha (α), Beta (β) and Sharpe Ratio for assessment of risk-return prospect of various mutual fund schemes to be chosen by a corporate. The outcome of such analysis reveals that mutual funds, if chosen scientifically and invested with segmented diversification, can add-up to extra return to a company on its reserve fund within a predetermined risk trajectory.

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In view of falling rate of interest, Mutual Funds are gaining more relevance as the alternative vehicle of investment for growing the idle money. Like individuals, body corporates and companies often choose Mutual Funds for investing the excess fund lying as retained earnings subject to the provisions in Companies Act. However, difference between an Individual and a Company exists in every step of investments – starting from KYC to Risk-Return Trade-Off.

The Companies Act 2013 stipulates certain legal norms for investing in mutual funds vide Section 186. A company can invest up to (a) 60% of its paid-up equity capital, free reserves and share premium or (b) 100% of its free reserves and share premium, higher of the (a) and (b) subject to a board resolution with respect to such investments. Any amount to be invested over and above the stipulated limits, require shareholders' approval. Moreover, in case of Free Reserves, it must not include any amount of unrealised gains or notional gains or gain on asset revaluation or any surplus in P&L Account arising out of measurement of assets or liability at a fair value.

Apart from the above ceilings of investment, a Company which invests its free reserves, need to maintain Register of Investments in Form MBP-2 with all particulars of investments made at its registered office under the custody of the Company Secretary. MBP-2 register should be made available for inspection by the shareholders.

In spite of conforming rigorous norms and complying with all the legal complexities, Mutual Fund investments by a body corporate offers better play fields to corporate managers to maximize returns from reserve funds.

Individual. It is due to an obvious reason that an Individual has an approximate life span for which he would be drawing a financial plan, while a Company runs, by virtue, on the basis of a going concern.

CATEGORIZATION OF MUTUAL FUND SCHEMES

Before going to discuss about corporate objectives of investing in mutual funds, we must have a little attention to the various categories of mutual funds along with suitability of investor groups. The two broad Structural categories are – Open Ended and Close Ended. The Open ended funds can be purchased and redeemed all the time after its public issue which is known as New Fund Offer or NFO. Whereas, Close Ended Funds can be purchased only during its NFO. Another classification is based on markets – Equity Funds, Debt Funds and Balanced Funds. Equity funds create their portfolio with equity shares. Corpus of the Debt Funds mainly consists of Bonds, Debentures, and Fixed Income Securities. In the debt funds, a nominal portion may also belong to equities. The Balanced funds are essentially of hybrid in nature consisting of equities and debt instruments – both in a predetermined proportions, viz. Equity to Debt ratio of 40:60 or customized within applicable norms.

More complex categorization also prevails which is based on market capitalization of equities – like, Large-Cap, Mid-Cap and Small Cap funds. Each scheme of mutual funds definitely belong to a specific category with appropriate sub-category. It may be an Open Ended Large Cap Fund or may be Close Ended Fixed Maturity Debt Fund. Even if the scheme falls in hybrid class, it may belong to sub-class of Aggressive Hybrid, Conservative Hybrid, Balanced Hybrid, or even belong to a class where Multi-Asset Allocation patterns seen.

Hence from the above analysis, it is clear that objective of a mutual fund scheme depends on the very nature of the class or category. Not all the categories or class give the similar return or have equal degree of risk. That is why not all the classes of investors choose the same scheme for achieving return because every investor, be an Individual or a Corporate, has different risk appetite as well as different demand for return.

OBJECTIVES OF CORPORATE

GROWTH ANALYSIS OF COMPOSITE p -ADIC ENTIRE FUNCTIONS FROM THE VIEW POINT OF RELATIVE (p, q) -TH ORDER AND RELATIVE (p, q) -TH TYPE

By

Ritam Biswas

Department of Mathematics, Krishnath College

P.O.- Berhampore, Dist- Murshidabad

PIN-742101, West Bengal, India

Email: ritamitr@yahoo.co.in

Tannay Biswas

Rajbari, Rabindrapally, R. N. Tagore Road

P.O.- Krishnagar, Dist-Nadia

PIN- 741101, West Bengal, India

Email: tannaybiswas.nath@rediffmail.com

Chinmay Biswas

Department of Mathematics, Nabadwip Vidyasagar College

Pacca Tole Road, Nabadwip, Nadia

PIN-741302, West Bengal, India

Email: chinmay.shib@gmail.com

(Received : July 26, 2020 ; Revised: October 30, 2020)

Abstract

Suppose \mathbb{K} be a complete ultrametric algebraically closed field and suppose $\mathcal{A}(\mathbb{K})$ be the \mathbb{K} -algebra of entire functions on \mathbb{K} . In this paper we study some growth properties of composite p -adic entire functions on the basis of their relative (p, q) -th order, relative (p, q) -th type and relative (p, q) -th weak type.

2010 Mathematics Subject Classifications: 12J25, 30D35, 30G06, 46S10.

Keywords and phrases: p -adic entire functions, growth, relative (p, q) -th order, relative (p, q) -th type, relative (p, q) -th weak type, composition.

1 Introduction and Definitions

Let us consider \mathbb{K} be an algebraically closed field of characteristic 0, complete with respect to a p -adic absolute value $|\cdot|$ (example \mathbb{C}_p). For any $\alpha \in \mathbb{K}$ and $R \in]0, +\infty[$, the closed disk $\{x \in \mathbb{K} : |x - \alpha| \leq R\}$ and the open disk $\{x \in \mathbb{K} : |x - \alpha| < R\}$ are denoted by $d(\alpha, R)$ and $d(\alpha, R^-)$ respectively. Also $C(\alpha, r)$ denotes the circle $\{x \in \mathbb{K} : |x - \alpha| = r\}$. Moreover $\mathcal{A}(\mathbb{K})$ represent the \mathbb{K} -algebra of analytic functions in \mathbb{K} i.e. the set of power series with an infinite radius of convergence. For the most comprehensive study of analytic functions inside a disk or in the whole field \mathbb{K} , we refer the reader to the books [11, 12, 15, 17]. During the last several years the ideas of p -adic analysis have been studied from different aspects and many important results were gained (see [2] to [10], [13, 14]).

Let $f \in \mathcal{A}(\mathbb{K})$ and $r > 0$, then we denote by $[f](r)$ the number $\sup\{|f(x)| : |x| = r\}$ where $|\cdot|(r)$ is a multiplicative norm on $\mathcal{A}(\mathbb{K})$. Moreover, if f is not a constant, the $[f](r)$ is strictly increasing function of r and tends to $+\infty$ with r

SUM AND PRODUCT THEOREMS OF (p, q) - φ RELATIVE GOL'DBERG TYPE AND (p, q) - φ RELATIVE GOL'DBERG WEAK TYPE OF ENTIRE FUNCTIONS OF SEVERAL COMPLEX VARIABLES

TANMAY BISWAS* AND CHINMAY BISWAS

ABSTRACT. In this paper, we established sum and product theorems connected to (p, q) - φ relative Gol'dberg type and (p, q) - φ relative Gol'dberg weak type of entire functions of several complex variables with respect to another one under somewhat different conditions.

1. Introduction, Definitions and Notations

The symbols \mathbb{C}^n and \mathbb{R}^n will stand for complex and real n -spaces respectively. In addition, let us assume that the points (z_1, z_2, \dots, z_n) , (m_1, m_2, \dots, m_n) of \mathbb{C}^n or I^n be represented by their corresponding unsuffixed symbols z, m respectively where I denotes the set of non-negative integers. Then the modulus of z , denoted by $|z|$, is defined as $|z| = (|z_1|^2 + \dots + |z_n|^2)^{\frac{1}{2}}$. If the coordinates of the vector m are non-negative integers, then the expression $z_1^{m_1} \dots z_n^{m_n}$ will be denoted by z^m where $\|m\| = m_1 + \dots + m_n$.

Consider $D \subseteq \mathbb{C}^n$ to be an arbitrary bounded complex n -circular domain with center at the origin of coordinates. Then for any entire

Received August 15, 2020. Revised November 24, 2020. Accepted November 30, 2020.

2010 Mathematics Subject Classification: 32A15.

Key words and phrases: (p, q) - φ relative Gol'dberg order, (p, q) - φ relative Gol'dberg lower order, (p, q) - φ relative Gol'dberg type, (p, q) - φ relative Gol'dberg weak type, Property (G), Property (X).

* Corresponding author.

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Some results on generalized relative order (α, β) and generalized relative type (α, β) of meromorphic function with respect to an entire function

Tanmay Biswas¹ and Chinmay Biswas²

¹ Rajbari, Rabindrapally
R. N. Tagore Road, Krishnagar-741101, India.
tanmaybiswas_math@rediffmail.com

² Department of Mathematics
Nabadwip Vidyasagar College, Nabadwip-741302, India.
chinmay.shib@gmail.com

Abstract

In this paper we introduce the idea of generalized relative order (α, β) and generalized relative type (α, β) of meromorphic function with respect to an entire function where α and β are continuous non-negative on $(-\infty, +\infty)$ functions and then study some growth properties of entire and meromorphic functions on the basis of their generalized relative order (α, β) and generalized relative type (α, β) .

Subject Classification: 30D35, 30D30, 30D20

Keywords: Entire function, meromorphic function, growth, generalized relative order (α, β) , generalized relative type (α, β) .

1. Introduction, Definitions and Notations.

Let us consider that the reader is familiar with the fundamental results and the standard notations of the Nevanlinna theory of meromorphic functions which are available in [6,8,11]. We also use the standard notations and definitions of the theory of entire functions which are available in [10] and therefore we do not explain those in details. Let f be an entire function and $M_f(r) = \max\{|f(z)| : |z| = r\}$. When f is meromorphic, one may introduce another function $T_f(r)$ known as Nevanlinna's characteristic function of f (see [6,p.4]), playing the same role as $M_f(r)$.

However, the Nevanlinna's characteristic function of a meromorphic function f is defined as

$$T_f(r) = N_f(r) + m_f(r),$$

wherever the function $N_f(r, a)$ ($\bar{N}_f(r, a)$) known as counting function of a -points (distinct a -points) of meromorphic f is defined as follows:

$$N_f(r, a) = \int_0^r \frac{n_f(t, a) - n_f(0, a)}{t} dt + n_f(0, a) \log r$$

Some results on generalized relative order (α, β) and generalized relative type (α, β) of meromorphic function with respect to an entire function

Tanmay Biswas¹ and Chinmay Biswas²

¹ *Rajbari, Rabindrapally
R. N. Tagore Road, Krishnagar-741101, India.
tanmaybiswas_math@rediffmail.com*

² *Department of Mathematics
Nabadwip Vidyasagar College, Nabadwip-741302, India.
chinmay.shib@gmail.com*

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$$N_f(r, a) = \int_0^r \frac{n_f(t, a) - n_f(0, a)}{t} dt + n_f(0, a) \log r$$

AN OVERVIEW OF THE MANAGEMENT OF BRUCHIDS :A POST-HARVEST DISEASE PEST OF MUNGBEAN

Dr. Swati Das (Sur)
Assistant Professor of Botany
Nabadwip Vidyasagar College, Nabadwip, Nadia, West Bengal

ABSTRACT: Bruchid beetles are commonly known as the cowpea weevil or cowpea seed beetle. But they are recognised as the most devastating, notorious and detrimental storage pest of grain legumes. Their multiplication occurs during storage of grains and within a few months they can destroy seed stocks in a rapid way. But they do not create any difficulties in mungbeans. More than 90% of the immature bruchids can survive in storage condition. Implementation of several methods like cultural, biological, physical and chemical control measures were taken against bruchids but none of them were found to be effective against it. Recent study indicates the development of transgenic- and marker-assisted breeding programme as an upcoming method for the management of these pests. We can attain a goal of success in the yield by avoiding losses due to bruchids and improve the productivity of mungbean. It is evident that the conventional breeding techniques by molecular techniques such as molecular markers linked to bruchid resistance are very important to us. To identify bruchid resistant mungbean, locate genes coding for bruchid resistance, clone and develop molecular markers for mapping bruchid resistance are carried out by Molecular techniques.

Key Words: Bruchids, mungbean, pest, post-harvest disease, resistant variety, source of resistance, inheritance, breeding strategy.

INTRODUCTION: Bruchid beetles (*Callosobruchus* spp.), belong to the family *Chrysomelidae*, commonly known as the cowpea weevil or cowpea seed beetle (Tran, 1995) [1]. Probably the beetle originated in West Africa and moved around the world with the trade of different crops (Fabricius, 1775) [2]. Due to rapid generation time, dimorphism in sexual life and easy maintenance, it is used as a model organism for in the field of research and education (Beck, 2013) [3]. But they are recognised as the most devastating, notorious and detrimental storage pest of grain legumes mainly in tropical and subtropical regions except Antarctica. The infection of mungbean by *Callosobruchus* sp. starts in the field at very low levels. Their multiplication occurs during storage of grains and within a few months they can destroy seed



Synergistic effect of pistachio shell powder and nano-zerovalent copper for chromium remediation from aqueous solution

Sandeep Kumar¹ · Ravinderdeep Singh Brar¹ · J. Nagendra Babu² · Amarjeet Dahiya² · Sandip Saha¹ · Avneesh Kumar³

Received: 19 April 2021 / Accepted: 29 June 2021

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Abstract

Pistachio shell powder supported nano-zerovalent copper (ZVC@PS) material prepared by borohydride reduction was characterized using SEM, FTIR, XRD, TGA/DTA, BET, and XPS. SEM, XRD, and XPS revealed the nano-zerovalent copper to consist of a core-shell structure with CuO shell and Cu(0) core with a particle size of 40–100 nm and spherical morphology aggregated on PS biomass. ZVC@PS was found to contain 39% (w/w %) Cu onto the pistachio shell biomass. Batch sorption of Cr(VI) from the aqueous using ZVC@PS was studied and was optimized for dose (0.1–0.5 g/L), initial Cr(VI) concentration (1–20 mg/L), and pH (2–12). Optimized conditions were 0.1 g/L doses of sorbent and pH=3 for Cr(VI) adsorption. Langmuir and Freundlich adsorption isotherm models fitted well to the adsorption behavior of ZVC@PS for Cr(VI) with a pseudo-second-order kinetic behavior. ZVC@PS (0.1 g/L) exhibits q_{max} for Cr(VI) removal up to 110.9 mg/g. XPS and other spectroscopic evidence suggest the adsorption of Cr(VI) by pistachio shell powder, coupled with reductive conversion of Cr(VI) to Cr(III) by ZVC particles to produce a synergistic effect for the efficient remediation of Cr(VI) from aqueous medium.

Keywords Zerovalent copper · Pistachio · Biomass · Cr(VI) · Adsorption · Kinetics · Synergistic effect

Introduction

Consumer demands of expanding population on the planet are met by our industries with production, which is a threat to sustainable development. Herein, industries produce goods as per the demand of the consumer. Industries meet these demands through time-efficient processes, which demand the use of chemicals that could be fossil-oriented or mining-oriented (Carvalho 2017). These chemicals then enter into the biosphere through various environmental pathways and food chains (Garvey 2019). Heavy metals are essential components of these chemicals due to their desired redox, coordination,

and physical attributes (Aigberua et al. 2018; Vardhan et al. 2019). Chromium is considered as the 7th most abundant element on earth, existing in the core and mantle, and also ranked 21st in the earth crust with an average concentration of 185 mg kg⁻¹ (Sperling 2005). Chromium finds anthropogenic use in leather tanning, manufacturing, electroplating, chemical refining, organic synthesis, etc. (Lunk 2015; Nigam et al. 2015; Tadesse et al. 2017). The majority of the method for the treatment of chromium in wastewater involves the use of chemical precipitation, coagulation, bioreduction, electrocoagulation, etc. (GracePavithra et al. 2019; Owlad et al. 2009; Peng and Guo 2020; Pradhan et al. 2017). In spite of these treatment techniques, chromium does find its way into our environment, wherein it exists in two oxidation states (i.e., Cr(VI) and Cr(III)). Trivalent chromium is relatively stable and less toxic but poses health concerns at higher concentrations. However, hexavalent chromium is very harmful even at lower concentrations due to its carcinogenicity, hemotoxicity, and genotoxicity (Barceloux and Barceloux 1999; Burrows 2019). Based on the toxicity associated with chromium, the World Health Organization (WHO 2003) and Bureau of Indian Standards (BIS 10500-2012) have set the permissible limit of chromium at 50 µg/L in wastewater.

Responsible Editor: Tão Roberto Cadaval Jr

✉ Sandeep Kumar
sandeepchem83@gmail.com

¹ Department of Chemistry, Akal University, Talwandi Sabo, Bathinda, Punjab 151302, India

² Department of Chemistry, School of Basic and Applied Science, Central University of Punjab, Bathinda, Punjab 151001, India

³ Department of Botany, Akal University, Talwandi Sabo, Bathinda, Punjab 151302, India

SOME MANAGEMENT STRATEGIES TO INCREASE YIELD IN MUNGBEAN AGAINST ABIOTIC STRESS: AN OVERVIEW

Dr. Swati Das (Sur)

Assistant Professor of Botany

Nabadwip Vidyasagar College, Nabadwip, Nadia

ABSTRACT: Legume crops are very rich in proteins and micronutrients. Mungbean, also known as green gram or golden gram, is one of the important major pulse crops in India and others Asian countries. Plants can change their molecular, cellular, biochemical, morphological and physiological parameters to adapt and survive in a stressed condition. Under this stressed microenvironment different plant respond in different ways to adapt and achieve cellular homeostasis in their phenotypical characters. Being highly sensitive to these stresses mungbean changes many of its physical and biochemical characters affecting the growth pattern. Varieties resistant to biotic and abiotic stress factors can improve the productivity of the mungbean. Salt stress and drought affects the crop mungbean mostly. Salt stress i.e. higher concentrations of sodium chloride (NaCl) has many adverse effects on mungbean by reducing yield per plant, seed germination, fresh and dry biomass, shoot and root length. There is no such significant achievement regarding salt-tolerant mungbean varieties over years. Though mungbean is a low-irrigated crop but it is affected by the available soil moisture content and reduces its growth and seed yield. Mungbean deserve a special attention for trait based breeding as crop production model projects are rare in this crop.

Keywords— Mungbean, abiotic stress, salt stress, drought stress, root and shoot growth, seed yield, agronomic strategies, physiological improvement.

INTRODUCTION: Legume crops are very rich in proteins and micronutrients [1] (Foyer et al., 2016). Due to symbiosis with Rhizobium bacteria they can fix nitrogen which is beneficial for soil improvement in farming systems [2] (Snapp et al., 2010) and crop succeeding [3] (Ali, 1992). Mungbean [*Vigna radiata* (L.) R. Wilczek var. *radiata*], also known as green gram or golden gram, is one of the important major pulse crops in India and others Asian countries [4] (Khattak et al., 2001). The yield of mungbean has become stagnant due to abiotic and biotic constraints, poor knowledge regarding crop management and non-availability of seeds of improved varieties to farmers [5] (Chauhan et al., 2010); [6] (Pratap et al., 2019a). Due to recent climatic change and environmental deterioration abiotic stress has now become a major constraints as well as a threat to human beings. Like us plants are affected in abiotic stress too. Plants can change their molecular, cellular, biochemical, morphological and physiological parameters to adapt and survive in such a stressed condition [7] (Beck et al., 2007); [8] (Ahmad and Prasad, 2012); [9] (Martinez-Beltran and Manzur, 2005); [10] (Neto et al, 2004); [11] (Zhu

RELATIVE $(p, q) - \varphi$ ORDER BASED SOME GROWTH ANALYSIS OF COMPOSITE p -ADIC ENTIRE FUNCTIONS

TANMAY BISWAS AND CHINMAY BISWAS*

ABSTRACT. Let \mathbb{K} be a complete ultrametric algebraically closed field and $\mathcal{A}(\mathbb{K})$ be the \mathbb{K} -algebra of entire function on \mathbb{K} . For any p -adic entire functions $f \in \mathcal{A}(\mathbb{K})$ and $r > 0$, we denote by $|f|(r)$ the number $\sup\{|f(x)| : |x| = r\}$ where $|\cdot|(r)$ is a multiplicative norm on $\mathcal{A}(\mathbb{K})$. In this paper we study some growth properties of composite p -adic entire functions on the basis of their relative $(p, q) - \varphi$ order where p, q are any two positive integers and $\varphi(r) : [0, +\infty) \rightarrow (0, +\infty)$ is a non-decreasing unbounded function of r .

1. Introduction, Definitions and Notations

Let us consider an algebraically closed field \mathbb{K} of characteristic zero complete with respect to a p -adic absolute value $|\cdot|$ (example \mathbb{C}_p). For any $\alpha \in \mathbb{K}$ and $R \in]0, +\infty[$, the closed disk $\{x \in \mathbb{K} : |x - \alpha| \leq R\}$ and the open disk $\{x \in \mathbb{K} : |x - \alpha| < R\}$ are denoted by $d(\alpha, R)$ and $d(\alpha, R^-)$ respectively. Also $C(\alpha, r)$ denotes the circle $\{x \in \mathbb{K} : |x - \alpha| = r\}$. Moreover $\mathcal{A}(\mathbb{K})$ represent the \mathbb{K} -algebra of analytic functions in \mathbb{K} i.e. the set of power series with an infinite radius of convergence. For the most comprehensive study of analytic functions inside a disk or in the whole field \mathbb{K} , we refer the reader to the books [14–16, 18]. During the last several years the ideas of p -adic analysis have been studied from different aspects and many important results were gained (see [10] to [11], [12, 13]).

Let $f \in \mathcal{A}(\mathbb{K})$ and $r > 0$, then we denote by $|f|(r)$ the number $\sup\{|f(x)| : |x| = r\}$ where $|\cdot|(r)$ is a multiplicative norm on $\mathcal{A}(\mathbb{K})$. Moreover, if f is not a constant, the $|f|(r)$ is strictly increasing function of r and tends to $+\infty$ with r , therefore there exists its inverse function $\widehat{|f|} : (|f(0)|, \infty) \rightarrow (0, \infty)$ with $\lim_{s \rightarrow \infty} \widehat{|f|}(s) = \infty$.

For $x \in [0, \infty)$ and $k \in \mathbb{N}$, we define $\log^{[k]} x = \log(\log^{[k-1]} x)$ and $\exp^{[k]} x = \exp(\exp^{[k-1]} x)$ where \mathbb{N} is the set of all positive integers. We also denote $\log^{[0]} x = x$ and $\exp^{[0]} x = x$. Throughout the paper, \log denotes the Neperian logarithm. Further we assume that throughout the present paper p, q and m always denote positive

Received February 16, 2021. Revised April 10, 2021. Accepted April 15, 2021.

2010 Mathematics Subject Classification: 12J25, 30D35, 30G06, 46S10.

Key words and phrases: p -adic entire function, growth, composition, relative $(p, q) - \varphi$ order, relative $(p, q) - \varphi$ lower order.

* Corresponding author.

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SUM AND PRODUCT THEOREMS RELATING TO GENERALIZED RELATIVE ORDER (α, β) AND GENERALIZED RELATIVE TYPE (α, β) OF ENTIRE FUNCTIONS

TANMAY BISWAS^a CHINMAY BISWAS^b BISWAJIT SAHA^{c,*}

ABSTRACT. Orders and types of entire functions have been actively investigated by many authors. In this paper, we investigate some basic properties in connection with sum and product of generalized relative order (α, β) , generalized relative type (α, β) and generalized relative weak type (α, β) of entire functions with respect to another entire function where α, β are continuous non-negative functions on $(-\infty, +\infty)$.

1. INTRODUCTION, DEFINITIONS AND NOTATIONS

We denote by \mathbb{C} the set of all finite complex numbers. Let f be an entire function defined on \mathbb{C} . The maximum modulus function $M_f(r)$ of $f = \sum_{n=0}^{\infty} a_n z^n$ on $|z| = r$ is defined as $M_f = \max_{|z|=r} |f(z)|$. Moreover, if f is non-constant entire then $M_f(r)$ is also strictly increasing and continuous functions of r . Therefore its inverse $M_f^{-1} : (M_f(0), \infty) \rightarrow (0, \infty)$ exists and is such that $\lim_{s \rightarrow +\infty} M_f^{-1}(s) = \infty$. Further a non-constant entire function f is said to have the Property (A) if for any $\sigma > 1$ and for all sufficiently large r , $[M_f(r)]^2 \leq M_f(r^\sigma)$ holds (see [2]). We use the standard notations and definitions of the theory of entire functions which are available in [6] and [7], and therefore we do not explain those in details.

Let L be a class of continuous non-negative on $(-\infty, +\infty)$ function α such that $\alpha(x) = \alpha(x_0) \geq 0$ for $x \leq x_0$ with $\alpha(x) \uparrow +\infty$ as $x \rightarrow +\infty$ and $\alpha((1+o(1))x) = (1+o(1))\alpha(x)$ as $x \rightarrow +\infty$. We say that $\alpha \in L^0$, if $\alpha \in L$ and $\alpha(cx) = (1+o(1))\alpha(x)$ as $x_0 \leq x \rightarrow +\infty$ for each $c \in (0, +\infty)$, i.e., α is slowly increasing function. Clearly

Received by the editors March 27, 2020. Accepted May 07, 2021.

2010 Mathematics Subject Classification. 30D35, 30D30, 30D20.

Key words and phrases. entire function, growth, composition, generalized relative order (α, β) , generalized relative type (α, β) , generalized relative weak type (α, β) .

* Corresponding author.

SUM AND PRODUCT THEOREMS RELATING TO GENERALIZED RELATIVE ORDER (α, β) AND GENERALIZED RELATIVE TYPE (α, β) OF ENTIRE FUNCTIONS

TANMAY BISWAS^a CHINMAY BISWAS^b BISWAJIT SAHA^{c,*}

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Let L be a class of continuous non-negative on $(-\infty, +\infty)$ function α such that $\alpha(x) = \alpha(x_0) \geq 0$ for $x \leq x_0$ with $\alpha(x) \uparrow +\infty$ as $x \rightarrow +\infty$ and $\alpha((1+o(1))x) = (1+o(1))\alpha(x)$ as $x \rightarrow +\infty$. We say that $\alpha \in L^0$, if $\alpha \in L$ and $\alpha(cx) = (1+o(1))\alpha(x)$ as $x_0 \leq x \rightarrow +\infty$ for each $c \in (0, +\infty)$, i.e., α is slowly increasing function. Clearly

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* Corresponding author.

SOME GENERALIZED GROWTH PROPERTIES OF COMPOSITE ENTIRE AND MEROMORPHIC FUNCTIONS

TANMAY BISWAS AND CHINMAY BISWAS*

ABSTRACT. In this paper we wish to prove some results relating to the growth rates of composite entire and meromorphic functions with their corresponding left and right factors on the basis of their generalized order (α, β) and generalized lower order (α, β) , where α and β are continuous non-negative functions defined on $(-\infty, +\infty)$.

1. Introduction, Definitions and Notations

Let us consider that the reader is familiar with the fundamental results and the standard notations of the Nevanlinna's theory of meromorphic functions which are available in [8, 11, 17]. We also use the standard notations and definitions of the theory of entire functions which are available in [16] and therefore we do not explain those in details. Let f be an entire function and $M_f(r) = \max\{|f(z)| : |z| = r\}$. When f is meromorphic, the Nevanlinna's characteristic function $T_f(r)$ (see [8, p.4]) plays the same role as $M_f(r)$. For $x \in [0, +\infty)$ and $k \in \mathbb{N}$ where \mathbb{N} is the set of all positive integers, we define iterations of the exponential and logarithmic functions as $\exp^{[k]} x = \exp(\exp^{[k-1]} x)$ and $\log^{[k]} x = \log(\log^{[k-1]} x)$, with convention that $\log^{[0]} x = x$, $\log^{[-1]} x = \exp x$, $\exp^{[0]} x = x$, and $\exp^{[-1]} x = \log x$. Further we assume that p and q always denote positive integers. Now considering this, let us recall that Juneja et al. [10] defined the (p, q) -th order and (p, q) -th lower order of an entire function, respectively, as follows:

DEFINITION 1.1. [10] Let $p \geq q$. The (p, q) -th order $\rho^{(p,q)}(f)$ and (p, q) -th lower order $\lambda^{(p,q)}(f)$ of an entire function f are defined as:

$$\rho^{(p,q)}(f) = \limsup_{r \rightarrow +\infty} \frac{\log^{[p]} M_f(r)}{\log^{[q]} r} \quad \text{and} \quad \lambda^{(p,q)}(f) = \liminf_{r \rightarrow +\infty} \frac{\log^{[p]} M_f(r)}{\log^{[q]} r}.$$

If f is a meromorphic function, then

$$\rho^{(p,q)}(f) = \limsup_{r \rightarrow +\infty} \frac{\log^{[p-1]} T_f(r)}{\log^{[q]} r} \quad \text{and} \quad \lambda^{(p,q)}(f) = \liminf_{r \rightarrow +\infty} \frac{\log^{[p-1]} T_f(r)}{\log^{[q]} r}.$$

Received October 28, 2020. Accepted February 16, 2021. Published online March 30, 2021.

2010 Mathematics Subject Classification: 30D35, 30D30.

Key words and phrases: Entire function, meromorphic function, growth, composition, generalized order (α, β) .

* Corresponding author.

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RELATIVE $(p, q, t)L$ -TH ORDER ORIENTED SOME GROWTH PROPERTIES OF WRONSKIAN

TANMAY BISWAS AND CHINMAY BISWAS*

Abstract. In the paper we establish some new results depending on the comparative growth properties of composite transcendental entire and meromorphic functions using relative $(p, q, t)L$ -th order and relative $(p, q, t)L$ -th lower order and wronskian generated by one of the factors.

1. Introduction, definitions and notations

Let us consider that the reader is familiar with the fundamental results and the standard notations of the Nevanlinna theory of meromorphic functions which are available in [6, 9, 14, 15]. We also use the standard notations and definitions of the theory of entire functions which are available in [13] and therefore we do not explain those in details. Let f be an entire function defined in the open complex plane \mathbb{C} . The maximum modulus function $M_f(r)$ corresponding to f is defined on $|z| = r$ as $M_f(r) = \max_{|z|=r} |f(z)|$. If f is non-constant then it has the following property:

PROPERTY (A). [2]: A non-constant entire function f is said have the Property (A) if for any $\sigma > 1$ and for all sufficiently large values of r , $[M_f(r)]^2 \leq M_f(r^\sigma)$ holds.

For examples of functions with or without the Property (A), one may see [2].

When f is meromorphic, one may introduce another function $T_f(r)$ known as Nevanlinna's characteristic function of f , playing the same role as $M_f(r)$.

The integrated counting function $N_f(r, a)$ ($\bar{N}_f(r, a)$) of a -points (distinct a -points) of f is defined as

$$N_f(r, a) = \int_0^r \frac{n_f(t, a) - n_f(0, a)}{t} dt + n_f(0, a) \log r,$$

$$\left(\bar{N}_f(r, a) = \int_0^r \frac{\bar{n}_f(t, a) - \bar{n}_f(r, a)}{t} dt + \bar{n}_f(0, a) \log r \right),$$

where we denote by $n_f(t, a)$ ($\bar{n}_f(t, a)$) the number of a -points (distinct a -points) of f in $|z| \leq t$ and an ∞ -point is a pole of f . In many occasions $N_f(r, \infty)$ and $\bar{N}_f(r, \infty)$ are

Mathematics subject classification (2010): 30D20, 30D30, 30D35.

Keywords and phrases: Transcendental entire function, transcendental meromorphic function, relative $(p, q, t)L$ -th order, relative $(p, q, t)L$ -th lower order, growth, slowly changing function, Property (A), wronskian.

* Corresponding author.

ON SOME GROWTH PROPERTIES OF COMPOSITE ENTIRE
AND MEROMORPHIC FUNCTIONS FROM THE VIEW POINT
OF THEIR GENERALIZED TYPE (α, β) AND GENERALIZED
WEAK TYPE (α, β)

Tanmay Biswas and Chinmay Biswas*
Rajbari, Rabindrapally, R. N. Tagore Road
Krishnagar, Nadia - 741101, West Bengal, INDIA
E-mail : tanmaybiswas_math@rediffmail.com

*Department of Mathematics,
Nabadwip Vidyasagar College,
Nabadwip, Nadia - 741302, West Bengal, INDIA
E-mail : chinmay.shib@gmail.com

(Received: Oct. 31, 2020 Accepted: Feb. 23, 2021 Published: Apr. 30, 2021)

Abstract: The main aim of this paper is to prove some results related to the growth rates of composite entire and meromorphic functions on the basis of their generalized type (α, β) and generalized weak type (α, β) , where α and β are continuous non-negative functions defined on $(-\infty, +\infty)$.

Keywords and Phrases: Entire function, meromorphic function, growth, generalized order (α, β) , generalized type (α, β) , generalized weak type (α, β) .

2020 Mathematics Subject Classification: 30D35, 30D30.

1. Introduction, Definitions and Notations

Let us consider that the reader is familiar with the fundamental results and the standard notations of the Nevanlinna theory of meromorphic functions which are available in [7, 9, 14]. We also use the standard notations and definitions of the theory of entire functions which are available in [13] and therefore we do not explain those in details. Let f be an entire function and $M_f(r) = \max\{|f(z)| : |z| = r\}$.

A NOTE ON THE INTEGRAL REPRESENTATIONS OF
GENERALIZED RELATIVE ORDER (α, β) AND GENERALIZED
RELATIVE TYPE (α, β) OF ENTIRE AND MEROMORPHIC
FUNCTIONS WITH RESPECT TO AN ENTIRE FUNCTION

TANMAY BISWAS^a AND CHINMAY BISWAS^{b,*}

ABSTRACT. In this paper we wish to establish the integral representations of generalized relative order (α, β) and generalized relative type (α, β) of entire and meromorphic functions where α and β are continuous non-negative functions defined on $(-\infty, +\infty)$. We also investigate their equivalence relation under some certain condition.

1. INTRODUCTION

For any entire function $f = \sum_{n=0}^{\infty} a_n z^n$ on $|z| = r$, $M_f(r)$, a function of r is defined as follows:

$$M_f(r) = \max_{|z|=r} |f(z)|.$$

If an entire function f is non-constant then $M_f(r)$ is strictly increasing and continuous and its inverse $M_f^{-1} : (|f(0)|, \infty) \rightarrow (0, \infty)$ exists and is such that $\lim_{s \rightarrow +\infty} M_f^{-1}(s) = \infty$.

Whenever f is meromorphic, one can define another function $T_f(r)$ (see [13, p.4]) known as Nevanlinna's characteristic function of f plays the same role as $M_f(r)$. Moreover, if f is non-constant entire then $T_f(r)$ is also strictly increasing and continuous function of r . Therefore its inverse $T_f^{-1} : (T_f(0), \infty) \rightarrow (0, \infty)$ exists and is such that $\lim_{s \rightarrow +\infty} T_f^{-1}(s) = \infty$.

Received by the editors May 31, 2021. Accepted August 10, 2021.

2010 Mathematics Subject Classification. 30D35, 30D30, 30D20.

Key words and phrases. entire functions, meromorphic function, generalized relative order (α, β) , generalized relative lower order (α, β) , generalized relative type (α, β) , generalized relative weak type (α, β) .

*Corresponding author.

SOME REMARKS ON THE GROWTH OF COMPOSITE p -ADIC ENTIRE FUNCTION

TANMAY BISWAS* AND CHINMAY BISWAS

ABSTRACT. In this paper we wish to introduce the concept of generalized relative index-pair (α, β) of a p -adic entire function with respect to another p -adic entire function and then prove some results relating to the growth rates of composition of two p -adic entire functions with their corresponding left and right factors.

1. Introduction and preliminaries

Let us consider an algebraically closed field \mathbb{K} of characteristic zero complete with respect to a p -adic absolute value $|\cdot|$ (example \mathbb{C}_p). For any $\Lambda \in \mathbb{K}$ and $R \in]0, +\infty[$, the closed disk $\{x \in \mathbb{K} : |x - \Lambda| \leq R\}$ and the open disk $\{x \in \mathbb{K} : |x - \Lambda| < R\}$ are denoted by $d(\Lambda, R)$ and $d(\Lambda, R^-)$ respectively. Also $C(\Lambda, r)$ denotes the circle $\{x \in \mathbb{K} : |x - \Lambda| = r\}$. Moreover $\mathcal{A}(\mathbb{K})$ represent the \mathbb{K} -algebra of analytic functions in \mathbb{K} i.e., the set of power series with an infinite radius of convergence. For the most comprehensive study of analytic functions inside a disk or in the whole field \mathbb{K} , we refer the reader to the books [17–19, 22]. During the last several years the ideas of p -adic analysis have been studied from different aspects and many important results were gained (see [3] to [16]).

Let $f \in \mathcal{A}(\mathbb{K})$ and $r > 0$, then we denote by $|f|(r)$ the number $\sup\{|f(x)| : |x| = r\}$ where $|\cdot|(r)$ is a multiplicative norm on $\mathcal{A}(\mathbb{K})$. Moreover, if f is not a constant, the $|f|(r)$ is strictly increasing function of r and tends to $+\infty$ with r , therefore there exists its inverse function $\widehat{|f|} : (|f(0)|, \infty) \rightarrow (0, \infty)$ with $\lim_{s \rightarrow \infty} \widehat{|f|}(s) = \infty$.

For $x \in]0, \infty)$ and $k \in \mathbb{N}$, we define $\log^{[k]} x = \log(\log^{[k-1]} x)$ and $\exp^{[k]} x = \exp(\exp^{[k-1]} x)$ where \mathbb{N} is the set of all positive integers. We also denote $\log^{[0]} x = x$ and $\exp^{[0]} x = x$. Throughout the paper, \log denotes the Neperian logarithm. Taking this into account the (p, q) -th order and (p, q) -th lower order of an entire function $f \in \mathcal{A}(\mathbb{K})$ are defined as follows:

DEFINITION 1.1. [7] Let $f \in \mathcal{A}(\mathbb{K})$ and p, q be two positive integers. Then the (p, q) -th order $\rho^{(p,q)}(f)$ and (p, q) -th lower order $\lambda^{(p,q)}(f)$ of f are respectively defined

Received July 17, 2021. Revised September 12, 2021. Accepted September 24, 2021.

2010 Mathematics Subject Classification: 12J25, 30D35, 30G06, 46S10.

Key words and phrases: p -adic entire function, growth, composition, generalized relative order (α, β) , generalized relative index-pair (α, β) .

* Corresponding author.

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SOME REMARKS ON THE GENERALIZED ORDER AND GENERALIZED TYPE OF ENTIRE MATRIX FUNCTIONS IN COMPLETE REINHARDT DOMAIN

TANMAY BISWAS AND CHINMAY BISWAS*

ABSTRACT. The main aim of this paper is to introduce the definitions of generalized order and generalized type of the entire function of complex matrices and then study some of their properties. By considering the concepts of generalized order and generalized type, we will extend some results of Kishka et al. [5].

1. Introduction

In this paper we represent the field of complex variables by \mathbb{C} and the space of several complex variables by \mathbb{C}^n . We assume that the readers are familiar with the fundamental results and standard notations of the analytic functions of several complex variables. However, In 1959, Gol'dberg had introduced the definitions of the Gol'dberg order and Gol'dberg type of entire function in several complex variables (cf. [2]). For more details about the study of the order and type of entire functions we refer to ([1,3], [6] to [9]). The main purpose of this present paper is to study of entire function of several complex matrices in complete Reinhardt domains which is also known as poly cylindrical regions. After introducing the definitions of generalized order and generalized type of the entire function of complex matrices in complete Reinhardt domains, we study some of their growth properties which considerably extend the earlier results of [5]. To prove our main results we have followed some of the techniques as used by Kishka et al. [5].

Let $\mathbf{z} = (z_1, z_2, \dots, z_n)$ be a point of \mathbb{C}^n ; the space of several complex variables, a closed complete Reinhardt domain of radii $(\alpha_s r > 0)$; $s \in I = 1, 2, 3, \dots, n$ is here denoted by $\bar{\Gamma}_{\{\alpha r\}}$ and is given by

$$\bar{\Gamma}_{\{\alpha r\}} = \{\mathbf{z} \in \mathbb{C}^n : |z_s| \leq \alpha_s r; s \in I,$$

where α_s are positive numbers.

The open Reinhardt domain is here denoted by $\Gamma_{\{\alpha r\}}$ and is given by

$$\Gamma_{\{\alpha r\}} = \{\mathbf{z} \in \mathbb{C}^n : |z_s| < \alpha_s r; s \in I.$$

Received August 17, 2021. Revised September 30, 2021. Accepted November 30, 2021.

2010 Mathematics Subject Classification: 32A17, 32A30, 30B10, 30D15, 26A12.

Key words and phrases: Entire function, generalized order, generalized type, Matrix function.

* Corresponding author.

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SOME GROWTH PROPERTIES OF SPECIAL TYPE OF DIFFERENTIAL POLYNOMIAL GENERATED BY ENTIRE AND MEROMORPHIC FUNCTIONS ON THE BASIS OF THEIR RELATIVE $(p, q, r)L$ -th ORDER

By

Tanmay Biswas¹, Ritam Biswas² and Chinmay Biswas³

¹Rajbari, Rabindrapally, R. N. Tagore Road, P.O. Krishnagar, Dist.-Nadia- 741101, West Bengal, India

²Department of Mathematics, Krishnath College, P.O.- Berhampore, Dist.- Murshidabad-742101, West Bengal, India

³Department of Mathematics, Nabadwip Vidyasagar College, Nabadwip, Dist.- Nadia-741302, West Bengal, India

Email: tanmaybiswas_math@rediffmail.com, ritamitr@yahoo.co.in, chinmay.shib@gmail.com

(Received : March 16, 2021 ; Revised in format: March 24, 2021 ; Revised in final form : October 03, 2021)

Abstract

In the paper we establish some new results depending on the comparative growth properties of composite transcendental entire and meromorphic functions using relative $(p, q, r)L$ -th order and relative $(p, q, r)L$ -th lower order and that of a special type of differential polynomial generated by one of the factors.

2020 Mathematical Sciences Classification: 30D20, 30D30, 30D35.

Keywords and Phrases: Transcendental entire function, transcendental meromorphic function, relative $(p, q, r)L$ -th order, relative $(p, q, r)L$ -th lower order, growth, slowly changing function, property(A), special type of differential polynomial.

1 Introduction, Definitions and Notations

Let us consider that the reader is familiar with the fundamental results and the standard notations of the Nevanlinna theory of meromorphic functions which are available in [6, 9, 14, 15]. We also use the standard notations and definitions of the theory of entire functions which are available in [13] and therefore we do not explain those in details. Let f be an entire function defined in the open complex plane \mathbb{C} . The maximum modulus function $M_f(r)$ corresponding to f is defined on $|z| = r$ as $M_f(r) = \max_{|z|=r} |f(z)|$. When f is meromorphic, one may introduce another function $T_f(r)$ known as Nevanlinna's characteristic function of f , playing the same role as $M_f(r)$. If f is a non-constant entire function then it has the following property:

Property (A) [2]: A non-constant entire function f is said have the Property (A) if for any $\sigma > 1$ and for all sufficiently large values of r , $[M_f(r)]^2 \leq M_f(r^\sigma)$ holds.

For examples of functions with or without the Property (A), one may see [2].

Now we just recall the following properties of meromorphic functions which will be needed in the sequel.

Let $n_0, n_1, n_2, \dots, n_k$ be non negative integers. For a transcendental meromorphic function f , we call the expression $M[f] = f^{n_0}(f^{(1)})^{n_1}(f^{(2)})^{n_2} \dots (f^{(k)})^{n_k}$ to be a monomial generated by f . The numbers $\gamma_M = n_0 + n_1 + n_2 + \dots + n_k$ and $\Gamma_M = n_0 + 2n_1 + 3n_2 + \dots + (k+1)n_k$ are called respectively the degree and weight of the monomial. If $M_1[f], M_2[f], \dots, M_n[f]$ denote monomials in f , then

$$Q[f] = a_1 M_1[f] + a_2 M_2[f] + \dots + a_n M_n[f],$$

where $a_j \neq 0 (j = 1, 2, \dots, n)$ is called a differential polynomial generated by f of degree $\gamma_Q = \max\{\gamma_{M_j} : 1 \leq j \leq n\}$ and weight $\Gamma_Q = \max\{\Gamma_{M_j} : 1 \leq j \leq n\}$. Also we call the numbers $\underline{\gamma}_Q = \min_{1 \leq j \leq n} \gamma_{M_j}$ and k (the order of the highest derivative of f) the lower degree and the order of $Q[f]$ respectively. If $\underline{\gamma}_Q = \gamma_Q$, $Q[f]$ is called a homogeneous differential polynomial.

However, the Nevanlinna's Characteristic function of a meromorphic function f is characterized as

$$T_f(r) = N_f(r) + m_f(r),$$

wherever the function $N_f(r, a) (\bar{N}_f(r, a))$ known as counting function of a -points (distinct a -points) of meromorphic f is defined as follows:

$$N_f(r, a) = \int_0^r \frac{n_f(t, a) - n_f(0, a)}{t} dt + n_f(0, a) \log r$$
$$(\bar{N}_f(r, a) = \int_0^r \frac{\bar{n}_f(t, a) - \bar{n}_f(0, a)}{t} dt + \bar{n}_f(0, a) \log r),$$

GENERALIZED RELATIVE TYPE (α, β) AND GENERALIZED RELATIVE WEAK TYPE (α, β)
ORIENTED SOME GROWTH ANALYSIS OF COMPOSITE p -ADIC ENTIRE FUNCTIONS

By

Tanmay Biswas¹ and Chinmay Biswas²

¹Rajbari, Rabindrapally, R. N. Tagore Road, P.O. Krishnagar, Dist. Nadia-741101, West Bengal, India

²Department of Mathematics, Nabadwip, Vidyasagar College, Nabadwip, Dist. Nadia-741302, West Bengal, India

Email: tanmaybiswas_math@rediffmail.com, chinmay.shib@gmail.com

(Received : July 23, 2021; In format : September 15, 2021; Revised : November 20, 2021)

Abstract

The main aim of this paper is to prove some results related to the growth rates of composite p -adic entire functions on the basis of their generalized relative type (α, β) and generalized relative weak type (α, β) where α and β are continuous non-negative functions defined on $(-\infty, +\infty)$.

2020 Mathematical Sciences Classification: (2020) : 12J25, 30D35, 30G06, 46S10.

Keywords and Phrases: p -adic entire function, growth, generalized order (α, β) , generalized type (α, β) , generalized weak type (α, β) , generalized relative order (α, β) , generalized relative type (α, β) , generalized relative weak type (α, β) .

1 Introduction

Let us consider an algebraically closed field \mathbb{K} of characteristic zero complete with respect to a p -adic absolute value $|\cdot|$ (example \mathbb{C}_p). For any $\Lambda \in \mathbb{K}$ and $R \in]0, +\infty[$, the closed disk $\{x \in \mathbb{K} : |x - \Lambda| \leq R\}$ and the open disk $\{x \in \mathbb{K} : |x - \Lambda| < R\}$ are denoted by $d(\Lambda, R)$ and $d(\Lambda, R^-)$ respectively. Also $C(\Lambda, r)$ denotes the circle $\{x \in \mathbb{K} : |x - \Lambda| = r\}$. Moreover $\mathcal{A}(\mathbb{K})$ represent the \mathbb{K} -algebra of analytic functions in \mathbb{K} , i.e., the set of power series with an infinite radius of convergence. For the most comprehensive study of analytic functions inside a disk or in the whole field \mathbb{K} , we refer the reader to the books [16, 17, 18, 20]. During the last several years the ideas of p -adic analysis have been studied from different aspects and many important results were gained (see [2] to [15]).

Let $f \in \mathcal{A}(\mathbb{K})$ and $r > 0$, then we denote by $|f|(r)$ the number $\sup\{|f(x)| : |x| = r\}$ where $|\cdot|(r)$ is a multiplicative norm on $\mathcal{A}(\mathbb{K})$. Moreover, if f is not a constant, the $|f|(r)$ is strictly increasing function of r and tends to $+\infty$ with r , therefore there exists its inverse function $\widehat{|f|} : (|f|(0), \infty) \rightarrow (0, \infty)$ with $\lim_{x \rightarrow \infty} \widehat{|f|}(x) = \infty$.

For $x \in [0, \infty)$ and $k \in \mathbb{N}$, we define $\log^{[k]} x = \log(\log^{[k-1]} x)$ and $\exp^{[k]} x = \exp(\exp^{[k-1]} x)$ where \mathbb{N} is the set of all positive integers. We also denote $\log^{[0]} x = x$ and $\exp^{[0]} x = x$. Throughout the paper, \log denotes the Neperian logarithm. Taking this into account the (p, q) -th order and (p, q) -th lower order of an entire function $f \in \mathcal{A}(\mathbb{K})$ are defined as follows:

Definition 1.1[6] Let $f \in \mathcal{A}(\mathbb{K})$ and p, q be any two positive integers. Then the (p, q) -th order $\varrho^{(p,q)}(f)$ and (p, q) -th lower order $\lambda^{(p,q)}(f)$ of f are respectively defined as:

$$\varrho^{(p,q)}(f) = \limsup_{r \rightarrow \infty} \frac{\log^{[p]} |f|(r)}{\log^{[q]} r} \text{ and } \lambda^{(p,q)}(f) = \liminf_{r \rightarrow \infty} \frac{\log^{[p]} |f|(r)}{\log^{[q]} r}.$$

Definition 1.1 avoids the restriction $p \geq q$ of the original definition of (p, q) -th order (respectively (p, q) -th lower order) of entire functions introduced by Juneja et al. [19] in complex context.

When $q = 1$, we get the definitions of generalized order and generalized lower order of an entire function $f \in \mathcal{A}(\mathbb{K})$ which symbolize as $\varrho^{(p)}(f)$ and $\lambda^{(p)}(f)$ respectively. If $p = 2$ and $q = 1$ then we write $\varrho^{(2,1)}(f) = \varrho(f)$ and $\lambda^{(2,1)}(f) = \lambda(f)$ where $\varrho(f)$ and $\lambda(f)$ are respectively known as order and lower order of $f \in \mathcal{A}(\mathbb{K})$ introduced by Boussaf et al. [12].

Now let L be a class of continuous non-negative functions α defined on $(-\infty, +\infty)$ such that $\alpha(x) = \alpha(x_0) \geq 0$ for $x \leq x_0$ with $\alpha(x) \uparrow +\infty$ as $x \rightarrow +\infty$ and $\alpha((1 + \alpha(1))x) = (1 + \alpha(1))\alpha(x)$ as $x \rightarrow +\infty$. We say that $\alpha \in L^0$, if $\alpha \in L$ and $\alpha(\epsilon x) = (1 + \alpha(1))\alpha(x)$ as $x_0 \leq x \rightarrow +\infty$ for each $\epsilon \in (0, +\infty)$, i.e., α is slowly increasing function. Clearly $L^0 \subset L$.

The concept of generalized order (α, β) of entire function in complex context was introduced by Sheremeta [21] where $\alpha, \beta \in L$. In complex context, several authors made close investigations on the properties of entire functions related to generalized order (α, β) in some different direction. For the purpose of further applications of generalized order (α, β) of entire function in complex context, Biswas et al. [3, 6] rewrite the definition of generalized order (α, β) of an entire function considering $\alpha, \beta \in L^0$. For details about generalized order (α, β) and generalized lower order

REVIEW

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Impact of metal oxide nanoparticles on cotton (*Gossypium hirsutum* L.): a physiological perspective

SINGH BRAR Ravinderdeep¹, KUMAR Avneesh², KAUR Simranjeet², SAHA Sandip¹, KUMAR Anuj³ and KUMAR Sandeep^{1*}

Abstract

Cotton production substantiated a crucial part in the escalating economic development of many countries. To realize the increasing global demand for cotton, the emphasis should be laid on to improve cotton fiber growth and production. The bioengineered transgenic cotton proved expedient in resolving inadequacies of conventional cotton, but still required improvements to encounter heightened demand of textile industries. One possible solution pertaining to this has been provided by nanoscience in the form of metal or metal oxide nanoparticles. These metal oxide nanoparticles have easy access to the various parts of cotton plants through its transportation system, and thus significantly influence several parameters relative to the growth and production of cotton fiber. This review summarizes the distribution and accumulation of metal oxide nanoparticles in cotton plant and its impact on different plant growth-promoting factors, which resulted in the improved cotton yields.

Keywords: Cotton, Bt-transgenic, Nanoparticles, Metal oxide nanoparticles, Phytohormones, Superoxide dismutase, Nutrient element

Background

Cotton, *Gossypium hirsutum* L. (Malvaceae), is a natural plant fiber of great economic significance, grown worldwide and now dominates the natural textile industry (Wegier et al. 2016). Additionally, cottonseed is a well-known livestock and poultry feed rich in fiber (24%), fat (20%) and protein (23%). Refined and deodorized cottonseed oil is one of the nutritious edible oils due to the presence of high levels of antioxidants such as tocopherol (Nix et al. 2017; Yang et al. 2019; Yang et al. 2017). The supply, however, has not grown proportionately to its diverse uses. Further, the gap between demand and supply has widened with the exponential growth of the population. To fill this gap, a genetically-modified Bt-cotton comprising the parasporal crystal protein genes of bacteria *Bacillus thuringiensis* (Bt) with insecticidal proteins

(δ -endotoxin) was developed with many advantages over conventional cotton to improve yield, quality, and pest resistance, etc., which has encouraged the commercialization of the transgenic cotton in recent years (Abdelmoteleb et al. 2018; Roh et al. 2007). The high yield Bt-cotton resulted in a 30% reduction of the land area used for cotton cultivation globally over the last 30 years, as well as the global cotton production has increased around 400% (Mehboob-ur-Rahman et al. 2012; Witjaksono et al. 2014). Many factors such as climate (temperature, light, rainfall, dew, wind, etc.), duration of growing season, availability of nutrients, relative humidity, soil moisture, pests, heavy metal contamination and cultivation practices may have unexpected responses to the growth of cotton plants (Sawan 2017; Mei et al. 2018; Xu et al. 2019). The target for the improved cotton yield can be realized by using advanced agricultural technologies and genetically-improved cotton breeds, understanding of climatic conditions, and soil fertilizer management, etc. (Thorp et al. 2014). Other than these technological developments for

* Correspondence: sandeepchem83@gmail.com


¹Department of Chemistry, Akal University, Talwandi Sabo, Bathinda, Punjab 151302, India

Full list of author information is available at the end of the article



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Ethnobotany, phytochemistry, pharmacology, and toxicity of *Centella asiatica* (L.) Urban: A comprehensive review

Dew Biswas¹ | Sujata Mandal¹ | Suchismita Chatterjee Saha² |
Champa Keeya Tudu³ | Samapika Nandy³ | Gaber El-Saber Batiha³ |
Mahipal S. Shekhawat⁴ | Devendra Kumar Pandey⁵ | Abhijit Dey¹ 

¹Department of Life Sciences, Presidency University, Kolkata, India

²Department of Zoology, Nabachip Vidyasagar College, Nabachip, India

³Department of Pharmacology and Therapeutics, Faculty of Veterinary Medicine, Damouthour University, Damouthour, Egypt

⁴Department of Plant Biology and Biotechnology, Kanchi Mamunihar Government Institute for Postgraduate Studies and Research, Pondicherry, India

⁵Department of Biotechnology, Lovely Professional University, Phagwara, India

Correspondence

Abhijit Dey, Department of Life Sciences, Presidency University, 86/1, College Street, Kolkata, West Bengal, India.
Email: abhijit.dbs@presuniv.ac.in

The well-known medicinal plant *Centella asiatica* (L.) Urban is an Ayurvedic and traditional Chinese medicine used in the treatment of different health problems and as an edible vegetable in a regular diet. Ease of availability in the wide range of environmental conditions plus low-cost cultivation process has made the plant popular in ethno-medicinal healthcare systems. In the present review, phytochemical analysis of plant-extract and pharmacological activities of bioactive-compounds are discussed based upon the available reports to understand their therapeutic potentialities along with the mechanisms behind. The results exhibited that *C. asiatica* and its triterpenoids demonstrated an array of pharmacological effects and health benefits, some of which were confirmed in many preclinical and clinical studies. Those reports also provided considerable evidences in support of the principles of folk treatment in different countries. Increase and maintenance of the prospective plant secondary metabolites would provide an enriched resource of drug molecules. Development of suitable derivatives of the therapeutic compounds can give an assurance for getting more effective drug candidates with reduced side effects. The review also enumerates the application of advanced nanotechnology, toxicology, and clinical-trial reports on the plant with notes on the shortcomings in the present research and future perspectives of using this medicinal plant.

KEYWORDS

Centella asiatica, ethnobotany, phytochemicals, pharmacology, toxicity, nanotechnology, clinical studies

Abbreviations: AAS, atomic absorption spectrophotometer; AE, arille adona; AMP, adenosine mono phosphate; CFR, capillary filtration rate; CFR, conditioned fear response; DPPH, 2,2-diphenyl-1-picrylhydrazyl; GAD, generalized anxiety disorder; GC-MS, gas chromatography mass spectrometry; HBV, Chronic Hepatitis B virus; HCV, hepatitis C virus; HIV, human immunodeficiency virus; HPLC, high-performance liquid chromatography; HPTLC, high-performance thin-layer chromatography; ICH, international conference on harmonization; IL, interleukin; LPS, lipopolysaccharide; LTP, long-term potentiation; NRM, nucleus basalis of Meynert; ROS, reactive oxygen species; SOD, Superoxide dismutase; TGF, Transforming growth factor; TNF, tumor necrosis factor; TSS, total symptom score; VEGF, vascular endothelial growth factor; VSV, vesicular stomatitis virus; WHO, World Health Organization.

Dew Biswas and Sujata Mandal contributed equally to this study.

1 | INTRODUCTION

History of traditional medicinal plants depicted their significant therapeutic potentials with beneficial effects on living body. Recent global trend of using these plants as an effective strategy for the discovery of novel bioactive compounds has involved researchers in this field, vastly. Those plants are enriched bio-resource of notable pharmaceutical compounds (e.g., secondary metabolites like alkaloids, flavonoids, terpenoids etc.) which are popularly used for several semi-synthetic and synthetic drug development (Salehi, Abu-Reidah, et al., 2020;



Withania somnifera (L.) Dunal (Ashwagandha): A comprehensive review on ethnopharmacology, pharmacotherapeutics, biomedical and toxicological aspects

Subhabrata Paul^{a,1}, Shreya Chakraborty^{b,1}, Uttpal Anand^{c,1}, Swarnali Dey^d,
Samapika Nandy^e, Mimosa Ghorai^b, Suchismita Chatterjee Saha^f, Manoj Tukaram Patil^g,
Ramesh Kandimalla^{h,1}, Jaroslaw Proćków^{h,1}, Abhijit Dey^{h,1}*

^a School of Biotechnology, Presidency University (2nd Campus), Kolkata 700156, West Bengal, India

^b Department of Life Sciences, Presidency University, 86/1 College Street, Kolkata 700073, West Bengal, India

^c Department of Life Sciences, Ben-Gurion University of the Negev, Beer-Sheva 84105, Israel

^d Department of Botany, University of Calicut, Kozhikode 700019, West Bengal, India

^e Department of Zoology, Nalanda Vidyapeeth College (Affiliated to the University of Kalyani), Nalanda 741302, West Bengal, India

^f Post Graduate Department of Botany, SNU's KRDA Arts, SMGL Campus and SPJ Science College (Affiliated to Santiraj Mahi Puri University), Chandernagore, Kachhi 421101, Maharashtra, India

^g CSIR Indian Institute of Chemical Technology, Uppal Road, Taranaka, Hyderabad 500007, Telangana, India

^h Department of Biochemistry, Katowice Medical College, Wierzbog 500007, Telangana, India

¹ Department of Plant Biology, Institute of Environmental Biology, Wrocław University of Environmental and Life Sciences, Koszuchowska 5b, 51-631 Wrocław, Poland

ARTICLE INFO

Keywords:
Ashwagandha
Ethnobotany
Phytochemistry
Pharmacology
Toxicology
Withanolides
Withania somnifera

ABSTRACT

Withania somnifera (L.) Dunal (Solanaceae) has been used as a traditional Rasayana herb for a long time. Traditional uses of this plant indicate its ameliorative properties against a plethora of human medical conditions, viz. hypertension, stress, diabetes, asthma, cancer etc. This review presents a comprehensive summary of the geographical distribution, traditional use, phytochemistry, and pharmacological activities of *W. somnifera* and its active constituents. In addition, it presents a detailed account of its presence as an active constituent in many commercial preparations with curative properties and health benefits. Clinical studies and toxicological considerations of its extracts and constituents are also elucidated. Comparative analysis of relevant in-vitro, in-vivo, and clinical investigations indicated potent bioactivity of *W. somnifera* extracts and phytochemicals as anti-cancer, anti-inflammatory, apoptotic, immunomodulatory, antimicrobial, anti-diabetic, hepatoprotective, hypoglycaemic, hypolipidemic, cardio-protective and spermatogenic agents. *W. somnifera* was found to be especially active against many neurological and psychological conditions like Parkinson's disease, Alzheimer's disease, Huntington's disease, ischemic stroke, sleep deprivation, amyotrophic lateral sclerosis, attention deficit hyperactivity disorder, bipolar disorder, anxiety, depression, schizophrenia and obsessive-compulsive disorder. The probable mechanism of action that imparts the pharmacological potential has also been explored. However, in-depth studies are needed on the clinical use of *W. somnifera* against human diseases. Besides, detailed toxicological analysis is also to be performed for its safe and efficacious use in preclinical and clinical studies and as a health-promoting herb.

1. Introduction

Since its inception in 6000 B.C., *Withania somnifera* (L.) Dunal (Solanaceae), popularly known as Ashwagandha in Sanskrit, has been

extensively implemented as herbal medicine. An evergreen woody shrub of the Solanaceae family, *W. somnifera* has been assigned several names with distinct meanings such as "Indian winter cherry" or "Indian ginseng" in English, "Punir" or "Asgandh" in Hindi and "Asgand" in

* Corresponding authors.

E-mail addresses: jaroslaw.prockow@upwr.edu.pl (J. Proćków), abhijit.dey@presiuniv.ac.in (A. Dey).

¹ Equal contribution.

<https://doi.org/10.1016/j.bioph.2021.112175>

received 18 June 2021; Received in revised form 3 September 2021; Accepted 7 September 2021

available online 27 September 2021

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RELATIVE (p, q, t) -TH TYPE AND RELATIVE (p, q, t) -TH WEAK TYPE ORIENTED GROWTH PROPERTIES OF WRONSKIAN

TANMAY BISWAS^a AND CHINMAY BISWAS^{b,*}

ABSTRACT. In the paper we establish some new results depending on the comparative growth properties of composite transcendental entire and meromorphic functions using relative (p, q, t) -th order, relative (p, q, t) -th type and relative (p, q, t) -th weak type and that of Wronskian generated by one of the factors.

1. INTRODUCTION

Let us consider that the reader is familiar with the fundamental results and the standard notations of the Nevanlinna theory of meromorphic functions which are available in [7, 10, 15, 16]. We also use the standard notations and definitions of the theory of entire functions which are available in [14] and therefore we do not explain those in details. Let f is an entire function defined in the open complex plane \mathbb{C} . The maximum modulus function $M_f(r)$ corresponding to f is defined on $|z| = r$ as $M_f(r) = \max_{|z|=r} |f(z)|$. If f is non-constant then it has the following property:

Property (A) ([2]): A non-constant entire function f is said have the *Property (A)* if for any $\sigma > 1$ and for all sufficiently large values of r , $[M_f(r)]^2 \leq M_f(r^\sigma)$ holds. For examples of functions with or without the Property (A), one may see [2].

When f is meromorphic, one may introduce another function $T_f(r)$ known as Nevanlinna's characteristic function of f , playing the same role as $M_f(r)$.

The integrated counting function $N_f(r, a)$ ($\bar{N}_f(r, a)$) of a -points (distinct a -points) of f is defined as

Received by the editors September 10, 2021. Revised September 21. Accepted October 04, 2021.
2010 *Mathematics Subject Classification.* 30D35, 30D30, 30D20.

Key words and phrases. entire function, meromorphic function, Wronskian, relative (p, q, t) -th order, relative (p, q, t) -th type, relative (p, q, t) -th weak type, growth, slowly changing function, Property (A).

*Corresponding author.



Size Dependent Chromosome Positioning using Gene-Density-Based Model

Nirmalendu Ganai*

Department of Physics, Nabadwip Vidyasagar College, Nabadwip, Nadia - 741302, West Bengal, India.

Received: 05 Oct 2021

Revised: 16 Oct 2021

Accepted: 29 Oct 2021

*Address for Correspondence

Nirmalendu Ganai

Department of Physics,
Nabadwip Vidyasagar College,
Nabadwip, Nadia - 741302,
West Bengal, India.

Email: nirmalendu.phy@gmail.com



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ABSTRACT

Chromosomes are not distributed randomly inside eukaryotic cell nuclei in interphase. There are mainly two chromosome positioning schemes – one is based on gene density and the other is based on chromosome size which is studied here. Computer simulation shows that the size dependent radial positioning of chromosomes appears because of the inhomogeneous distribution of activity across chromosomes which is originated because ATP consuming processes required in chromatin remodelling and transcription are distributed non-uniformly on each chromosome. Result obtained from computer simulation is in good agreement with the experimental data.

Keywords: chromosome positioning, out of equilibrium, active matter, computational biology, lopolymer

INTRODUCTION

Recent studies suggest that chromosomes are not organised randomly within the nucleus at interphase. Gene rich chromosome 19 in human cells is generally located near the centre of the nucleus whereas similarly sized but gene poor chromosome 18 takes the peripheral position [1,2]. In general, gene-rich chromosomes are found more centrally than gene-poor chromosomes which provides gene-density-based positioning scheme for all chromosomes [3]. It has also been reported that in some human cell types, chromosomes are distributed within the nucleus based on their size with the centre of mass of smaller chromosome located more centrally than that of the larger one [4-6]. Most computational models are based on the assumption that the chromosomes are polymers in thermal equilibrium [7-12] and they are unable to predict the chromosome positioning schemes based on gene density and size.

Enzymatic activities associated with DNA repair, chromatin remodelling and transcription are ATP consuming processes and the theories of "active-matter" [13-16] can be used to model such ATP consuming processes. It is

37190





Tetrahedron report 1243

Diaminopimelic acid and its analogues: Synthesis and biological perspective

Bhaskar Chatterjee ^{a, *}, Dhananjoy Mondal ^b, Smritilekha Bera ^b

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<https://doi.org/10.1016/j.tet.2021.132403>

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Abstract

Diaminopimelic acid and its analogues have attracted substantial attention owing to their fascinating biochemistry and the desire to develop potentially useful antimicrobial agents. Peptidoglycan, a key structural component of the bacterial cell wall, is largely dependent on meso-2,6-diaminopimelic acid (DAP), which acts as a cross-linking agent between glycan strands. Several synthetic strategies based on structural features of peptidoglycan have been focused on synthesizing DAP and its analogues to better understand their mechanism of action against specific DAP enzymes. To gain a deep insight into the chemistry and biology of such useful compounds, a concise overview would thus be beneficial. The current review highlighted some of the key synthetic ventures and biological activities of diaminopimelic acid and its various analogues including aza, cyclopropyl, phosphonate, heterocyclic, unsaturated ones and DAP-fragments of peptides.

Graphical abstract



Review

Promising botanical-derived monoamine oxidase (MAO) inhibitors: pharmacological aspects and structure-activity studies

Tuyele Das^{1,3,6}, Suchismita Chatterjee Saha^{2,3,6}, Kumari Sunita^{2,3}, Madhumita Majumder^{3,4}, Mimosa Ghorai^{1,3}, Abhijit Bhagwan Mane^{3,5}, Dorairaj Arvind Prasanth^{3,6}, Prasann Kumar^{3,7}, Devendra Kumar Pandey^{3,8}, Abdel Rahman Al-Tawaha^{3,9}, Gaber El-Saber Batiba^{3,10}, Mahipal S Shekhawat^{3,11}, Arabinda Ghosh^{3,12}, Javad Sharifi-Rad^{3,13}, Abhijit Dey^{1,3,*}

¹ Department of Life Sciences, Presidency University, 86/1 College Street, Kolkata, 700073, West Bengal, India

² Department of Zoology, Nabadwip Vidyasagar College, Nabadwip, West Bengal, India

³ Department of Botany, DPU Gorakhpur University Gorakhpur

⁴ Department of Botany, Rashtreeya College, West Bengal, India

⁵ Department of Zoology, Dr. P. Prangosa Kadam Mahavidyalaya, Ramnagar (Bar), Maharashtra, India

⁶ Department of Microbiology, School of Biosciences, Periyar University, Salem-636011, Tamilnadu, India

⁷ Department of Agronomy, Lovely Professional University, Jalandhar, Punjab, 144411, India

⁸ Department of Biotechnology, Lovely Professional University, Punjab, India

⁹ Department of Biological Sciences, Al-Hussein Bin Talal University, Maan, Jordan

¹⁰ Department of Pharmacology and Therapeutics, Faculty of Veterinary Medicine, Damanhour University, Damanhour 22511, Al-Behira, Egypt

¹¹ Department of Plant Biology and Biotechnology, K.M. Centre for Post Graduate Studies, Lawspet, Pondicherry 605 606, India

¹² Department of Botany, Gauhati University, Gauhati, Assam 781014, India

¹³ Phytochemistry Research Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran

ARTICLE INFO

Article history:

Received 24 May 2021

Received in revised form 2 August 2021

Accepted 14 September 2021

Editor: Dr D. Naidoo

Keywords:

MAO

MAO-A

MAO-B

MAO inhibitors

Plant natural products

ABSTRACT

Monoamine oxidase (MAO) is capable of catalysing the oxidative deamination of amines and neurotransmitters. MAO plays a pivotal role in maintaining neurotransmitters linked to neurological disorders viz. Alzheimer's disease (AD), Parkinson's disease (PD) etc. Therefore, inhibition of MAO can be implicated to the cure of such diseases. Synthetic MAO inhibitors are known to inhibit MAO activity. However, there are safety issues with synthetic MAO inhibitors and many of their effects are non-selective and irreversible. Contrasting synthetic drug-derived natural products have been popularized globally owing to their extensive acceptability and availability, therapeutic potency and minimum side effects which potentiated the possibility of developing reversible MAO inhibitors based on natural products. The present review comprehensively elucidates plant-derived natural reversible MAO inhibitors using the literature from the popular databases such as Google Scholar, Scopus, PubMed and Web of Science. This literature review reports approximately 51 plants that have been evaluated for MAO inhibitory activity. In addition, 93 plant-derived natural compounds were retrieved as MAO inhibitors. Majority of these investigations predominantly utilized an *in vitro* approach to evaluate the inhibitors in relation to the developing treatments of related neurological diseases. However, *in vivo* studies and clinical trials are still lacking in evaluating the botanical-based MAO inhibitors. The aim of this review is to retrieve the recent literature to explore the *in vitro* and *in vivo* studies of plant-based natural products as MAO inhibitors, their structure-activity relationship and relevant molecular docking analyses and their roles as an emerging therapy against disorders like AD, and PD. Further, the review also discusses the shortcomings of existing research in order to generate more coordinated and focused research in future.

Advancing urban ethnopharmacology: a modern concept of sustainability, conservation and cross-cultural adaptations of medicinal plant lore in the urban environment

Tusheema Dutta^{1,1}, Utpal Anand^{2,1}, Suchismita Chatterjee Saha³, Abhijit Bhagwan Mane⁴,
Dorairaj Arvind Prasanth⁵, Ramesh Kandimalla^{6,7}, Jarosław Proćków^{8,*} and Abhijit Dey^{1,*}

¹Ethnopharmacology and Natural Product Research Laboratory, Department of Life Sciences, Presidency University, 86/1 College Street, Kolkata, 700073, West Bengal, India

²Department of Life Sciences, Ben-Gurion University of the Negev, Beer-Sheva, 84105, Israel

³Department of Zoology, Nabadwip Vidyasagar College (Affiliated to the University of Kalyani), Nabadwip, West Bengal, 741302, India

⁴Department of Zoology, Dr. Patangrao Kadam Mahavidyalaya, Sangli, (Affiliated to Shivaji University of Kolhapur), Maharashtra, 416308, India

⁵Department of Microbiology, School of Biosciences, Periyar University, Salem, 636011, Tamilnadu, India

⁶CSIR-Indian Institute of Chemical Technology, Uppal Road, Tarnaka, Hyderabad, 500007, Telangana, India

⁷Department of Biochemistry, Kakatiya Medical College, Warangal, 506007, Telangana, India

⁸Department of Plant Biology, Institute of Environmental Biology, Wrocław University of Environmental and Life Sciences, Koźuchowska 5b, 51-631 Wrocław, Poland

*Corresponding author: Jarosław Proćków: Department of Plant Biology, Institute of Environmental Biology, Wrocław University of Environmental and Life Sciences, Koźuchowska 5b, 51-631 Wrocław, Poland. Email: jaroslaw.prockow@upwr.edu.pl

Abhijit Dey: Ethnopharmacology and Natural Product Research Laboratory, Department of Life Sciences, Presidency University, 86/1 College Street, Kolkata, 700073, West Bengal, India. Email: abhijit.dbs@presiuniv.ac.in; abhijitbio25@yahoo.com.

¹These authors contributed equally to this work.

The discipline 'urban ethnopharmacology' emerged as a collection of traditional knowledge, ancient civilizations, history and folklore being circulated since generations, usage of botanical products, palaeobotany and agronomy. Non-traditional botanical knowledge increases the availability of healthcare and other essential products to the underprivileged masses. Intercultural medicine essentially involves 'practices in healthcare that bridge indigenous medicine and western medicine, where both are considered as complementary'. A unique aspect of urban ethnopharmacology is its pluricultural character. Plant medicine blossomed due to intercultural interactions and has its roots in major anthropological events of the past. Unani medicine was developed by Khalif Harun Al Rashid and Khalif Al Mansur by translating Greek and Sanskrit works. Similarly, Indo-Aryan migration led to the development of Vedic culture, which product is Ayurveda. Greek medicine reached its summit when it travelled to Egypt. In the past few decades, ethnobotanical field studies proliferated, especially in the developed countries to cope with the increasing demands of population expansion. At the same time, sacred groves continued to be an important method of conservation across several cultures even in the urban aspect. Lack of scientific research, validating the efficiency, messy applications, biopiracy and slower results are the main constraints to limit its acceptability. Access to resources and benefit sharing may be considered as a potential solution. Indigenous communities can copyright their traditional formulations and then can collaborate with companies, who have to provide the original inventors with a fair share of the profits since a significant portion of the health economy is generated by herbal medicine. Search string included the terms 'Urban' + 'Ethnopharmacology', which was searched in Google Scholar to retrieve the relevant literature. The present review aims to critically analyse the global concept of urban ethnopharmacology with the inherent plurality of the cross-cultural adaptations of medicinal plant use by urban people across the world.

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Anticancer Applications and Pharmacological Properties of Piperidine and Piperine: A Comprehensive Review on Molecular Mechanisms and Therapeutic Perspectives

OPEN ACCESS

Edited by:

Wang Lingchi,

National University of Singapore,
Singapore

Reviewed by:

Nalangen Bhaskaran,

Sri Ramachandra University, India
Hanyawan Road, Ezzer Dyari,
National University of Malaysia,
Malaysia

*Correspondence:

Jaroslav Pročkův

jaroslav.prockov@upwr.edu.pl

Abhijit Dey

abhi@dzl@prsu.ksu.ac.in

These authors share first authorship

Specialty section:

This article was submitted to
Pharmacology of Anti-Cancer Drugs,
a section of the journal
Frontiers in Pharmacology

Received: 09 September 2021

Accepted: 18 November 2021

Published: 07 January 2022

Citation:

Mitra S, Anand U, Jha NK,
Shekhawat MS, Saha SC,
Nongdam P, Rengasamy KR,
Pročkův J and Dey A (2022)
Anticancer Applications and
Pharmacological Properties of
Piperidine and Piperine: A
Comprehensive Review on Molecular
Mechanisms and
Therapeutic Perspectives.
Front. Pharmacol. 12:772418.
doi: 10.3389/fphar.2021.772418

Sicon Mitra^{1†}, Uttpal Anand^{2†}, Niraj Kumar Jha¹, Mahipal S. Shekhawat³,
Suchismita Chatterjee Saha⁴, Potshangbam Nongdam⁵, Kannan R. R. Rengasamy⁶,
Jaroslav Pročkův^{7*} and Abhijit Dey^{8*}

¹Department of Biotechnology, School of Engineering and Technology, Sherida University, Greater Noida, India, ²Department of Life Sciences, Ben-Gurion University of the Negev, Beer-Sheva, Israel, ³Department of Plant Biology and Biotechnology, Kanchi Marunvir Government Institute for Postgraduate Studies and Research, Lawspet, India, ⁴Department of Zoology, Nalbedwip Vishwasegar College (Affiliated to the University of Kalyani), Nalbedwip, India, ⁵Department of Biotechnology, Manipur University, Canchipur, India, ⁶Green Biotechnologies Research Centre of Excellence, University of Limpopo, Sovenga, South Africa, ⁷Department of Plant Biology, Institute of Environmental Biology, Wrocław University of Environmental and Life Sciences, Wrocław, Poland, ⁸Ethnopharmacology and Natural Product Research Laboratory, Department of Life Sciences, Presidency University, Kolkata, India

Piperine and piperidine are the two major alkaloids extracted from black pepper (*Piper nigrum*); piperidine is a heterocyclic moiety that has the molecular formula $(CH_2)_5NH$. Over the years, many therapeutic properties including anticancer potential of these two compounds have been observed. Piperine has therapeutic potential against cancers such as breast cancer, ovarian cancer, gastric cancer, glioma cancer, lung cancer, oral squamous, chronic pancreatitis, prostate cancer, rectal cancer, cervical cancer, and leukemia. Whereas, piperidine acts as a potential clinical agent against cancers, such as breast cancer, prostate cancer, colon cancer, lung cancer, and ovarian cancer, when treated alone or in combination with some novel drugs. Several crucial signalling pathways essential for the establishment of cancers such as STAT-3, NF- κ B, PI3k/Akt, JNK/p38-MAPK, TGF- β /SMAD, Smac/DIABLO, p-I κ B etc., are regulated by these two phytochemicals. Both of these phytochemicals lead to inhibition of cell migration and help in cell cycle arrest to inhibit survivability of cancer cells. The current review highlights the pharmaceutical relevance of both piperine and piperidine against different types of cancers.

Keywords: piperine, piperidine, piper, anti-breast cancer, anti-prostate cancer, anti-ovarian effect, mechanism of action, anti-gastric cancer



Electronic and transport property of two-dimensional boron phosphide sheet

Rajkumar Mondal^{a,b}, N. Bedamani Singh^c, Jyotirmoy Deb^a, Swarnakamal Mukherjee^d,
Utpal Sarkar^{a,*}

^a Department of Physics, Assam University, Silchar, 788011, India

^b Department of Physics, Bidyotsay Vidyanagar College, West Bengal, 741302, India

^c Department of Physics, Nipaland University, Nigaland, 792004, India

^d Department of Educational Sciences, Assam University, Silchar, 788011, India

ARTICLE INFO

Keywords:

Two-dimensional boron phosphide
Density functional theory
Electronic properties
Electrical transport property
Thermal transport property

ABSTRACT

Using density functional theory (DFT) approach, we have investigated the effect of strain on the electronic properties of two-dimensional (2D) boron phosphide (BP) sheet. With the increase in uniaxial and biaxial tensile strain band gap increases while band gap decreases and becomes metallic with the increase in uniaxial and biaxial compressive strain. Electrical and thermal transport properties of zigzag and armchair 2D BP sheets have been explored using nonequilibrium Green's function formalism (NEGF) and the changes in the nature of I-V characteristics with the application of strain have been reported. The magnitude of the current decreases with the increase of strain value along transport direction for both zigzag and armchair 2D BP sheets. For unstrained systems, the magnitude of current is nearly same for both zigzag and armchair 2D BP sheets. However, for a particular strain value, magnitude of current is more for zigzag sheet compared to armchair sheet. Though both zigzag and armchair 2D BP sheets have reasonably high ZT, which confirms its potentiality for designing efficient thermoelectric material but zigzag sheet is more preferable for thermoelectric application compared to armchair sheet due to its higher ZT, in comparison to armchair sheet.

1. Introduction

2D materials like graphene, hexagonal boron nitride (h-BN), phosphorene, transition metal dichalcogenides (TMD), metal oxides are interesting to the researcher due to their excellent structural, mechanical and physical properties [1–6]. Because of the exciting electrical and thermal transport properties, 2D materials are promising candidates for thermal management, thermal energy generation [5,6] and battery applications [7,8]. Another interesting property is their large stretchability. They have a great potentiality for using strain engineering to tune and modulate their electronic and thermal properties, which indicates another direction to their thermoelectric properties [9,10]. The band gap value of 2D materials ranges from 0 to 6.0 eV (zero for graphene, silicene, 0.5–1.0 eV for phosphorene, about 1.0–2.0 eV for TMD and 3.0–6.0 eV in some metal oxides and hBN), for different materials. These wide band gap ranges of 2D materials are convenient for different electronic devices [11–15].

Graphene [16] is successively recognized as an important material

for numerous theoretical investigations and promising applications because of its unique structural, mechanical and electronic properties. The experimental realization of graphene by mechanical exfoliation has paved the path for rapid research on various 2D materials [17]. Among the different applications of graphene, some of them are as charge carriers behaving as mass-less Dirac fermions, Klein tunneling, ballistic transport at room temperature, anomalous quantum Hall effects, etc. [18]. Also, field-effect transistors, micromechanical resonators, gas sensors using graphene have already been proposed from the experimental point of view and interestingly most of these are connected with its transport properties [19]. Transport studies show that spin-valve devices based on graphene nanoribbons can exhibit magnetoresistance values, much higher than previously reported experimental values [20–22]. Not only graphene but unusual effects of doping on the transport properties of graphene nanoribbons have also been reported [23,24]. However, the zero band gap of graphene puts constraints on its different properties.

Many 2D materials such hexagonal-boron nitride [25], silicene [26],

* Corresponding author.

E-mail address: utpalsarkar1984@gmail.com (U. Sarkar).

<https://doi.org/10.1016/j.jmgm.2021.108117>

Received 23 July 2021; Received in revised form 9 November 2021; Accepted 22 December 2021

Available online 29 December 2021

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Thermoelectric properties of pentagraphene

Jyotirmoy Deb^a, Rajkumar Mondal^{a,b}, Swarnakamal Mukherjee^c, Utpal Sarkar^{a,*}

^a Department of Physics, Azam University, Sakha, 700011, India

^b Department of Physics, Mahabip Vidyasagar College, West Bengal, 747302, India

^c Department of Educational Science, Azam University, Sakha, 700011, India

ARTICLE INFO

Keywords

Pentagraphene

Density functional theory

Phonon transmission

Thermoelectric properties

ABSTRACT

Here we have investigated the thermoelectric property of a two-dimensional pentagraphene sheet. Both the electronic and phononic contribution is considered to study the thermal transport property. Pentagraphene possesses higher Seebeck coefficient compared to conventional thermoelectric materials confirming its potentiality as a thermoelectric device. Moreover, the Seebeck coefficient decreases with the increase in temperature. Interestingly, electrical and thermal conductance increases with an increase in temperature, which leads to the significant thermoelectric performance of PG with an increase in temperature. Finally, having a moderate ZT of -0.14 at 700 K, confirms that pentagraphene might be helpful in designing thermoelectric materials.

1. Introduction

Finding graphene has the invigorating hunt for novel two-dimensional (2D) materials, resulting in experimental synthesis and theoretical prediction of different systems with various properties [1–3]. Possibly carbon is one of the most adaptable elements in the periodic table, capable of forming various stable structures. Diamond, fullerene [4], carbon nanotube (CNT) [5], multi-layer graphene [6], graphyne [7], graphdiyne [8], twin-graphene [9–11] and pentagraphyne [12] are the most well-known 2D allotropes of carbon. Graphyne and graphdiyne [8] are metastable compared to graphene, but they have already been synthesized experimentally [13,14]. Furthermore, some 2D carbon allotropes are forecasted to show notable properties that even exceed graphene, such as anisotropic Dirac cones [15], intrinsic ferromagnetism [16], high catalytic activity [8], etc. These show that the topological arrangement of carbon atoms is related to many of the novel properties of carbon allotropes and highlight the importance of the structure-property relationship [17]. A new dynamically and mechanically stable 2D carbon allotrope pentagraphene (PG) has been predicted by Zhang et al., which is completely composed of carbon pentagons [18]. PG can be obtained from T12-carbon by breaking the covalent bonds between layers. PG is a buckled structure with tetragonal symmetry. The electronic structure of PG reveals that it is a semiconductor with a quasi-direct band gap [18]. PG is energetically more favourable than the experimentally synthesized smallest fullerene C_{20} , but it is a metastable carbon allotrope with respect to graphene. So despite some claims related to its instability [19,20], it is rational to ex-

pect that PG may be experimentally feasible. Although PG has not been synthesized experimentally, the theoretical analysis identifies many fascinating properties that are worth discussing more elaborately. The presence of large band gap (3.25 eV) and mechanical strength makes it a potential candidate for optoelectronics and photovoltaics [18,21] devices. In comparison to graphene, PG shows reduced thermal conductivity, making it a suitable candidate for thermal applications [21–23]. Moreover, by surface functionalization, both the mechanical and electronic properties of PG can be tuned. PG is an auxetic material, i.e., it shows a negative Poisson ratio [18,24]. It is suitable as an anode material in battery [25], as a metal-free catalyst for CO oxidation [26] and in hydrogen storage [27]. In addition, the mechanical, optical and electronic properties of PG can be adjusted by doping and functionalization [28–30].

Thermoelectric materials convert heat into electricity and vice versa, hence these materials have received enormous interest from the researcher for both theoretical and technological applications. Thermoelectric efficiency is defined by the dimensionless parameter, namely figure of merit ZT, $ZT = S^2GT/k$, where G , S , T and k represents the electronic conductance, Seebeck coefficient, absolute temperature and thermal conductance (containing both phononic and electronic contributions), respectively. So it is clear that an ideal thermoelectric material must require metal-like high electronic conductance, high Seebeck coefficient and low thermal conductance. Some research groups found that low-dimensional systems manifest high ZT due to the quantum confinement effect.

* Corresponding author.

E-mail address: utpalchemlitkgp@yahoo.com (U. Sarkar).

<https://doi.org/10.1016/j.physb.2022.414091>

Received 31 July 2021; Received in revised form 1 June 2022; Accepted 5 June 2022

0921-4526/© 20XX



GENERALIZED RELATIVE NEVANLINNA ORDER (α, β) AND GENERALIZED RELATIVE NEVANLINNA TYPE (α, β) BASED SOME GROWTH PROPERTIES OF COMPOSITE ANALYTIC FUNCTIONS IN THE UNIT DISC

Tanmay BISWAS¹ and Chinmay BISWAS²

¹Rajbati, Rabindrapally, R. N. Tagore Road, P.O. Krishnagar, Dist-Nadia,
PIN- 741101, West Bengal, INDIA

²Department of Mathematics, Nabadwip Vidyaagar College, Nabadwip, Dist.- Nadia,
PIN-741392, West Bengal, INDIA

ABSTRACT. Our aim in this paper is to introduce some idea about general-
ized relative Nevanlinna order (α, β) and generalized relative Nevanlinna type
 (α, β) of an analytic function with respect to another analytic function in the
unit disc where α and β are continuous non-negative functions on $(-\infty, +\infty)$.
So we discuss about some growth properties relating to the composition of two
analytic functions in the unit disc on the basis of generalized relative Nevan-
linna order (α, β) and generalized relative Nevanlinna type (α, β) as compared
to the growth of their corresponding left and right factors.

1. INTRODUCTION

A function g which is analytic in the unit disc $U = \{z : |z| < 1\}$ is said to
have finite Nevanlinna order [1] if there exists a number μ for which the Nevanlinna
characteristic function $T_g(r)$ of g satisfies $T_g(r) < (1-r)^{-\mu}$ for all r in $0 < r_0(\mu) <$
 $r < 1$ where $T_g(r)$ is defined as

$$T(r, g) = \frac{1}{2\pi} \int_0^{2\pi} \log^+ |g(re^{i\theta})| d\theta$$

where $\log^+ r = \max(0, \log r)$.

2020 Mathematics Subject Classification. 30B10, 30J99.

Keywords. Growth, analytic function, composition, unit disc, generalized relative Nevanlinna
order (α, β) , generalized relative Nevanlinna type (α, β) .

✉ tanmaybiswas_math@rediffmail.com-Corresponding author; chinmay.ahib@gmail.com

© 0000-0001-6084-6897; 0000-0002-6058-4517.

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Communications Faculty of Sciences University of Ankara Series A1 Mathematics and Statistics



Chemical characterizations of neurotransmission receptors of human and plant to unfold the evolutionary relationships among them

Antara Sengupta^{a,*}, Subhadip Chakraborty^b, Pabitra Pal Choudhury^c

^a Department of Computer Science and Engineering, University of Calicut, West Bengal, India

^b Department of Botany, Mahabipati Vidyalaya College, Mahabipati, India

^c Applied Statistics Unit, Indian Statistical Institute, Kolkata, West Bengal, India

ARTICLE INFO

Keywords:

Ionotropic glutamate receptors
GABA A receptors
AMT
Arabidopsis thaliana
Human
Chemical properties

ABSTRACT

Vertebrates have very well defined nervous systems. A group of researchers hypothesize that plant also has an alternative sort of sensitive nervous system. They find a close relationship of the neurotransmission mechanism of animal with that of the plant and suspect a close relationship in amino acid transport mechanism among both the organisms. Although the protein structure is conserved more than molecular sequences, but the 3D structure of protein is largely influenced by the amino acid residues in the interior part of it. The constituents of a primary protein sequence have a variety of biochemical information which control the structure, function and stability of the protein. Hence, in this present study it is tried for characterization and comparison of neurotransmission receptors associated with human and plant to unfold the evolutionary relationships among them in bio-molecular level based on the chemical properties of the amino acids. The protein sequences of ionotropic glutamate receptor and GABA receptor of human (from vertebrate) and *Arabidopsis thaliana* (from plant) are considered as datasets. The 20 standard amino acids are classified into 8 chemical groups and are identified by specific numeric values. Alignment-based methods are used to identify the identical and similar amino acids among the aligned sequences. The common pattern finding procedure finds some conserved regions in the receptor protein sequences of both the species. The proximity between the protein sequences are calculated based on the distribution of each chemical group (in percentage) in them and phylogenetic trees are constructed to show the evolutionary relationships of neurotransmission receptors of both the species. The conventional multiple sequence alignment (MSA) method is also applied on the datasets and the results are compared. The analysis is further extended to structural level to understand the extent to which the animal and plant proteins are similar.

1. Introduction

Vertebrates have very well defined nervous systems. Plants grow in silence, but wounded leaves can communicate their damage status to one another through poorly understandable signaling process (Mousavi et al., 2013). In 1873 Sir John Scott Burdon-Sanderson in his experiment first experienced the existence of a current from the proximal to the distal end of the leaf which he termed as "normal leaf-current" (Burdon-Sanderson, 1873). After few years, the great biologist Charles Darwin talked about the nervous impulse in insectivorous plants (Darwin and Darwin, 1883). In early 1900s the term "plant nerve" is first introduced by the great physicist Acharya Jagdish Chandra Bose. Using microelectrode recording system devised by him he recorded responses of individual cells of different parts of plant and found that plants also

have receptors for stimuli and the most important fact that he established in plant-response is the nervous character of the impulse transmitted to a distance (Bose, 1926; Tandon, 2019.). He also reported that the nervous impulse transmitted in plant is responsible for various physiological functions viz. growth, photosynthesis, respiration, motor activity, environmental responses etc (Tandon, 2019). Neurotransmission refers to a process by which signaling molecules are released by the axon terminal of a neuron, and then react with the receptors on the dendrites of another neuron by binding with them. In vertebrate two types of receptors are there which act as neurotransmitters for the central nervous system (CNS), viz. Ionotropic glutamate Receptors (iGluRs) and gamma-aminobutyric acid (GABA) receptors (Allen and Sharma, 2018). The balance between inhibitory neuronal transmission via GABA and excitatory neuronal transmission via glutamate keep the

*Corresponding author.

E-mail addresses: antara.sngpt@gmail.com (A. Sengupta), subhadipncb@gmail.com (S. Chakraborty), pabitropalchoudhury@gmail.com (P. Pal Choudhury).



doi.org/10.1016/j.cbb.2022.107685

Received 11 May 2021; Received in revised form 12 April 2022; Accepted 16 April 2022

Available online 21 April 2022

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Inclusion of a coumarin derivative inside the macrocyclic hosts: A spectroscopic, thermodynamic and theoretical investigation

Sayed Ashique Ahmed^a, Soma Seth (Duley)^b, Rajesh Kumar Gautam^a, Debabrata Seth^a  

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<https://doi.org/10.1016/j.molliq.2018.05.081>

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Highlights

- Host-guest interaction between 7-DCCAE with CB7 and CB8 were reported.
- Photophysics of 7-DCCAE were modulated several folds in the presence of CB7 and CB8.
- The stoichiometry of the complexes was found to be 1:1 for both systems.
- The complexation processes are enthalpically and entropically favourable process.

Abstract

In aqueous medium, the guest-host interaction of 7-(diethylamino)coumarin-3-carboxylic acid *N*-succinimidyl ester (7-DCCAE) with cucurbit[7]uril (CB7) and cucurbit[8]uril (CB8) are very interesting. The interaction of 7-DCCAE with CB7 and CB8 have been investigated in a systematic way by different types of spectroscopic techniques such as UV-Vis spectroscopy, steady state and time resolved fluorescence emission spectroscopy, ¹H-NMR along with thermodynamic approach by isothermal titration calorimetry measurement. We observed that the photophysical properties of the aqueous solution of 7-DCCAE are

<https://www.sciencedirect.com/science/article/abs/pii/S0167732218315484?via%3DIihub>

Graphene Oxide as an Enhancer of Fluorescence

Aloke Bapli, Rajesh Kumar Gautam, Dr. Soma Seth (Duley), Rabindranath Jana, Souvik Pandit, Dr. Debabrata Seth ✉

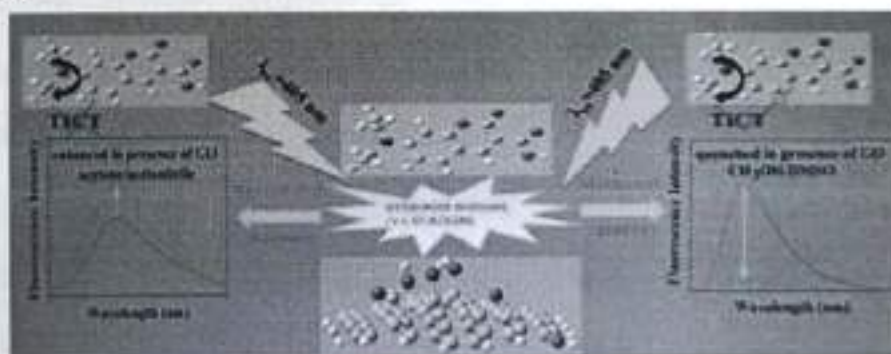
First published: 26 February 2020

<https://doi.org/10.1002/asia.202000118>

Citations: 8

Graphical Abstract

GO-induced enhancement of fluorescence properties of a hydrophilic molecule was observed. This study could lead to applications of GO-induced nanocomposite for biosensors, device applications and in dye sensitized solar cells.




Abstract

Solvent-dependent switching of graphene oxide (GO) as fluorescence quencher or enhancer was observed. In some solvents, GO increases the fluorescence yield of a hydrophilic molecule 7-(diethylamino)-coumarin-3-carboxylic acid (7-DCA), and in some solvents GO acts as a quencher of fluorescence.

Home > Tropical Ecology > Article

Research Article | Published: 01 August 2020

Biomass model development for carbon stock estimation in the tropical forest of Eastern India: an allometric approach

Saroni Biswas, Anirban Biswas, Arabinda Das & Saon Banerjee 

Tropical Ecology **61**, 360–370 (2020)

89 Accesses | [Metrics](#)

Abstract

Allometric regression models are one of the common methods of carbon stock estimation based on growing stock data conversion to estimates of above ground biomass (AGB). Therefore, allometric model selection is important functional aspect that has considerable influence on accuracy of biomass estimation. As destructive sampling is restricted in our study area, the site specific biomass model is developed for the first time based upon the forest inventory data that includes measurements of diameter at breast height (DBH) and tree height (H). To minimize the error in AGB estimation, intensive sampling was done where 78,201 individual tree were enumerated (6034 quadrats laid over 1207 plots). 20 locally abundant tree species were assessed. Tree

<https://link.springer.com/article/10.1007/s42965-020-00098-2>



Corruption and 'Crooked Practices': Representation of Social Realism of Post-
Independence India in Arun Joshi's *The Apprentice*

Arun Kumar Biswas

Abstract:

Society in post-independence twentieth century India, no doubt, underwent many challenges, threats and evil (mal) practices. Corruption and various malpractices embodying such 'crude reality' have greatly wrapped the post-independence Indian social life and systems. The Indian English literature has obviously depicted all the seamy truth of life. Arun Joshi's *The Apprentice* (1974) is a vivid literary dossier of the contemporary Indian society preoccupied with the ideologies of money, power, and corruption. In the typical Joshi's style, the novel vividly illustrates the existential predicament of contemporary life with its ethical confusion and moral chaos and the quest for meaning and remedy in the changing social context. The novel deals with the journey of Ratan Rathor, an ambitious careerist public employee, who gradually becomes corrupt for materialistic gain through bribery and betrayal. The present paper seeks to explore the grim reality of post-independence Indian society as represented in Arun Joshi's *The Apprentice*.

Key words: Reality, existential crisis, post-independence Indian society, corruption, crookedness, bribery.

Corruption is worse than prostitution.

- Karl Kraus


Introduction

Reality being the soul of literature records contemporary time and spirit it is produced. The Indian English literature typically registers the essence of Indian society and people. It also

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Full Article | Published: 07 January 2021

Anxiety level among students of different college and universities in India during lock down in connection to the COVID-19 pandemic

Arani Biswas & Anirban Biswas 

Journal of Public Health **31**, 49–55 (2023)

4871 Accesses | 11 Citations | [Metrics](#)

Abstract

Objectives

COVID-19 incidence became a pandemic immediately after its origin and spread. Apart from death because of coronavirus infection, the pandemic brought unbearable psychological pressure to all. We assessed the psychological pressure on college and university students in India through cluster sampling.

Methods

The students responded ($n = 209$) to an online questionnaire following the Generalized Anxiety

Included in the UGC-CARE list (Group B Sr. No 172)

Portrayal of Partition History, Memory and Pain in Chaman Nahal's *Azadi*

Abstract:

Memory recreates and explores history. The memories of achievement of Indian freedom in 1947 evoke the tragic history of Partition of the subcontinent. A dark chapter shaking the whole nation, the partition is a human tragedy for millions of people still haunting the memories of human history. History and memory as the theme of creative fiction have cast a spell over many an Indian English novelists who pen the history of partition with critical attitude 'unlocking and remembering' its tragic 'truth'. Necessarily preoccupied with the memory of the past, partition novels such as Chaman Nahal's "Azadi" (1975) rewrites the partition history replete with memories of trauma and pain. Nahal's "Azadi" dramatizes through the vision of Lala Kanshi Ram of Sialkot the sinister impact of partition resulting in a sense of pain and loss among its victims. This paper seeks to expose the partition memories and the sense of anxiety, pain and suffering of common people trapped in the... Nahal depicts recollecting the