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Article

Global Dynamics of SARS-CoV-2 Infection with Antibody Response and the Impact of Impulsive Drug Therapy

Amar Nath Chatterjee ¹, Fahad Al Basir ^{2,*}, Dibyendu Biswas ³, Teklebirhan Abraha ^{4,5}

- ¹ Department of Mathematics, K.L.S. College, Nawada, Magadh University, Bodhgaya 805110, Bihar, India
 - ² Department of Mathematics, Asansol Girls' College, Asansol 713304, West Bengal, India
 - ³ Department of Mathematics, City College of Commerce and Business Administration, 13, Surya Sen Street, Kolkata 700012, West Bengal, India
 - ⁴ Department of Mathematics, Addis Ababa Science and Technology University, Addis Ababa P.O. Box 16417, Ethiopia
 - ⁵ Department of Mathematics, Aksum University, Aksum P.O. Box 1010, Ethiopia
- * Correspondence: fahadbasir@gmail.com

Abstract: Mathematical modeling is crucial to investigating the ongoing coronavirus disease 2019 (COVID-19) pandemic. The primary target area of the SARS-CoV-2 virus is epithelial cells in the human lower respiratory tract. During this viral infection, infected cells can activate innate and adaptive immune responses to viral infection. Immune response in COVID-19 infection can lead to longer recovery time and more severe secondary complications. We formulate a micro-level mathematical model by incorporating a saturation term for SARS-CoV-2-infected epithelial cell loss reliant on infected cell levels. Forward and backward bifurcation between disease-free and endemic equilibrium points have been analyzed. Global stability of both disease-free and endemic equilibrium is provided. We have seen that the disease-free equilibrium is globally stable for $R_0 < 1$, and endemic equilibrium exists and is globally stable for $R_0 > 1$. Impulsive application of drug dosing has been applied for the treatment of COVID-19 patients. Additionally, the dynamics of the impulsive system are discussed when a patient takes drug holidays. Numerical simulations support the analytical findings and the dynamical regimes in the systems.

Keywords: epithelial cell; antibody response; basic reproduction number; transcritical bifurcation; impulsive control; drug holidays

1. Introduction

COVID-19 is considered to be transmitted mainly between people who are close in contact with one another within about six feet, as well as through respiratory droplets created when an infected person coughs or sneezes. These droplets can enter the mouths or noses of people close by or possibly be inhaled into the lungs [1]. Virus spread depends on the possibility of touching virus-infected surfaces or objects and then touching one's own mouth, nose, or possibly eyes [2,3].

In a SARS-CoV-2-infected human, the innate and adaptive immune responses work together to neutralize the threat of SARS-CoV-2 infection [4–6]. When the virus enters the human body, the innate immune response starts immediately. Proteins of the natural immune system in a healthy cell also respond against the invading pathogens within the first minutes or hours of infection [7]. This response is of great importance in preventing new infections through the activation of the adaptive immune system [8,9]. Cytokines, which are small soluble proteins, are an essential component of the immune system [10]. They are secreted from different cells in the human body. They can be categorized into one of four families: (i) the hematopoietic family, (ii) the immunoglobulin superfamily, (iii) the tumor necrosis factor family, and (iv) interferons (IFNs) [11]. Cytokines balance the innate and adaptive immune responses. Among cytokines, IFNs play a vital role in the innate



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Role of alternative food and Allee in controlling chaos in an eco-epidemiological model with disease in the prey

Krishna Pada Das^{1*}, Fahad Al Basir², Kulbhushan Agnihotri³

¹ Department of Mathematics,
Mahadebananda Mahavidyalaya, Monirampur, P.O.-Barrackpore, India

² Department of Mathematics,
Asansol Girls' College, Asansol-4, West Bengal-713304, India
E-mail: fahadbasir@gmail.com

³ Department of Mathematics,
Shahid Bhakat Singh State Technical University, Ferozepur-152004, Punjab, India

* Corresponding Author. E-mail: krishnaisi@yahoo.co.in

Abstract. In this article, we have derived a prey-predator model assuming that the predator consumes both the susceptible as well as the infected prey following the modified Holling type-II functional response. The focuses of this study are the role of infection rate, alternative food, and allee in a predator-prey system including disease in the prey population. The existence and stability of the equilibrium points have been analysed. We have observed that the system enters into limit cycle oscillations from stable position, limit cycle to chaos for different parametric conditions. It is also shown that the infection rate, enrichment of the alternative food and allee can move the chaotic situation to limit cycle oscillations, limit cycle to a stable focus. This study provides insightful the ecological and the disease reproduction numbers for understanding how disease propagation in predator population in the presence of alternative food and Allee.

International Journal of Dynamics and Control
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Mathematical analysis of an ecological system using a non-monotonic functional response: effects of gestation delay and predator harvesting

Sahabuddin Sarwardi¹ · Sajjad Hossain¹ · Fahad Al Basir² · Santanu Ray³

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Abstract

This article has formulated a mathematical model for the dynamics of an ecological system consisting of one prey (nutrient) and two predators (two fish populations). We have assumed Holling Type I and generalized Holling Type IV (non-monotonic) functional responses for first and second predators, respectively, and harvesting of both predators. We have considered constant recruitment of nutrients (prey), and a certain fraction of nutrients is assumed to be unused/decomposed during interaction with the predators. The local stability behavior and the existence of the Hopf bifurcation of coexisting steady-state for both the delayed and non-delayed systems are analyzed. Using the normal form theory and the center manifold theorem, we have discussed the direction of the Hopf bifurcation and the stability of the bifurcating periodic solution. Finally, the results of theoretical analysis are verified via numerical simulations. We have established that time delay and harvesting parameters play a significant role in the system's dynamics. Model dynamics are sensitive to the initial size of the population. As the rate of harvesting increases, the steady state's stability shifts from unstable to stable, consequently bifurcation occurs when the harvesting rate changes. We have found that the Hopf bifurcation of both delayed and the non-delayed system is of sub-critical type.

Keywords Predator-prey model · Harvesting · Time delay · Direction and stability · Hopf bifurcation

Mathematics Subject Classification 34D20 · 92D25 · 92D40 · 37G15 · 93C43

Article

A Fractional-Order Compartmental Model of Vaccination for COVID-19 with the Fear Factor

Amar Nath Chatterjee ^{1,†}, Fahad Al Basir ^{2,*}, Bashir Ahmad ^{3,†} and Ahmed Alsaedi ^{3,†}

¹ Department of Mathematics, K.L.S. College, Magadh University, Nawada 805110, Bihar, India;

amarnr@klscollege.ac.in

² Department of Mathematics, Asansol Girls' College, Asansol 713304, West Bengal, India

³ Nonlinear Analysis and Applied Mathematics (NAAM)-Research Group, Department of Mathematics, King Abdulaziz University, P.O. Box 80203, Jeddah 21589, Saudi Arabia; bashirahmad_qau@yahoo.com (B.A.); aalsaedi@hotmail.com (A.A.)

* Correspondence: fahadbasir@gmail.com

† These authors contributed equally to this work.

Abstract: During the past several years, the deadly COVID-19 pandemic has dramatically affected the world; the death toll exceeds 4.8 million across the world according to current statistics. Mathematical modeling is one of the critical tools being used to fight against this deadly infectious disease. It has been observed that the transmission of COVID-19 follows a fading memory process. We have used the fractional order differential operator to identify this kind of disease transmission, considering both fear effects and vaccination in our proposed mathematical model. Our COVID-19 disease model was analyzed by considering the Caputo fractional operator. A brief description of this operator and a mathematical analysis of the proposed model involving this operator are presented. In addition, a numerical simulation of the proposed model is presented along with the resulting analytical findings. We show that fear effects play a pivotal role in reducing infections in the population as well as in encouraging the vaccination campaign. Furthermore, decreasing the fractional-order parameter α value minimizes the number of infected individuals. The analysis presented here reveals that the system switches its stability for the critical value of the basic reproduction number $R_0 = 1$.

Keywords: COVID-19; fear factor; mathematical model; basic reproduction number; Caputo fractional derivative

MSC: 92B05; 34A08; 34H05



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Research article

COVID-19 propagation and the usefulness of awareness-based control measures: A mathematical model with delay

Chandan Maji¹, Fahad Al Basir^{2,*}, Debasis Mukherjee³, Kottakkaran Sooppy Nisar⁴ and Chokkalingam Ravichandran⁵

¹ Department of Mathematics, Jagannath Kishore College, Purulia, West Bengal-723101, India

² Department of Mathematics, Asansol Girls' College, Asansol-4, West Bengal-713304, India

³ Department of Mathematics, Vivekananda Collage, Thakurpukur, Kolkata-700063, India

⁴ Department of Mathematics, College of Arts & Sciences, Prince Sattam bin Abdulaziz University, Wadi Aldawaser-11991, Saudi Arabia

⁵ Department of Mathematics, Kongunadu Arts and Science College (Autonomous), Coimbatore-641029, India

* Correspondence: Email: fahadbasir@gmail.com.

Abstract: The current emergence of coronavirus (SARS-CoV-2 or COVID-19) has put the world in threat. Social distancing, quarantine and governmental measures such as lockdowns, social isolation, and public hygiene are helpful in fighting the pandemic, while awareness campaigns through social media (radio, TV, etc.) are essential for their implementation. On this basis, we propose and analyse a mathematical model for the dynamics of COVID-19 transmission influenced by awareness campaigns through social media. A time delay factor due to the reporting of the infected cases has been included in the model for making it more realistic. Existence of equilibria and their stability, and occurrence of Hopf bifurcation have been studied using qualitative theory. We have derived the basic reproduction number (R_0) which is dependent on the rate of awareness. We have successfully shown that public awareness has a significant role in controlling the pandemic. We have also seen that the time delay destabilizes the system when it crosses a critical value. In sum, this study shows that public awareness in the form of social distancing, lockdowns, testing, etc. can reduce the pandemic with a tolerable time delay.

Keywords: mathematical model; basic reproduction number; stability analysis; time delay; Hopf bifurcation; sensitivity analysis

Mathematics Subject Classification: 34C23, 93A30



Stage-structure model for the dynamics of whitefly transmitted plant viral disease: an optimal control approach

Sagar Adhurya¹ · Fahad Al Basir² · Santanu Ray¹

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Abstract

In this article, a mathematical model is formulated to study the dynamics of whitefly transmitted viral diseases in plants. Here, the aim is to capture the effect of whitefly's age-stages on the disease dynamics. The existence of the equilibria, basic reproductive number (\mathcal{R}_0), and stability have been studied through qualitative analysis. It is found that the onset of oscillations may occur through Hopf bifurcation in the system. Forward bifurcation is also observed at $\mathcal{R}_0 = 1$. Finally, optimal control theory has been applied for the cost-effectiveness of disease management.

Keywords Mathematical model · Basic reproduction ratio · *Bemisia* · Forward and Hopf bifurcation · Optimal control · Numerical simulation

Mathematics Subject Classification 92-10 · 92B05 · 92-XX · 93-10

1 Introduction

Bemisia tabaci (Hemiptera: Aleyrodidae) is an economically important pest and vector of many plant viruses (Mahy and Van Regenmortel 2008; Smith 1972). It is known to cause damage to crops, especially in tropical and subtropical regions. It has about 36 identified biotypes of which B, Q, and K biotypes are more harmful than others (De Barro et al. 2011). It is a highly polyphagous plant vector and has more than 600 documented host plants (Li et al. 2011). Most importantly, it is the vector of nearly 120 plant viruses (CAB International 2019a, b). It shows hemimetabolous development, i.e., the life cycle of this insect divisible into three main stages: egg, nymph, and adult (Gerling et al. 1986; Kedar et al. 2014). Spindle-shaped eggs are laid at the abaxial surface of the leaf. Eggs are hatched

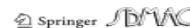
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✉ Fahad Al Basir
fahadbaser@gmail.com

¹ Systems Ecology and Ecological Modeling Laboratory, Department of Zoology, Visva-Bharati, Santiniketan 731235, India

² Department of Mathematics, Asansol Girls' College, Asansol, West Bengal 713304, India

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SPECIAL ISSUE PAPER

WILEY

Integrated pest management for *Jatropha Curcus* plant: An impulsive control approach

Jahangir Chowdhury¹ | Fahad Al Basir² | Xianbing Cao³ | Priti Kumar Roy⁴

¹Department of Applied Science, RCC Institute of Information Technology, Kolkata, India

²Department of Mathematics, Asansol Girls' College, Asansol, West Bengal, India

³College of Science China, Beijing Technology and Business University, Beijing, China

⁴Department of Mathematics, Jadavpur University, Kolkata, India

Correspondence

Jahangir Chowdhury, Department of Applied Science, RCC Institute of Information Technology, Kolkata 700015, India.
Email: jahangirchowdhuryju@gmail.com

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In this research, an integrated pest management model using impulsive differential equations has been investigated for *Jatropha curcus* plantation to control its natural pests through relying on the release of infective pest individuals and spraying of chemical pesticides. First, identify susceptible pest eradication solutions and assess their feasibility. We then show that all system variables are bounded. Using Floquet's theory and the small amplitude perturbation method, it is obtained that there exists an asymptotically stable susceptible pest eradication periodic solution when the release amount of infected pest is larger than the critical maximum value (or strength of chemical pesticide spraying is larger than some critical maximum value). Also, we have established the permanence of the system. After comparison, it is explored that integrated pest management is more effective than biological control or chemical control. Finally, verify the analytical results through numerical simulation.

KEYWORDS

biological control, chemical control, Floquet's theory, infected pests, integrated pest management, susceptible pests

MSC CLASSIFICATION

34-XX; 34Dxx; 65-XX

1 | INTRODUCTION

Cultivation of the *Jatropha curcus* plant has been considered as one of the best solutions to the problems of energy insecurity in developing countries for several years because *Jatropha curcus* is the best promising crops among the biofuel producing crops and it produces the finest quality of biodiesel oil. Also *Jatropha curcus* has significant economic importance due to its several potential industrial and medicinal uses.^{1,2} *Jatropha curcus* seed oil is proven to be toxic to many microorganisms, insects and animals. Despite its toxicity, *Jatropha* is not pest and disease resistant. The major pests and diseases affecting *Jatropha* are as follows: the leaf miner *Stomphastis Thraustica*, the leaf and stem miner *Pempelia Morosalis* and the shield-backed bug *Calidea Panaethiopia*, which can cause flower and fruit abortion. Damage from these pests was particularly great during the second year after the plantations and before later receding. Thus, pest control is very important for *Jatropha curcus* cultivation.³⁻⁶

Controlling of pest has become an increasingly complex issue over the past two decades. The traditional method is application of a large variety of single pesticides onto the crops. But too much use of single control is not a favour to control

Modeling the transmission dynamics of plant viral disease using two routes of infection, nonlinear terms and incubation delay

Fahad Al Basir

Department of Mathematics, Asansol Girls' College
Asansol-713304, West Bengal, India
E-mail: fahadalbasir@yahoo.com

Santanu Ray

Systems Ecology & Ecological Modeling Laboratory
Department of Zoology, VSSU-Bharati, Santiniketan-731235, India
E-mail: sray@vssu-bharati.ac.inReceived (Day Mth. Year)
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Plant viral diseases have devastating effects on agricultural products worldwide. In this research, a delay differential equation model has been proposed for the transmission dynamics of plant viral disease using the vector-to-plant (primary) transmission and plant-to-plant (i.e., secondary) transmissions modeled via nonlinear (saturated) terms. Also, a time delay is considered in the model due to the incubation period of the plant. Feasibility and stability analysis of the equilibria of the model have been provided based on the basic reproduction numbers. Stability changes occur through Hopf bifurcation in both the delayed and non-delayed systems. Sensitivity analysis shows the impact of a parameter on the infection. The mathematical analysis of the model and numerical examples suggest that the disease will occur if the incubation period of the plant is small. Viral disease of a plant can be controlled by maintaining the distance between plants, removing the infected plants, and increasing crop resistance towards the disease.

Keywords: Primary and secondary transmission; Mathematical model; Incubation delay; Saturated incidence rate; Basic reproduction number; Sensitivity analysis; Numerical stability and simulations.

1. Introduction

Viral diseases of plants (such as Cotton, Soybean, Tomato, Cassava, Jatropha etc.) affect the host plants and reduce the yield. Virus transmission is the main factors in understanding the epidemiology of plant viral diseases [1, 2].

The majority of plant viruses are transferred from an infected plant to a susceptible plant by insect vectors when the vectors feed on living green parts of the host plant. Fewer plant viruses are transmitted by other ways, such as via seeds, vegetative propagation, saps, fungi, nematodes, and phanerogamic plant parasites.

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ORIGINAL PAPER

**A model for pest control using integrated approach: impact of latent and gestation delays**

Fahad Al Basir · Monirul Hassan Noor

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Abstract In this article, we have established a mathematical model using impulsive differential equations for the dynamics of crop pest management in the presence of a pest with its predator and bio-pesticides. The pest population is divided into two subpopulations, namely, the susceptible pests and the infected pests. In this control process, bio-pesticides (generally virus) infect the susceptible pest through viral infection within the pest and make it infected so that predators can consume it quickly. We assume that pest controlling, using this integrated approach, is a delayed process and thus incorporated latent time of susceptible pest and gestation delay of predator in the model as time delay parameters. The system dynamics have been analyzed using qualitative theory: the existence of the equilibrium points and their stability properties has been derived. Hopf bifurcation of the coexisting equilibrium point is presented for both the delayed and non-delayed system. Detail numerical simulations are performed in support of analytical results and illustrate the different dynamical regimes observed in the system. We have observed that the system becomes free of infection when the latent time of the pest is large. Coexisting equilibrium exists for the lower value of latent

F. A. Basir
Department of Mathematics, Asansol Girls' College,
Asansol, West Bengal 713304, India
e-mail: fahadbasir@gmail.comM. H. Noor
Adarsha Vidyamandir (H.S.), 52, Surya Sen Street,
Kolkata 700009, India

delay, and it can change the stability properties from stable to unstable when it crosses its critical value. In contrast, gestation delay affects the stability switches of coexisting equilibrium only. The combined effect of the two delays on the system is shown numerically. Also, viral replication rate, infection rate (from virus to pest) is also significant from the pest management perspective. In summary, both the delay are essential for crop pest management, and pest control will be successful with tolerable delays.

Keywords Biopesticides · Predator · Mathematical model · Latent and gestation delay · Hopf bifurcation · Numerical stability analysis.

1 Introduction

Food scarcity gives us the challenge to improve our agricultural tools and techniques at an advanced level and consequently increase the production of crops. Chemicals affect insect populations, pests, and beneficial insects to increase the yield from a crop field. In classical biological control, the pest population is controlled from the region of its origin by the introduction of natural enemies [1]. However, chemical control acts as a hazard to the ecosystem. It makes lots of unwanted harmful effects on other related and nonrelated populations. This kind of problem can be solved if Integrated Pest Management (IPM) is adopted.

A model analysis to measure the adherence of Etanercept and Fezakinumab therapy for the treatment of psoriasis*

Amit Kumar Roy^a, Fahad Al Basir^b, Priti Kumar Roy^{a,1},
Amar Nath Chatterjee^c

^aCentre for Mathematical Biology and Ecology,
Department of Mathematics, Jadavpur University,
Kolkata 700032, India
priti.ju@gmail.com

^bDepartment of Mathematics, Asansol Girls' College,
Asansol-4, West Bengal 713304, India

^cDepartment of Mathematics, K.L.S. College,
Nawada, Magadh University,
Bodh Gaya, Bihar 805110, India

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Abstract. This article deals with an immunological model, which includes multiple classes of T cells, namely, the naive T cell, type I, type II and type 17 T helper cells (Th_1 , Th_2 , Th_{17}), regulatory T cell (T_{reg}) along with the activated natural killer cells (NK cells) and epidermal keratinocytes. In order to describe the etiology of psoriasis development, we have studied the basic mathematical properties of the model, existence and stability of the interior equilibrium. We have also derived the drug-induced mathematical model using impulse differential equation to determine the effects of combined biologics Etanercept (TNF- α inhibitor) and Fezakinumab (IL-22 monoclonal antibody) therapy considering perfect dosing during the inductive phase. We have determined the required dosing interval of both drugs to maintain the keratinocytes concentration below a threshold level. This study shows that Etanercept alone could theoretically maintain the keratinocytes level, whereas frequent dosing of Fezakinumab alone may not be enough to control the hyper-proliferation of keratinocytes. Furthermore, combination of the drugs with perfect dosing has the noticeable effect on keratinocytes dynamics, which may be suitable therapeutic approaches for treatment of psoriasis.

Keywords: keratinocytes, T helper cells, activated natural killer cells, immunological model, impulse differential equation.

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¹Corresponding author.

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ORIGINAL ARTICLE

Combined impact of predatory insects and bio-pesticide over pest population: impulsive model-based study

Fahad Al Basir¹, Jahangir Chowdhury², Suvendu Das³, Santanu Ray³

¹ Department of Mathematics, Asansol Girls' College, Asansol-4, West Bengal 713304, India

² Department of Applied Science, RCC Institute of Information Technology, Canal South Road, Beliaghata, Kolkata, West Bengal 700015, India

³ Systems Ecology and Ecological Modeling Laboratory, Department of Zoology, Visva-Bharati, Santiniketan 731235, India

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Abstract The production with increasing demands maintaining the balance of nature and natural diversity is the most challenging part of the agricultural system. However, pests and other insect populations are significant obstacles to the continuous food supply. This study proposes a crop pest management mathematical model using the predator (pests' natural enemy) and viral infection through bio-pesticides. Impulsive differential equations have been implemented to study the dynamics between all populations, considering the repetitive release of virus micro-pesticides and predator insects in the crop field. The hypothesized model gives the outlook of complex natural dynamics. Two types of scenarios have been analyzed here using the model: One deals with the complete eradication of the field's pest population, and another is sounder from a biodiversity conservation perspective, that defines the minimum pest population below the economic injury level, which is, nowadays, the major challenge in the agricultural field. Numerical examples show that pest management is successful when considering the minimum pest level that keeps the economic threshold by optimizing predator and virus levels cost-effectively.

Keywords Integrated Pest Management (IPM) · Mathematical modeling and simulations · Viral infection · Predatory insect · Impulsive differential equation · Economic injury level (EIL)

1 Introduction

Pest and pest control are significant challenges in the agricultural sector since human civilization's primary evolutionary stage. Humans invent day by day new tools and techniques with all sophisticated methods to control the pest. Human manifestation to control pests makes our nature and natural ecosystem stay on the verge of extinction. The use of chemical pesticides is widespread. The adverse effect of chemical pesticides affects all insect population including beneficial insect and disrupts the balance of biodiversity. Therefore, it induces to generate some alternative to control pests in a much-generalized way (Abraha et al. 2021; Al Basir et al. 2019; Samada and Tambunan 2020; Wilby and Thomas 2002).

In natural and uninterrupted conditions, each crop field contains pests and other insect populations. Some insects act as predators for pest populations at any specific or multiple developmental stages (Perdikis et al. 2011; Luff 1983; Ostad-Alt-Askari andShayannejad 2021). In classical biological control, the pest population is controlled from the region of its origin by introducing natural enemies, including invertebrates, vertebrate predators, weeds, and plant diseases. Generally, most of the synthetic pesticides are broad-spectrum kill both pests, as well as other beneficial organisms. Here, in this modeling, the predatory insect population is stickily concerned with all the pests as mentioned above (Chattopadhyay et al. 2017).

In Integrated Pest Management (IPM), all traditional, sociocultural, biological, chemical pest control measures are incorporated in systemic manners (Prokopy and Kogan 2009). The incorporation of biological control measures is one of the primary focuses for agricultural scientist through last few decades (Tang and Chen 2004). Biological control

Fahad Al Basir
fahadbasir@gmail.com

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Ranking of Political Science Journals covered in the UGC-CARE list: a quantitative study

Nandalal Mandal

Librarian, Asansol Girls' College, Asansol

Abstract

This study provides a ranking of UGC-CARE listed political science journals using the citation metric hg-index, which is the geometric mean of the h-index and g-index. The other aims are to make comparative rankings based on h-and g-indices, identify indexing databases, establish correlation among indices, measure central tendency, and identify the significant publication domain. To accomplish this study, the metrics quantitative data obtained from the Google Scholar database as citation sources using the Publish or Perish (PoP) citation retrieval programme for the publication period 2010-2019 and citation years 2010-2022. Out of thirty-seven total journals, thirty-two have selected based on the journal's selection criteria. The finding is that the top three journals are (1) International Studies, (2) European Security, and (3) Politics, Groups, and Identities. The open access journals are at 33.25 %, indexed in Scopus at 21.875%, in WoS at 6.25%, and 58.33% of the journals are of Indian origin. The h-, g-, and hg indices are positively related. The outcome of this study helps to evaluate the quality of the scholarly journal, its authors and publishers, and their impact on the political science discipline. It reflects the useful relative position of a journal and an author in the subject domain of political science, which influenced scholars, guides, libraries, and institutions to publish a quality product. It may be helpful to the UGC and library and information centers in making a reference list of quality journals.

Keywords: Citation, g-index, h-index, hg-index, Journal ranking, Political science, UGC-CARE

1. Introduction

Political science is a basic discipline in social science with close association with other social science subjects but not a part of the other subjects and has developed its internal specializations (Almond et al., 1962). Political science journal articles hold a pre-eminent place in scholarly communication networks (Garand et al., 2009). The development of ICT, web technologies (Web 2.0, Web 3.0, and so on), and social networking has changed the behaviour of the collection, processing, and publication of

articles.

The number of research articles published in reputed journals is one of the globally accepted indicators (Jain, 2018). Thus, 'research published on journal ranking mirrors its interest for a variety of parties including researchers, practitioners, authors, journal editors, educators, students, departments, libraries, tenure and promotion committees, and so forth' (Moussa and Touzani, 2010). The journal ranking systems impact the authors to choose the publication outlet to maximize their publication scores

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RESEARCH ARTICLE

Urbanization and Nesting Behaviour of Heronry Birds of the Order Ciconiiformes at PCBL Colony, Durgapur, West Bengal, India

Supriya Ray^{1*} Anupam Ghosh², Rajendra Prasad Mondal³

¹Assistant Professor, Asansol Girls' College, Asansol, West Bengal, India.

²Associate Professor, Bankura Christian College, West Bengal, India.

³Assistant Professor, Bankura Sammilani College, Bankura West Bengal, India.

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*Address for Correspondence

Supriya Ray
Assistant Professor,
Asansol Girls' College,
Asansol, West Bengal, India.
Email: ray.supriya@gmail.com



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ABSTRACT

The heronry is the assemblage of single or multiple species of water bird that make colonial nests near water bodies. The present study is an attempt to understand the nesting behaviour of different species of egrets, herons, cormorants belonging to Order: Ciconiiformes and try to understand the population trends, selection of nesting plants by water birds. This present study also aims to investigate the impact of urbanization on birds in the study area. In Despite being a residential colony, the study area has low chances of human disturbances and contains a large number of trees that provide nesting and breeding places for birds like herons and cormorants in the rainy season. A total number of five species were recorded among which four species of Family: Ardeidae and one species of Family: Phalacrocoracidae. Water birds and nest count in the PCBL residential complex were much more than its adjacent forest habitat. Statistical analysis showed a significant difference between the means of total nest count of two habitat types as indicated by a one way ANOVA ($F=5.90, P<0.05$) followed by a Tukey's HSD test



COLORS OF SELF (ĀTMĀ) IN NĀSTIKA DARSANA: A COMPARATIVE STUDY

TAPAS ROY

Assistant Professor of Philosophy
Asansol Girl's College W.B. India

Abstract

In Indian tradition there are various contradictions that arise regarding the discussion of self. Indian philosophy is mainly divided into two groups namely *āstika* and *nāstika*. However, at the time of discussion regarding the nature of self, the *nāstika*, *astika* barrier vanishes. At that time, they only focused on their philosophical standpoint. As we all know, self is the central topic in Indian philosophy. However, the problem is that not everyone agrees with other schools, so no conclusion is reached. Here in this paper I would like to discuss the self in different *nāstika* Indian philosophical schools point of view. As we all know that in Indian tradition there are three schools known as *nastika*, because they do not believe in the authority of Veda. These three schools are Cārvāka, Buddha and Jaina. Regarding the nature of self, these three schools give different observations. Here in this paper, I have tried to discuss a comparative study among them. In addition, when the discussion needed I have discussed western thought and other Indian school concepts also. I have chosen this topic as because

Key words: *Self, nāstika darsana, astika darsana, mukti, Jiva, pañcaskandha, law of karma.*

Introduction:

self is the one of the central topics in Indian philosophy as well as western philosophy. What is the real nature of self? This is a very difficult question among all the philosophical questions. Regarding this question, different philosophical schools are divided into different groups. Naturally, it is thought that self is pure, eternal, unchangeable being. Someone said that consciousness is the nature of the self, another group says that consciousness is the quality of

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Article

Contract Farming in West Bengal: Patterns, Determinants and Policy Implications

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Sumana Mukherjee¹

Abstract

In order to revive the agricultural sector under the neoliberal regime, contract farming has been emerging as a new agricultural technology in India and in the state of West Bengal, in particular. The present paper is a micro-level comparative study of West Bengal, dominated mainly by small and marginal farmers, which serves as an interesting case for highlighting on the pattern of cropping changes over time. The study highlights on the contract farming models prevailing in the study area, the specific implications of the nature of contracts followed by a detailed discussion on the characteristics of the crop under contract and the structure of contract farming in the study area. The article also attempts to investigate the factors inducing contract farming by different size classes of farmers as well as contract farming through individual agents vis-a-vis cooperatives using a logistic regression model. The study reflects that the success of contract farming as an emerging alternative institution that may alter the existing farm practices as suggested by the recent Farm Bill, 2020, depends much on the nature of the product as well as the contract.

JEL Codes: Q12; Q13; Q15; Y10.

Keywords

Contracts, agents, cooperatives, logistic regression, Farm Bill

I. Introduction

Trade liberalisation and globalisation of agriculture have undoubtedly opened up new challenges and opportunities to the agrarian sector of India in a situation when the economy was experiencing a declining size of its agricultural holdings, slowing down of technological advances in staple crops, falling investment in agriculture and increasing degradation of natural resources. In order to sustain in

¹ Department of Economics, Asansol Girls' College, Asansol, West Bengal, India

Corresponding author:

Sumana Mukherjee, Department of Economics, Asansol Girls' College, Asansol, West Bengal 713304, India.
E-mail: smukherjee.m@gmail.com

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EVALUATING THE RESOURCE POTENTIALITIES OF WETLANDS: BARDHAMAN
SADAR SOUTH SUBDIVISION, WEST BENGAL

Dr. MANIKA SAHA, Assistant Professor of Geography, Asansol Girls' College, West Bardwan,
West Bengal, India.

Abstract

Wetlands are indispensable components of environment. They are interface and eco-tone between deep water and upland ecosystems. Scientists, therefore, use different sobriquets to appreciate their multi-tasking role as "cradles of biodiversity", "biological supermarkets", "kidneys of landscape", "repository of resources" etc. It is needless to say that a developing country like India and a state like West Bengal, where land is ploughed up over centuries for crop cultivation, studies are necessary to create more avenues, inter alia, to generate superior resources even from hitherto under-utilized sources. Although these wetlands have been found to be a rich source of aquatic flora and fauna, yet their economic utilization is neither satisfactory nor growth oriented. So the main objectives of the present study is to find out resource potentialities of wetlands of the study area and to suggest ways and means for better uses of wetlands from environmental and economic points of view. With view to assess their resource potentialities and their capabilities in generating various economic uses both primary and secondary data have respectively been generated and used.

Key words: Wetland, Resource potentiality, Economic utilization.

Introduction

Wetlands are indispensable components of environment. They are interface and eco-tone between deep water and upland ecosystems. These are reservoirs of two basic ingredients of environment, viz., water and aquatic life and play vital role as natural sink of pollutants as well as in recharging groundwater (Mitsch et al, 1986). Wetlands are considered to be among the most productive and biologically rich ecosystems (Chaudhuri, 1998). These are Common Property Resources (CPR) and are themselves receptacle of resources (Singh, 2015). Some of these resources of wetlands are traditionally known, while there are others which are under-utilized, untapped or exotic in nature. Wetlands are multi-dimensional entities in terms of their hydrologic processes, ecological nature, environmental significance and economic importance. Scientists, therefore, use different sobriquets to appreciate their multi-tasking role as "cradles of biodiversity", "biological supermarkets", "kidneys of landscape", "and repository of resources" etc. Wetlands received attention as environmental resources in the Ramsar Convention, 1971. According to the Ramsar Convention wetland is defined as "areas of marsh, fen, peat-land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt water, including areas of marine water, the depth of which at low tide does not exceed six metres" (MedWet, 2016). The National Wetland Conservation Programme (NWCP), implemented by the Govt. of India in close collaboration with the respective State Government since 1985-86, considers wetlands as areas where water is the primary factor controlling the environment and the associated plant and animal life. These occur where the water table is at or near the surface of the land, or where the land is covered by water. Once treated as transitional habitats or seral stages in succession from open water to land, the wetlands are now considered to be distinct ecosystems with specific ecological characteristics, functions and values. It further states that wetlands, natural and manmade, fresh water or brackish, provide numerous ecological services (Gol, NWCP).

India offers a large variety of wetlands with vast aquatic habitat owing to its physiographic and climatic diversities. Studies on wetlands in India earlier have been carried out mostly to make a survey of wetland plants, such as that by Agharkar (1923), Mukherjee (1926), Biswas and Calder (1936), Bhandari et. al. (1962), Deb (1976) etc. In recent years attention have further been drawn toward studying more varied and diverse aspects, such as ecosystems of wetlands (Vijayan and

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NEW TREND OF START-UPS WITH GREEN SOLUTIONS: A STUDY

Dr. SUROVI GUPTA, Assistant Professor, Department of Commerce
Asansol Girls' College, Asansol - 713 304, West Bengal

Abstract

21st century has been witnessing unimaginable crisis, be it climate change, catastrophe like earthquake, forest fire, storms or invasion of deadly virus covid19. Needless to mention is that the reason for all these has been human being's callousness and ignorance towards our environment. Extensive use of non-renewable resources, unrestricted exploration of natural resources, deforestation etc. has concluded to the present crisis of mother Earth. Although things have almost gone out of our hands but people are gradually realizing the damage done and moving forward towards sustainable livelihood before it's too late. One step towards this, which is being noticed in recent times, is that many startups are coming up with business ideas which provide solution to some of the environmental issues. These efforts are very encouraging as these shows that money can be earned without damaging our environment and profit making and sustainability can go hand in hand. The focus of this paper would be to study this new trend, explore the kinds of business ideas that the young entrepreneurs are coming up with, the challenges and difficulties being faced by them to materialize their ideas and measuring the extent of their success.

Key words: Start-ups, thinking green, waste recycle.

Introduction

21st century has been witnessing unimaginable crisis, be it climate change, catastrophe like earthquake, forest fire, storms or invasion of deadly virus covid19. Needless to mention is that the reason for all these has been human being's callousness and ignorance towards our environment. Extensive use of non-renewable resources, unrestricted exploration of natural resources, deforestation etc. has concluded to the present crisis of mother Earth. Talking about environment we are very much aware of the fact that in the present world every corner of our environment is polluted be it land, air, river, lakes, seas etc. heavy industrialization has caused the maximum air pollution. To add to it the excessive emission of harmful gases by automobiles has enormously increased the level of pollution. Soil pollution is mainly caused by plastic waste and the main problem with plastic waste is that they take hundreds of years to degenerate. Water bodies are polluted by human waste, chemical waste released by factories etc. global warming, ozone depletion, the results of deforestation and increased level of pollution has reached alarming level and the effects are already being witness by the climate change that we are facing now. Every year natural calamities are causing havoc loss of lives and properties. Although things have almost gone out of our hands but people are gradually realizing the damage done and moving forward towards sustainable livelihood before it's too late. One step towards this, which is being noticed in recent times, is that many startups are coming up with business ideas which provide solution to some of the environmental issues. These efforts are very encouraging as these shows that money can be earned without damaging our environment and profit making and sustainability can go hand in hand.

Objective of the Study

The objective of the study can be illustrated by the following points:

- Learn about start-ups,
- Focus on many entrepreneurs who are coming up with innovative business ideas which provide solution to environmental issues
- Studying this new trend which supports sustainable livelihood
- Challenges being faced and success achieved.

About Start-ups

Before studying the trend in start-ups we need to have a brief idea regarding start-ups. Startup is a company which is in the first stages of operations. Startups are founded by one or more

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Journey of Finance from Traditional to Autonomous: An Overview

By

Dr. Surovi Gupta

Assistant Professor

Department of Commerce

Asansol Girls' College, Asansol

Abstract

Very simply if we dig into the meaning of Autonomous Finance, it would be application of Artificial Intelligence in finance. The term Finance has been defined by many in many ways but basically finance means activities relating to money. Artificial Intelligence or AI is the ability of a digital computer or a computer-controlled robot which can perform tasks commonly associated with intelligent beings. It basically combines computer science and robust database to enable problem solving. Traditional Financial decision making was done by the human minds autonomous finance has replaced it, if not completely, with robots. The paper tries to highlight the concept, process of application of AI, the benefits and challenges and the way it's changing the world of financial services.

Key words: Artificial Intelligence, Financial services.

The Concept

Finance was in its traditional form before the Spreadsheets and then ERPs which marked the beginning of digital adoption in finance, they digitalized the manual recording and processing of finance and accounting transactions. It did not, however, transform finance digitally, which only began with the emergence of Industry 4.0 or emerging technologies, such as artificial intelligence (AI), machine learning (ML), deep learning (DL), natural language processing (NLP), internet of things (IoT), robotic process automation (RPA), big data, analytics, application programming interfaces (APIs), cognitive document data extraction, optical character recognition (OCR), computer vision, cloud computing, blockchain, web3, crypto, metaverse, among others, in finance as in other functions.

Cloud computing is now ruling every department of organizations including finance, from budget estimation to cash flow monitoring everything machines are capable of taking decisions, and finance

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Evolution of The Diversification Strategy: A Historic Perspective

Dr. Surovi Gupta

Assistant Professor

Department of Commerce

Asansol Girls' College, Asansol, West Bengal

Abstract

The term 'diverse' means various and hence, it can be said that 'diversification' refers to variety. Variety indicates different, discrete, separate etc. Different authors have defined diversification in their own ways. Ansoff (1957, 1965) defined 'diversification' as the entry of firms into new markets with new products. Rumelt (1974) stated that "Diversification move is an entry into new product market activity that requires or implies an appreciable increase in the available managerial competence within the firm". In brief, Diversification means spreading the base of a business to achieve growth and reduce overall risk by including all investments except those supporting the competitiveness of the existing business directly. Many research has been conducted to measure the impact of this strategy but what led to the development of this strategy was hardly studied. This paper tries to highlight the path of evolution of diversification strategy. Studying the history of the evolutionary path of this strategy would help a company to identify the right time to adopt it. The study would assist in identifying the factors that indicate the requirement for the adoption of the strategy. In my opinion unless we know the past its difficult to forecast the future so knowing the history helps us to deal with strategy in a better way.

Keywords: Diversification, integration, conglomerate, concentric.

1. Introduction

In an ever-changing environment where we struggle to survive and grow, dynamism is an essentiality. H. Igor Ansoff (1957) provided the world with his concept of business growth alternative. He gave product-market strategy as business growth alternative Product market strategy is the combination of a product line and the corresponding set of mission which the products are designed to fulfill. Again, product line of a manufacturing company include both the physical characteristics of the individual product as well as the performance characteristics of the product, while, product mission is a description of the job which the product is expected to perform. According to him there were four growth strategies:

- ❖ Market penetration where the company seeks to improve business performance either by increasing volume of sales to the present customers or by finding new customers for present product.
- ❖ Market development where the company attempts to find new market for its present product line generally with slight modification
- ❖ Product development, in this strategy the products are developed with new and different characteristics retaining the present mission as such will improve the performance of the mission
- ❖ Diversification which is the last and final alternative. It calls for simultaneous departure from the present product line as well as the market structure. This strategy is completely different from the other three alternatives because those alternatives are usually followed with the same technical, financial and merchandising resources used for the original product line but diversification required new skills, new techniques and new facilities that lead to change in the physical and organizational structure.

The term 'diverse' means various and hence, it can be said that 'diversification' refers to variety. Variety indicates different, discrete, separate etc. Different authors have defined diversification in their own ways. Ansoff (1957) defined 'diversification' as the entry of firms into new markets with new products. Rumelt (1974) stated that "Diversification move is an entry into new product market activity that requires or implies an appreciable increase in the available managerial competence within the firm".

Diversification strategies can again be broadly classified into two categories- Concentric or Related Diversification and Conglomerate or Unrelated Diversification.



ANALYSING POWER – VIOLENCE RELATIONSHIP : A STUDY OF PHOTOGRAPHS IN
DABIQ AND RUMIYAH

EYEVEE PAKRASHI, PH.D SCHOLAR, THE UNIVERSITY OF BURDWAN, ASSISTANT
PROFESSOR, ASANSOL GIRLS' COLLEGE, ASANSOL

Abstract:

The relationship between power and violence has been a subject of varied scholarly views. Out of these, this article focuses on two important but contrasting views. The first is the view which says power is manifested through violence. The second is Hannah Arendt's analysis which shows that power and violence are opposites and incompatible with each other. Taking the lead from both the scholars, this article attempts to show that violence can both establish and strengthen power if it is communicated properly. In this article photographs of violence in IS' two important online magazines Dabiq and Rumiyaah have been analysed as case study.

Keyword: Violence, Power, Fear, Punishment

Introduction:

The history of human violence and the quest for power is as old as the history of human existence on Earth. The term violence is ambiguous and fluid. According to Rogers Brubaker and David Laitin, the problem of defining violence is not that there is no consensus about the method of the explanation but the content of the explanation (Brubaker & Laitin, 1998:427). There is a plethora of happenings, emotions and hurts which comes under the term violence. Nevertheless, Elizabeth Englander attempts to delineate the meaning of violence. For her violence is an 'aggressive behaviour' which is performed with an 'intent' to inflict harm (Englander, 2003:2). In other words, those harms which are not inflicted intentionally but mere accidentally, are not violence. She classifies violence into three types. These are a) instrumental aggression; b) hostile aggression; and c) impulsive or stimulus seeking violence (Englander, 2003: 2-3).

The first category of violence is inflicted in order to achieve certain goal while the second category of violence is performed with the sole purpose of harming the target (Englander, 2003:2). Englander has borrowed the last category or the impulsive or stimulus seeking violence from A. R. Mawson who defines it as an impulsive reaction to certain emotion or performed to seek sensory stimulation (Englander, 2003:2-3; Mawson 1999).

Where the relationship between violence and power is concerned, the first two categories of violence are important. There are varying understandings of the relationship between the two. This article, however, focuses on two important but contrasting views. The first is the traditional argument which says that violence is the manifestation of power. The second view is associated with the writings of Hannah Arendt, for whom power and violence are incompatible with each other (Arendt, 1970). This article examines these two views and assays to show that violence can both generate power and establish power if it is communicated properly. This article analyses photographs in IS' two most important online magazines – Dabiq and Rumiyaah for this purpose.

প্রতিষ্ঠাতা সম্পাদক : ডাঃ ধীরেন্দ্রনাথ গঙ্গোপাধ্যায়
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মানবদর্শন

পাতলজীৱ মনসিকিৰ্ণসী
হেগেল ও বীরক্রোধ
প্রসঙ্গ পরিবেশ : প্রেক্ষিত ভারত
নাগাজাতির মুক্তির আকাঙ্ক্ষা
মার্কসবাদ ও বাস্তবত্ব
কিউবার মানবতাবাদ
আজকের শিশু ও প্রকৃতি
নেপালী
নেপালী পরিবেশ
স্বপ্নমোক্ষ ও মার্কসের প্রকৃতি
অভিব্যক্তিবাদী ও প্রকৃতি আন্দোলন
মহাভারত জিজ্ঞাসা
একটি জীবন : দীপকর রায়
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পুস্তক আন্দোলন
বিপ্লব

মানোবিজ্ঞান, জীববিজ্ঞান ও সমাজবিজ্ঞানের
আধুনিক ধারা পরিচায়ক
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প্রসঙ্গ পরিবেশ : প্রেক্ষিত ভারত
ড. মাল্যবান চট্টোপাধ্যায়

পরিবেশ নিয়ে ভারতের ভাবনার অংশ কীভাবে বিকৃত হয়েছে, এ নিয়ে ভাবতে গেলেই আধুনিক যুগের এক বইয়ের প্রতি প্রায় সকলের নজর যায়। সেটি হল 1962-তে প্রকাশিত রচনাকারেন এর লেখা 'Silent Spring' বইটি। কিন্তু এর আগে কি ভারতে পরিবেশ নিয়ে ভাবনার জাল বিকৃত হয়নি? নাকি তার বিস্তার বুঝে যেতে পারেনি সেপের পালকের মনসকে? স্বাধীনতার আগের প্রেক্ষিতই বা কেমন ছিল? কেমনভাবে ব্রিটিশরা ভারতের পরিবেশকে নিয়ে ভেবেছেন? নাকি তাদের জানাগুলো আসলে ছিল শোষণের মুখোশ? সেই মুখোশের মুখোমুখি যখন স্বাধীন ভারত গঠি হল তখন সেই শে-মার্কসবাই বা কতটা পারেনেন পরিবেশ বাসব হতে? কতটা উঁচু পারেনেন সেসিম আলি থেকে সুন্দরলাল বক্সনার মত মানুষের বন্ধনকে উন্নয়ন এর কাঠামোতে স্থান দিতে? এবং প্রশ্নের উত্তর এর সম্ভাবন করা হয়েছে আলোচনা নিচে।

পরিবেশ নিয়ে ভারতের ভাবনার অংশ কীভাবে বিকৃত হয়েছে, এ নিয়ে ভাবতে গেলেই আধুনিক যুগের এক বইয়ের প্রতি প্রায় সকলের নজর যায়। সেটি হল 1962-তে প্রকাশিত রচনাকারেন এর লেখা 'Silent Spring' বইটি।

এই বইতে তিনি জানান যে কৃষিক্ষেত্রের কীট মারার জন্য যে রাসায়নিক মার্কিন যুক্তরাষ্ট্রে ব্যবহৃত হচ্ছে, তাতে খাদ্যশস্যও বিঘাত হচ্ছে এবং সেই বিঘাত শস্যদানা থেকে বিক্রিমার কারণে পানিও নিপা হচ্ছে কারণ তাদের ডিমের খোল হয়ে যাচ্ছে পাতলা, যা থেকে পানির ছানার জন প্রশ্নের মুখোমুখি হচ্ছে। তাই তিনি শব্দ প্রকাশ করেছিলেন একদিন পৃথিবী এমন এক বসন্ত দেখবে যা হবে পানির কলকবলিহীন।

এ ছাড়াও এই সূত্রে উঠে আসে 1972-এর সুইডেনের স্টকহোম শহরে অনুষ্ঠিত প্রথম আন্তর্জাতিক আদ্যোদ্যোকে গৃহীত পরিবেশ রক্ষার শপথের বিবরণিও।

ইউগোপের স্টকহোম শহরে, 1972 খ্রিস্টাব্দে সম্মিলিত জাতিপুঞ্জ যে পরিবেশ বিধায়ক সম্মেলন করেন তা স্টকহোম সম্মেলন নামেই পরিচিত। এটি বিশ্বের পরিবেশ সচেতনতার ক্ষেত্রে প্রথম কোন সম্মিলিত প্রায়স যাত্রে ভারত সহ পৃথিবীর 113টি দেশ অংশ নিয়োজিত। এই সম্মেলনে বক্তব্য রাখতে গিয়ে ভারতের প্রধানমন্ত্রী ইন্দিরা গান্ধী উদ্বলনশীল সেপের পরিবেশগত সমস্যার ভিত্তির কথা বলেছিলেন। তিনি পরিবেশগত সমস্যাকে পরিষ্কার সঙ্গ সূত্র করেছিলেন। এই সম্মেলনে মোট 26টি সিদ্ধান্ত নেওয়া হয়েছিল, পরিবেশ রক্ষার জন্য। এই যাত্রা অল্পই থাকে আজও। সামাজিক কালে সম্মেলনে মোট 26টি সিদ্ধান্ত নেওয়া হয়েছিল, পরিবেশ রক্ষার জন্য। এই যাত্রা অল্পই থাকে আজও। সামাজিক কালে সম্মিলিত জাতিপুঞ্জ তাদের 'কনফারেন্স অব প্যাট্রন' এর 26 তম অধিবেশনে 2021 সালেই সিদ্ধান্ত নিয়েছেন যে পৃথিবীর ভাগমালা বৃদ্ধিকে রোধ করতে হবে। এই সচেতন হবার যাত্রাপথ কতটা মসৃণ ছিল স্বাধীনতা-পরবর্তী ভারতবর্ষে? কেন্দ্রবাই বা প্রেক্ষিত ছিল স্বাধীনতার আগের সময়ে ভারতীয় প্রেক্ষিত?

স্বাধীনতার পরে শিল্পায়ন ভারতকে বহিঃসের সৃষ্টির নিরিখে পশ্চিমের অর্থনীতি দেশগুলির সঙ্গে প্রতিযোগিতায় নামার পথে অনেকটা এগিয়ে দিয়েছে, সঙ্গে দিয়েছে তেমন পরিবেশ সমস্যাও। এটি আজ প্রায় সমাজশাল গঠিতে মাথা হাটা দিয়েছে।

সবুজ বিপ্লব এর ফলে জমির উর্বরতা হ্রাস যেমন হয়েছে ধীরে ধীরে তেমন বনজ সম্পদের ক্ষয়, অরণ্যভঙ্গ, কৃষি ক্ষেত্রে কীটনাশকের যথেষ্ট ব্যবহার, পরিবেশের সম্পর্কিত আইনের যথাযথ প্রয়োগের অভাবে অর্থাৎ ভূমিকমণ প্রভৃতির ক্ষয় পরিবেশ ক্ষয়ে উদ্ভয়ের কারণ হয়ে দাঁড়িয়েছে। এসবের মধ্যেই দুঃখাল ঘাস দুঃখিনীর ব্যাপকতা ভারতীয়দের যখন

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Impact of Combined Therapy in HIV-1 Treatment: A Double Impulsive Approach

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Abstract

The major class of antiretroviral drugs used in the treatment of HIV positive patients are fusion inhibitors (FIs) and protease inhibitors (PIs). The fusion inhibitor enfuvirtide is effective in early viral life cycle and prevents viral entry into host cells. Protease inhibitors efficiently reduce the number of infectious virus particles. In this article, a mathematical model has been derived to study the effect of enfuvirtide in combination with protease inhibitors in HIV treatment. The dynamics of the two drugs have been analysed with a double impulsive control approach. We have considered different impulse interval for each drug and determine the threshold value for the dosages and dosing intervals to ensure the stability of disease free equilibrium. This study suggests that FIs-and-PIs combination therapy can have a better outcome than single drug activity; furthermore it can also be a better treatment strategy than the current combination of drugs when applied with proper dose and dosing intervals.

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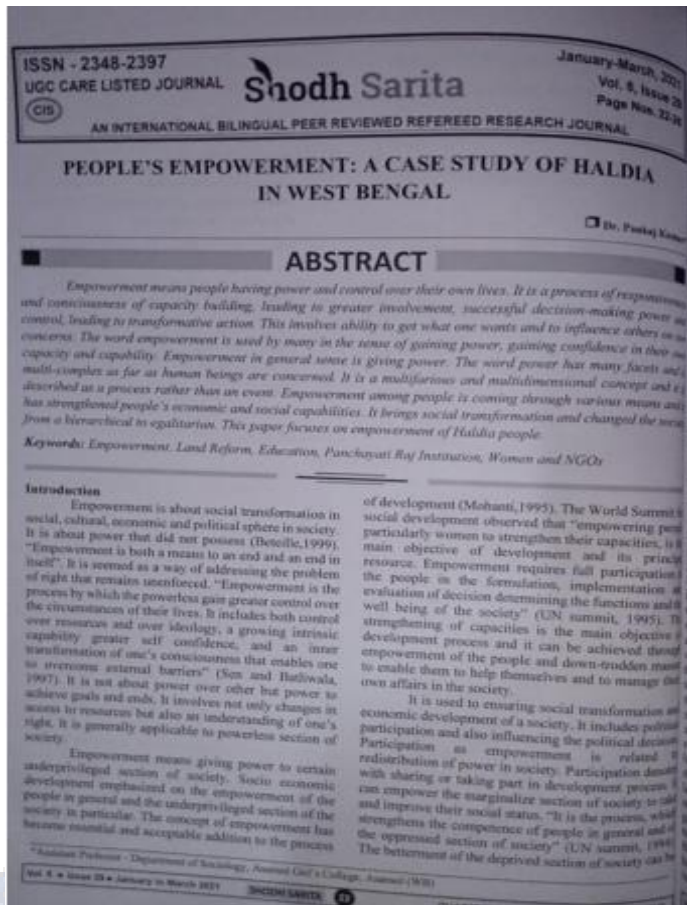
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Frontiers

Pest control using farming awareness: Impact of time delays and optimal use of biopesticides



Teklebirhan Abraha^a, Fahad Al Basir^b, Legesse Lemecha Obsu^a, Delfim F.M. Torres^{c,*}

^a Department of Mathematics, Adama Science and Technology University, Adama, Ethiopia

^b Department of Mathematics, Asansol Girls' College, West Bengal 713304, India

^c R&D Unit CIDMA, Department of Mathematics, University of Aveiro, 3810-193 Aveiro, Portugal

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ABSTRACT

We investigate a mathematical model in crop pest management, considering plant biomass, pest, and the effect of farming awareness. The pest population is divided into two compartments: susceptible pest and infected pest. We assume that the growth rate of self-aware people is proportional to the density of healthy pests present in the crop field. Impacts of awareness is modeled via a saturated term. It is further assumed that self-aware people will adopt biological control methods, namely integrated pest management. Susceptible pests are detrimental to crops and, moreover, there may be some time delay in measuring the healthy pests in the crop field. A time delay may also take place while becoming aware of the control strategies or taking necessary steps to control the pest attack. In agreement, we develop our model incorporating two time delays into the system. The existence and the stability criteria of the equilibria are obtained in terms of the basic reproduction number and time delays. Stability switches occur through Hopf-bifurcation when time delays cross critical values. Optimal control theory has been applied for the cost-effectiveness of the delayed system. Numerical simulations illustrate the obtained analytical results.

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1. Introduction

In recent times, integrated pest management is gaining more attention among researchers and its application is also increasing in the crop field. This method seeks to reduce the reliance on pesticides by emphasizing the contribution of biological control agents. The important role of microbial pesticides in integrated

the effect of awareness coverage in controlling infectious diseases we refer the reader to [5], where a SIS model is formulated considering individuals' behavioral changes due to the influences of media coverage, and where the susceptible class is divided into two subclasses: aware susceptible and unaware susceptible.

Correct and relevant knowledge about crop and its pests is very much essential for people engaged in cultivation. The role of elec-

Folk Medicine : Is it a Reflection of Man-Nature Relationship?

¹Manika Saha* and ²Susmita Sengupta

1. Assistant Professor in Geography, Asansol Girls' College, Asansol

2. Assistant Professor of Geography, Rabindra Mahavidyalaya, Champadanga, Dist. Hooghly, West Bengal, India

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ABSTRACT

The present paper documents ethnomedicinal values of various wild plants and herbs by Santal forest villagers of Jaypur forest range of Bankura district, West Bengal. Traditional knowledge often restores cultural heritage and establishes the identity of a group in a particular society. The concept of folk medicine is based on the folk education system, philosophical thought, and cultural origins of society and is usually transmitted orally. This research is a detailed field survey based on interviewing Santal medical healers and a few knowledgeable aged persons in three tribal villages of Jaypur, dense with natural forest resources and populated by tribal. I have applied a semi-structured and open-ended questionnaire. Apart from qualitative techniques, some relevant quantitative approaches like Informant Consensus factor, Fidelity Level analysis, Importance value, etc., have helped to explain the intimate man-nature relationship between forest resources and Santals through medicinal use of plants. It also discusses this social group's traditional knowledge to conserve and preserve forest resources.

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Keywords:

Medicine men,
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forest resources

Introduction:

From the beginning of human civilization, primitive human beings used to live in forest nurtured by nature. India's tribal communities live in the forest regions being isolated from the mainstream of life but in harmony with nature. They are in the multiplex relationship among populations of organisms for sustaining their livelihood within their habitat. Over 53 million tribal people in India, about 60% of the rural communities directly rely on the forest for their daily requirements (Saha and Sengupta, 2014). They use different parts of plants as medicine for ages as they are readily available, safe, and cost-effective. They have devised systems to get relief from the illness employing their indigenous technique, rooted in their belief

system. However, the ethnic minorities in rural India are characterized by geographic isolation and a strong sense of socio-cultural exclusion. Folk medicine includes healing practices and ideas on health care, limited to a specific cultural groups. This treasure of knowledge is transmitted orally by generation without any written document and is still retained by various indigenous groups of India. Folk healers carry an outstanding knowledge of wild plants. They have been developing the healthcare traditions through constant experimentation and years of experience rooted in understanding and realistic considerations (Gupta, Sharma and Sharma, 2014). The ethnic knowledge of using medicinal plants by these 'ecosystem people' has made them sustain their life through ages

Correspondence to Susmita Sengupta
Assistant Professor of Geography, Rabindra Mahavidyalaya, Champadanga, Dist. Hooghly, West Bengal, India
Email address: ssg.serampore2016@gmail.com

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UNDERSTANDING THE SIGNIFICANCE OF PCOS AND OBESITY IN THE MILIEU OF IRREGULAR MENSTRUAL CYCLE: A BIostatistical APPROACH

SUPRIYA RAY^{1*}

¹Department of Zoology, Asansol Girls' College, Asansol, 713304, WB, India.

AUTHOR'S CONTRIBUTION

The sole author designed, analysed, interpreted and prepared the manuscript.

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Original Research Article

ABSTRACT

Background: Global prevalence of obesity and PCOS are constantly increasing young population particularly in adolescents and college students.

Aim: Population based cross-sectional study to investigate of the menstrual abnormalities with PCOS and obesity among adolescence school students and college students.

Settings: The study was conducted in different rural, sub-urban and urban areas of Bankura and Paschim (west) Bardhaman District, West Bengal, India.

Methods: After proper consent from school/college authority, students were invited to answer a self-administered, semi-structured questionnaire was designed in English dealing with anthropometric data, psychological symptoms, menstrual history and health problems.

Results: PCOS had a high association with menstrual complications in all rural, Sub-urban and urban populations. Obesity also had a positive association with menstrual complications. Highest association of obesity to menstrual complication was observed in students of rural population.

Conclusion: PCOS and obesity are serious health problems affecting rural, sub-urban, urban adolescents and college students of Bankura, and West Bardhaman, West-Bengal.

Keywords: Menarche, menstrual complication, obesity, PCOS, yule's index.

1. INTRODUCTION

Menarche is a stage of major physical and mental change that leads to the development of reproductive capacity [1]. Menstrual and gynaecological disorders

like polycystic ovarian disease abnormalities such as dysmenorrhea, menorrhagia, and irregular cycles are common in adolescent and can lead to stressful conditions. PCOS is a common condition defined by 3 main features: irregular periods, excess androgen and

*Corresponding author: Email: ray.supriya@gmail.com



Organozinc hydrazides and their derivatives: synthesis, structural diversity and applications

Surajit Jana^{a*} and Rajat Saha^{b†}

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Organozinc hydrazides have gained considerable interest in current research for their significant applications as single source molecular precursors in chemical science as well as their versatile structural diversity. Various hydrazide derivatives are normally prepared from a 'one-pot' synthesis protocol by reacting dialkylzinc and hydrazine in the presence of secondary ligands at an appropriate ratio, and the reaction proceeds via successful replacement of one or more hydrazide units by secondary ligands through alkane elimination. Due to the polydentate binding nature of the N–N moiety of the hydrazine ligand, these organozinc hydrazides adopt a great variety of structures such as four-membered heterocycles, polycyclic frameworks and cages. The hydrogen storage properties of selected hydrazides and their derivatives are also discussed in this review.

1. Introduction

Organometallic hydrazides have attracted much interest in recent research for their use as single source precursor (SSP) materials to produce metal nitrides by organometallic chemical vapour deposition (OMCVD) techniques. These organometallic hydrazides are present as molecular aggregates with different metal ions. Hydrazides are particularly interesting as they offer

two N–N linked binding sites with the inherent lability of N–N bonds. In this context, aluminium and gallium hydrazides have been studied extensively to develop semiconducting AlN or GaN films using the respective SSPs.¹ Several research groups have explored the diverse structural motifs of such Group 13 hydrazides (Scheme 1) and also studied their reactivities. These compounds range from simple mononuclear units to complex multinuclear geometries. Due to the difficulties in synthesis and the necessity of using the Schlenk line method, only a few research groups have attempted to explore this field. Uhl *et al.*, Kim *et al.*, Nöth *et al.*, and Silverman *et al.* have worked to develop the chemistry of Group 13 organometallic hydrazides. They have synthesized: (a) **type A**: a mononuclear compound

^a Department of Chemistry, Asansol Girls' College, Asansol, India.

E-mail: surajit.jana@gmail.com

^b Department of Chemistry, Kazi Nazim University, Asansol, India.

E-mail: rajat.saha@knu.ac.in



Surajit Jana

Surajit Jana received his PhD from Westfälische Wilhelms-Universität Münster, Germany, in 2006. He joined Technische Universität, Berlin, Germany as a postdoctoral research fellow in 2007 and later joined University of East Anglia, UK in 2008 and then National University of Singapore in 2009. He has research expertise in the field of organometallic chemistry. He joined Asansol Girls' College, Asansol, India as an Assistant

Professor in 2010. His current research interests are mainly centered on coordination chemistry and MOFs.



Rajat Saha

Rajat Saha received his PhD from Jadavpur University, India, in 2013. He joined University of Limerick, Limerick, Ireland as a postdoctoral fellow in 2014 and later joined Indian Association for the Cultivation of Science, Kolkata, India in 2016. He has research expertise in the fields of structural chemistry, X-ray crystallography and MOFs. He joined the Department of Chemistry, Kazi Nazim University, Asansol, India as an

Assistant Professor in 2016. His current research interests are mainly centered on designing inorganic materials for versatile applications.

Abstract

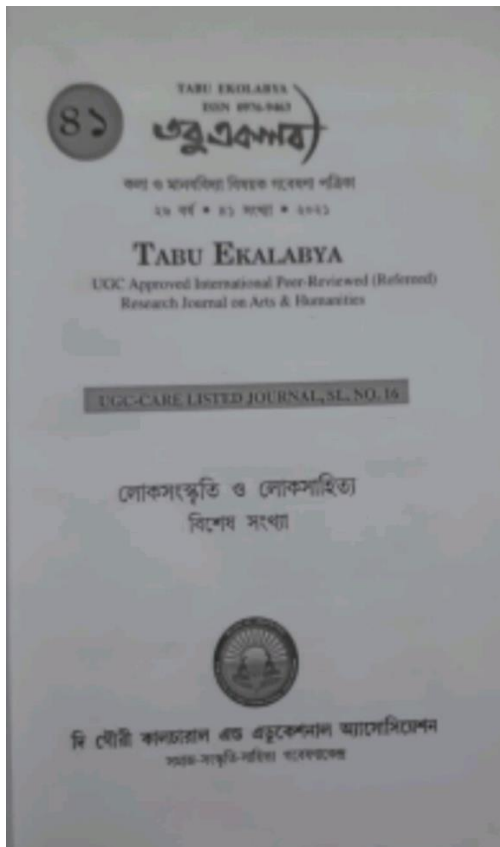
India, the land of rich tradition and cultural heritage has been held in high esteem in education since the Vedic period but lately the standard of Indian education has not been able to match the global education standard. The National Policy on Education 1986 stressed more upon universal education but the quality of education remained questionable. To achieve the global standards in education and bridge the gap between industry requirements and traditional educational structure, the National Education Policy (NEP) 2020 has been formulated wherein educational foundation starts at the age of three years and gradually proceeds towards innovation and research oriented learning. Research based learning starts earlier in NEP 2020, so that by the time a student reaches post-graduate level he has already developed research acumen. NEP 2020 is thus a step towards achieving social development and educational sustainability with a notable presence in global education platform by 2030.

Keywords: NEP 2020, Research oriented, Innovation, Social development, sustainability

Introduction

India is a country with a rich cultural heritage and background of its own. From the ancient times there has been imparting and spread of education in the country in its own form. Education is the basis for realizing potentiality and development of human and society. It is the backbone of any country and key to national development. Education improves rural people's capacity to diversify assets and activities, improves human capacity besides improving productivity in agricultural sector. India is one of the superpowers in the world today and going by the current trend, is going to be the third largest economy in the world with a projected GDP of around ten trillion dollars by 2030-2032. In such backdrop, it becomes very important that the country supports healthy and educated citizens. India is a country with 1.2 billion people, which stands close second in the world just after China. When we compare ourselves globally keeping the parameter of education we are nowhere near to the top. Even smaller countries like Singapore have surpassed us by a distance. The quality of education is going down although accessibility of education is improving. Education is considered as one of the important means to ensure food security. Right to Education is a Fundamental Right of every citizen of the nation. It is also the moral and social responsibility of the Government of any country to ensure education to the entire citizen, at least the elementary education. Government of India has always tried to make this issue a prime objective in its plans and policies. For the development of any country education plays a crucial role. Traditional economic theories formed since 1960s promoted the concept of human capital. As per the theory, human capital is considered as one of the primary means to achieve economic growth. Most of India lives in its villages and it is the rural people who are badly hit by the curse of illiteracy and poverty. It is always believed that education for rural people will help them to diversify resources, understand the parameters of health and sanitation, use technology to their advantage, implement scientific methods and techniques to enhance agricultural productivity and upgrade their lifestyle.

The aspiration of India to make quality education accessible universally for fulfilment of India's objective of continuous growth and ensuring leadership on the global platform in accordance to economic growth, progression in science and technology, equality and social justice and conservation of our rich culture. The immensely potential and talented human resource of India can best be developed by providing them quality education and which in turn will lead to the betterment of the individual and society as a whole. Globally a vigorous change is taking place in the knowledge scenario. With the advancement in science and technology we are encountering huge bulk of data and information which needs to be sorted and used according to the domain specific requirement. This leads to the development of such areas of study like- big data, artificial intelligence and



Mangalakavyas in Patachitra

Rohini Kar

A very popular genre of Bengali literature, were the Mangalakavyas, the tales of which were very popular among the masses. These Mangalakavyas were not mere figments of imagination but formed an integral part of the religious tradition of Bengal, a process that was initiated by the Bengal Puranas. It was the legacy of the Bengal Pura? as that these kavyas carried forward. Just as the Puranas by being the meeting point of Brahmanical and local traditions facilitated the entry of local Gods and Goddesses into the Brahmanical fold, the Mangalakavyas too did the same. These kavyas were composed at the time of Islamic rule in Bengal in the period between fifteenth and eighteenth century. The brahmanas fearing a large scale Islamisation of the local populace, tried to bring those cults which were still at the fringes into the brahmanical fold and the tools they chose for the task or to say in the words of Jawhar Sircar, the 'sponge' chosen for the mopping task was not the usual Sanskrit Puranic texts but the immensely popular Mangalakavyas written in the language of the people, valorizing the local Gods and Goddesses. It would not be incorrect to conjecture that before these were poetic compositions, they had remained as forms of popular entertainment for the rural folks. Indeed, Ma? galakavyas were intended to be performed, not read in solitude. It was for this reason that these kavyas were immensely popular among the masses despite the fact that most of them were illiterate and had no direct access to these. The way these kavyas were performed assumed various forms, like that of palaganas or singing expressing devotion to particular deities, jatra where there were different characters enacting scenes from the kavyas, and so on. Another very important medium, through which the stories of these kavyas, were relayed down to the masses, was that of the patachitra, which this discussion intends to focus on.

Generally 'patachitra' refers to a picture painted on cloth or paper. It is believed that the word 'pata' has its origin in the Sanskrit panna which means cloth as originally every such 'chitra' or painting was made on a piece of cloth. Later paper also came to be used and hence patachitras came to mean pictures painted on both cloth and paper. However there is also a contrary belief which holds that the word 'pata' is not derived from the

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Research article

Farming awareness based optimum interventions for crop pest control

Teklebirhan Abraha¹, Fahad Al Basir², Legesse Lemecha Obsu¹ and Delfim F. M. Torres^{3,*}

¹ Department of Mathematics, Adama Science and Technology University, Adama, Ethiopia

² Department of Mathematics, Asansol Girls' College, West Bengal 713304, India

³ Center for Research and Development in Mathematics and Applications (CIDMA), Department of Mathematics, University of Aveiro, 3810-193 Aveiro, Portugal

* Correspondence: Email: delfim@ua.pt; Tel: +351234370668; Fax: +351234370066.

Abstract: We develop a mathematical model, based on a system of ordinary differential equations, to the upshot of farming alertness in crop pest administration, bearing in mind plant biomass, pest, and level of control. Main qualitative analysis of the proposed mathematical model, akin to both pest-free and coexistence equilibrium points and stability analysis, is investigated. We show that all solutions of the model are positive and bounded with initial conditions in a certain significant set. The local stability of pest-free and coexistence equilibria is shown using the Routh–Hurwitz criterion. Moreover, we prove that when a threshold value is less than one, then the pest-free equilibrium is locally asymptotically stable. To get optimum interventions for crop pests, that is, to decrease the number of pests in the crop field, we apply optimal control theory and find the corresponding optimal controls. We establish existence of optimal controls and characterize them using Pontryagin's minimum principle. Finally, we make use of numerical simulations to illustrate the theoretical analysis of the proposed model, with and without control measures.

Keywords: mathematical modeling of ecological systems; Holling type-II functional response; stability; Hopf-bifurcation; optimal control; Pontryagin's minimum principle; numerical simulations

1. Introduction

Pest control is a worldwide problem in agricultural and forest ecosystem management, where mathematical modeling has an important impact [1–3]. Broad-spectrum chemical pesticides have been used in abundance in the containment and annihilation of pests of medical, veterinary, agricultural, and environmental importance. Although chemical plant defense plays a significant function in modern agricultural practices, it is at rest viewed as a profit-induced poisoning of the surroundings. The non-degradable chemical residues, which construct to damaging stages, are the

**SARS-CoV-2 infection with lytic and non-lytic immune responses: A fractional order optimal control theoretical study**Amar Nath Chatterjee^a, Fahad Al Basir^b, Muqrin A. Almuqrin^{c,*}, Jayanta Mondal^{d,e}, Ilyas Khan^{f,g}^a Department of Mathematics, K.L.S. College, Nawada, Magadh University, India^b Department of Mathematics, Asansol Girls' College, West Bengal 713304, India^c Department of Mathematics, Faculty of Science in Zulfu, Majmaah University, 11952, Kingdom of Saudi Arabia^d Department of Mathematics, Diamond Harbour Women's University, West Bengal 743368, India^e Department of Mathematics, College of Science Al-Zulfu, Majmaah University, Al-Majmaah 11952, Saudi Arabia**ARTICLE INFO****Keywords:**SARS-CoV-2
Lytic and nonlytic effect
Mathematical model
Fractional calculus
Optimal control**ABSTRACT**

In this research article, we establish a fractional-order mathematical model to explore the infections of the coronavirus disease (COVID-19) caused by the novel SARS-CoV-2 virus. We introduce a set of fractional differential equations taking uninfected epithelial cells, infected epithelial cells, SARS-CoV-2 virus, and CTL response cell accounting for the lytic and non-lytic effects of immune responses. We also include the effect of a commonly used antiviral drug in COVID-19 treatment in an optimal control theoretic approach. The stability of the equilibria of the fractional ordered system using qualitative theory. Numerical simulations are presented using an iterative scheme in Matlab in support of the analytical results.

Introduction

The novel coronavirus disease (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has rapidly spread across the globe. This disease causes more than 9.9 lakhs cases and 5 lakhs death as of 27th June 2020. The death rate of COVID-19 is approximately 5%. Most of the cases of COVID-19 are asymptomatic and can be recovered before testing. 20% of the patients [1] are found to be symptomatic. Common symptoms for COVID-19 include fever, cough, shortness of breath, sore throat, chills, fatigue, etc. But in the case of the patient suffering from diabetes, high blood pressure, chronic pneumonia, COVID-19 causes various organ collapses and also mortality.

The angiotensin-converting enzyme 2 (ACE2) receptors on the surface of the epithelial cells [1] are the major target area of the SARS-CoV-2 virus. The density of epithelial cells is the highest in the lungs, followed by the nose, and lastly, the trachea/bronchi tissues. Thus pneumonia is quite common for COVID-19 affected patients.

The immune system acts against the virus during viral infections in presence of inherent and antigen-specific immune responses [2]. These forms of immune responses classified into two categories (lytic and nonlytic). The lytic mechanism represents the killing process of infected cells and the non-lytic effector mechanism inhibit the viral replication by soluble mediators. Cytotoxic T Lymphocyte cells (CTLs) play a

pivotal role to kill infected cells, though antibodies deactivate free virus which results from the inhibition of infected cells. In this article, a COVID-19 model is constructed to study the cell-to-cell transmission of the virus. We have considered uninfected, infected epithelial cells, SARS-CoV-2 population, and CTL population. We have also studied the lytic and non-lytic immune responses effect on the model dynamics.

It has been observed that for COVID-19 infection, the average maturation period is 6 days to 13 days and the median time to discharge from the hospital of symptomatic patients is 22 days [1], however the average time to death is 18 days [3]. From clinical findings, it is observed among 29 patients who were undergone through antiviral drug lopinavir/ritonavir and were released. The average time from infection start to commencement of antiviral treatment was 14 days [1]. Also, the intermediate period of viral coming off was 22 days. Considering the effect of commonly used drugs, we have studied the effect of commonly used drugs to explore the best possible treatment regimen.

Fractional order differential equation is used as an important tool in nonlinear mathematical modeling [5–12].

Fractional differential equation (FDE) have recently used to model real-life phenomena and it stands as a strong tool to study the dynamics of the system. In recent studies, FDEs are being used as new and effective tools to model real-life phenomena instead of Integer order differential equations.

* Corresponding authors.

E-mail addresses: muqrin@mu.edu.sa (M.A. Almuqrin), jayantajumath@gmail.com (J. Mondal), ilyaskhan@tdtu.edu.vn (I. Khan).<https://doi.org/10.1016/j.rinp.2021.104260>

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ORIGINAL ARTICLE

**Effects of Vector Maturation Time on the Dynamics of Cassava Mosaic Disease**F. Al Basir¹ · Y. N. Kyrchko² · K. B. Blyuss² · S. Ray³

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Abstract

Many plant diseases are caused by plant viruses that are often transmitted to plants by vectors. For instance, the cassava mosaic disease, which is spread by whiteflies, has a significant negative effect on plant growth and development. Since only mature whiteflies can contribute to the spread of the cassava mosaic virus, and the maturation time is non-negligible compared to whitefly lifetime, it is important to consider the effects this maturation time can have on the dynamics. In this paper, we propose a mathematical model for dynamics of cassava mosaic disease that includes immature and mature vectors and explicitly includes a time delay representing vector maturation time. A special feature of our plant epidemic model is that vector recruitment is negatively related to the delayed ratio between vector density and plant density. We identify conditions of biological feasibility and stability of different steady states in terms of system parameters and the time delay. Numerical stability analyses and simulations are performed to explore the role of various parameters, and to illustrate the behaviour of the model in different dynamical regimes. We show that the maturation delay may stabilise epidemiological dynamics that would otherwise be cyclic.

Keywords Whitefly vector · Maturation delay · Plant viral disease · Hopf bifurcation · Numerical stability analysis**1 Introduction**

One of the major challenges to successful agriculture comes from plant viruses that target grains, legumes and vegetables, resulting in significant economic losses (Sanfaçon

✉ K. B. Blyuss
K.Blyuss@sussex.ac.uk¹ Department of Mathematics, Asansol Girls' College, Asansol, West Bengal 713304, India² Department of Mathematics, University of Sussex, Falmer, Brighton BN1 9QH, UK³ Systems Ecology and Ecological Modeling Laboratory, Department of Zoology, Visva-Bharati, Santiniketan 731235, India

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Simulation of Emergency Vehicle for Shortest Path in SUMO

Biru Rajak

birurajak@gmail.com
Asansol Girls' College

Dekate Shantanu Pradip
shantanudekate@gmail.com

Aakash Chandhoke
aakash.chandhoke24.mnmit@gmail.com

Dharmender Singh Kushwaha
dsk@mnmit.ac.in
MNNIT Allahabad

Abstract: In the present scenario, traffic jams are a common sight to see. Emergency vehicles like a fire truck, ambulance, and police cars get stuck in dense traffic scenarios and this is the reason for not reaching emergency vehicle at destination on time. There is a loss of life and property which could be saved if the vehicle arrives at the destination on time. We have proposed an algorithm that takes into account the different parameters on finding the route to the destination for an emergency vehicle. Dijkstra's algorithm has been extended taking into account. Using the proposed algorithm, the shortest route to the destination has been generated. Concerning roads, junctions are the nodes and lanes are the edges. The map represents a graph in a conceptual way. To simulate the scenario, a simulator Simulation of Urban Mobility (SUMO), has been used. It is an open-source traffic simulation suite that is used to simulate any scenario related to traffic which may consist of 1,000,000 vehicles.

Keywords: Simulation of Urban Mobility, SUMO, Dijkstra's Algorithm, A* algorithm

Introduction

Technology has been expanding in every field - be it medicine, transportation, or even household. Technology has been used in a transportation system that aims to provide services relating to different transportation which ease the life of the users using these services. This also leads to an increase in traffic. With the increase in traffic conditions for developing countries like India, it has become necessary to adopt the subtle ways that would help common people to reach their destination on time [1]. There are some cases where an emergency vehicle like a police vehicle or an ambulance is unable to reach the destination on time. There are some instances when a loss of life and property is observed in the incident. So, there is a need for government agencies to regulate the ever-increasing traffic in developing nations. A Smart Traffic Management System is one of the radical requirements for any developed city. It must have the potential to handle traffic congestion in a smart manner without hampering the other traffic flow, it helps in managing the ever-increasing traffic that faces a lot of problems due to congestion from different vehicles.

The scenario of finding the shortest route path for the emergency vehicle from the source to the destination using Dijkstra's algorithm [2] has been simulated in SUMO. In addition to finding the shortest route, an algorithm is proposed which includes extra parameters like congestion on the road, width of the road as well as construction on the road. By using this algorithm the emergency vehicle will get an alternate route to the destination. The congestion is evaluated statically then the path is

 **axioms**



Article

How Containment Can Effectively Suppress the Outbreak of COVID-19: A Mathematical Modeling

Bootan Rahman ^{1,†}, Sarbaz H. A. Khoshnaw ^{2,†}, Grace O. Agaba ^{3,†} and Fahad Al Basir ^{4,*†}

¹ Mathematics Unit, School of Science and Engineering, University of Kurdistan Hewlêr (UKH), Erbil 44001, Iraq; bootan.rahman@ukh.edu.krd

² Department of Mathematics, University of Raparin, Ranya 46012, Iraq; sarbaz.hamza@uor.edu.krd

³ Department of Mathematics and Computer Science, Benue State University, Makurdi P.M.B. 102119, Nigeria; omechesagala@gmail.com

⁴ Department of Mathematics, Asansol Girls' College, Asansol 713304, India

* Correspondence: fahadbasir@gmail.com

† All authors contributed equally to this work.

Abstract: In this paper, the aim is to capture the global pandemic of COVID-19 with parameters that consider the interactions among individuals by proposing a mathematical model. The introduction of a parsimonious model captures both the isolation of symptomatic infected individuals and population lockdown practices in response to containment policies. Local stability and basic reproduction numbers are analyzed. Local sensitivity indices of the parameters of the proposed model are calculated, using the non-normalization, half-normalization, and full-normalization techniques. Numerical investigations show that the dynamics of the system depend on the model parameters. The infection transmission rate (as a function of the lockdown parameter) for both reported and unreported symptomatic infected peoples is a significant parameter in spreading the infection. A nationwide public lockdown decreases the number of infected cases and stops the pandemic's peak from occurring. The results obtained from this study are beneficial worldwide for developing different COVID-19 management programs.

Keywords: SEIHR model; lockdown; epidemic peak; basic reproductive number; containment policies; sensitivity analysis



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Controlling crop pest with a farming awareness based integrated approach and optimal control

Teklebirhan Abraha¹ | Fahad Al Basir² | Legesse Lemecha Obsu¹ | Delfim F. M. Torres³

¹Department of Mathematics, Adama Science and Technology University, Adama, Ethiopia

²Department of Mathematics, Assanoil Girls' College, Assanoil, India

³R&D Unit CIDMA, Department of Mathematics, University of Aveiro, Aveiro, Portugal

Correspondence

Delfim F. M. Torres, R&D Unit CIDMA, Department of Mathematics, University of Aveiro, 3810-193 Aveiro, Portugal.
Email: delfim@ua.pt

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Abstract

We investigate a mathematical model in crop pest controlling, considering plant biomass, pest, and the effect of farming awareness. The pest population is divided into two compartments: susceptible pests and infected pests. We assume that the growth rate of self-aware people is proportional to the density of susceptible pests existing in the crop arena. Impacts of awareness are modeled through the usual mass action term and a saturated term. It is further assumed that self-aware people will adopt chemical and biological control methods, namely, integrated pest management. Bio-pesticides are costly and require a long-term process, expensive to impose. However, if chemical pesticides are introduced in the farming system along with bio-pesticides, the process will be faster as well as cost-effective. Also, farming knowledge is equally important. In this article, a mathematical model is derived for controlling crop pests through an awareness-based integrated approach. In order to reduce the negative effects of pesticides, we apply optimal control theory.

KEYWORDS

Hopf-bifurcation, mathematical modeling, numerical simulations, optimal control, stability

1 | INTRODUCTION

Problems connected with pests have become evident around the world as cultivation began. World's food supply is being wasted due to the cause of pests in agriculture. On the other hand, major side-effects of synthetic pesticides on the environment, human health, and biodiversity are generating widespread concerns. Thus, farmers' awareness of the risk of synthetic pesticides uses is one of the important factors to consider. The use of biological contents to protect crops against pests needs indigenous knowledge to implement such contents in pest management.^{1,2}

There are several good modeling studies on pest control. For example, Chowdhury et al.^{3,4} have proposed and analyzed mathematical models for biological pest control using the virus as a controlling agent. In fact, all eco-epidemic models with susceptible prey, infected prey, and predators can be used to discuss the nature of the susceptible pest, infected pest, and their predators.⁵ Zhang et al.⁶ used a delayed stage-structured epidemic model for pest management strategy. Wang and Song⁷ used mathematical models to control a pest population by infected pests. However, they did not use the influence of the predator populations on their works.

Many researchers utilize mathematical models for pest control in order to study different aspects of pest management policies with probable outcomes for improved applications, using system's analysis within the mathematical paradigm. Most of them suggest using chemical pesticides.^{8,9} However, it is recorded that chemical pesticides have resulted in pest resurgence, acute and chronic health problems, and environmental pollution.¹⁰ Thus, to resolve this type of problem,

Role of Information Communication and Technology at Kumbha Mela–2019 (Prayagraj).

Biru Rajak, Shrabani Mallick, Kumar Gaurav

Ilkogretim Online 20 (5), 2021

Adopting technology in every aspect of life is a major part of our development. Life cannot be possible without of use of technology, and in this technical world, information has a significant value. This information is then communicated through a proper channel to achieve and solved our daily life problems and make our life easier, so we can say that ICT plays a crucial role in our daily life [1]. The ICT is also not untouchable, especially when a large gathering for religious and spiritual have to handle. Administration and management for such a large gathering is a complicated task. Any single negligence in planning and management may result in an unfortunate incident. People may lose their life. The "Kumbha-2019" world largest gathering is managed and handled with the help of

Research article**Effect of DAA therapy in hepatitis C treatment — an impulsive control approach**Amar Nath Chatterjee¹, Fahad Al Basir^{2,*} and Yasuhiro Takeuchi³¹ Department of Mathematics, K.L.S. College, Nawada, Magadh University, Bodh Gaya, India² Department of Mathematics, Asansol Girls' College, Asansol-4, West Bengal-713304, India³ Department of Physics and Mathematics, Aoyama Gakuin University, Kanagawa 252-5258, Japan* **Correspondence:** Email: fahadbasir@gmail.com (F. Al Basir).

Abstract: In this article, we have presented a mathematical model to study the dynamics of hepatitis C virus (HCV) disease considering three populations namely the uninfected liver cells, infected liver cells, and HCV with the aim to control the disease. The model possesses two equilibria namely the disease-free steady state and the endemically infected state. There exists a threshold condition (basic reproduction number) that determines the stability of the disease-free equilibrium and the number of the endemic states. We have further introduced impulsive periodic therapy using DAA into the system and studied the efficacy of the DAA therapy for hepatitis C infected patients in terms of a threshold condition. Finally, impulse periodic dosing with varied rate and time interval is adopted for cost effective disease control for finding the proper dose and dosing interval for the control of HCV disease.

Keywords: hepatitis C; DAA therapy; mathematical model; basic reproduction number; impulsive control; drug adherence

1. Introduction

Hepatitis C is an infectious disease caused by the Hepatitis C virus. According to the World Health Organisation (WHO), an estimated 71 million people globally has been suffering from chronic Hepatitis C syndromes, resulting in cirrhosis and liver cancer. The fatality rate is approximately 39,900 every year [1]. It is highly blood contagious and at very low risk of sexual and vertical transmission [2]. Unhygienic clinical conditions and improper sterilization are the main reasons behind the Hepatitis C infection [3].

Hepatitis C syndromes are multiple and demographically manipulated. The virus generally spreads and affects between 2 weeks to 6 months in the human body. Fever, fatigue, nausea, vomiting, ab-

Review Paper:**A review on green synthesis of coinage metal sulphide nanoparticles and their applications**

Gorai Soma

Department of Chemistry, Asansol Girls' College, Asansol 713304, West Bengal, INDIA

gorai_soma@rediffmail.com

Abstract

Being a sustainable, eco-friendly and cost effective technique, the green methodology for the synthesis of various nanomaterials including metal sulphide nanoparticles has drawn great attention in recent years. In the conventional chemical and physical methods, high rate of hazardous chemicals and extreme reaction conditions are used. To overcome these problems nowadays, green synthesis pathway has been adopted. Among other metal sulphide nanoparticles, coinage metal sulphides such as silver sulphide and copper sulphide nanoparticles are very much important due to their remarkable optical, electrical, catalytic and biological properties.

This review briefly summarizes the recently reported biogenic synthesis of silver and copper sulphide nanoparticles using various bio-based sources and also focuses on some of the important properties of the said green synthesized nanoparticles like optical properties, photocatalytic abilities and different

Silver and copper sulfide NPs have been synthesized by a variety of techniques^{4,8,10,14,17-19,28,29,32,45,47}, however, the “green” route for synthesis of nanomaterials using bio-based materials has been of great interest mainly due to several advantages such as: (i) it is eco-friendly technique (ii) biomaterials are easily available in nature, so it is a cost-effective process, (iii) organic moiety present in the biomaterials serves as reducing as well as capping agent in the reaction^{5,37,56}.

The present study briefly summarizes the biosynthesis of silver and copper sulphide nanoparticles (NPs) using various bio-based sources and also highlighted various properties of these green synthesized NPs like optical properties, photocatalytic abilities and different biomedical activities.

Biosynthesis of Ag₂S NPs: Due to the increasing popularity of bio-based green methods, different works have been done to prepare Ag₂S NPs and copper sulphide NPs (Cu₂S, CuS) using different sources like plant parts, protein and amino acid molecules, bacteria, fungus, and others. These are summarized in table 1.

Original articles

Effects of incubation and gestation periods in a prey–predator model with infection in prey

 Fahad Al Basir^{a,*}, Pankaj Kumar Tiwari^b, Sudip Samanta^c
^a Department of Mathematics, Asansol Girls' College, Asansol 713304, India

^b Department of Basic Science and Humanities, Indian Institute of Information Technology, Bhagalpur 813210, India

^c Department of Mathematics, Bankura University, Bankura 722155, India

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Abstract

In this paper, we study a wide spectrum of dynamical features of a prey–predator model with infection in prey population only. In the model formulation, we consider nonlinear incidence for infection transmission and Holling type II as response function of predator. We analyze the model for local stability and Hopf bifurcation, and the theoretical results are validated and extrapolated by numerical simulations. Also, we perform sensitivity analysis to explore the significance of the crucial parameters influencing the densities of prey and predator populations. Our numerical results show that disease persists in the system even if the basic reproduction number is below unity. The rates of predation on susceptible and infected prey populations are shown to dramatically change the behavior of eco-epidemiological system. We extend our model by considering the fact that the newly infected prey becomes productively infectious after the effective contact between susceptible and infectious preys, and some time lag is involved in this biological process; also the conversion process conceals some time. We analyze our eco-epidemiological model with two time delays (incubation delay and predator's gestation delay) for stability and bifurcation. From numerical simulations, we observe that both the delay parameters substantially affect the stable configuration of the system.

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Keywords: Eco-epidemic model; Basic reproduction number (R_0); Time delay; Sensitivity; Stability; Bifurcation

1. Introduction

In recent times, theoretical biologists are paying more interest to study eco-epidemiological models which integrate an epidemic model with a predator–prey model [3]. This is due to the fact that parasites have the ability to alter the quantitative dynamics of their host population and can even send host population to extinction in the worst case. Predators, on the other hand, can greatly influence the population dynamics of hosts and parasites by consuming host population [17].

Parasites could be an important factor in regulating not only their host populations, but also for the community structure of their host populations [26]. Parasites can greatly alter the quantitative dynamics of the community

* Corresponding author.
 E-mail address: fahadbasir@gmail.com (F.A. Basir).

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Jørgensen research and review

Is the primary helper always a key group for the dynamics of cooperative birds? A mathematical study on cooperative breeding birds

 Sinchan Ghosh^{a,1}, Fahad Al Basir^b, Ganesh Chowdhury^c, Sabyasachi Bhattacharya^a, Santanu Ray^{d,*}
^a Agricultural and Ecological Research Unit, Indian Statistical Institute, Kolkata, India

^b Department of Mathematics, Asansol Girls' College, Asansol, India

^c Koochari, Kame, Bhubanes, India

^d Systems Ecology and Ecological Modelling Laboratory, Department of Zoology, Visva-Bharati, Santiniketan, India

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ABSTRACT

Cooperation is a fundamental requirement for the population dynamics of group-living organisms. Despite the substantial research work in cooperative breeding birds, the dependence of the population dynamics is unidentified on young or adult helpers in migratory populations. The existing mathematical models mostly ignore the migratory property for predicting the birds' cooperative dynamics. The cooperative breeding birds have three groups in their population, viz. immature or primary helpers, mature or secondary helpers, and breeders. We ask three questions to study migratory cooperative birds' population structure and dynamics through mathematical modeling under changing environments. Which group is the key to the population dynamics of cooperative migratory birds? Does the mature helper compensate young helpers' helping? Does the hierarchical structure of the population vary for variable migratory rates? We explore the answers based on the mathematical model's simulation experiment, a potential alternative to the game theory approach. This study estimates the parameters associated with the proposed model through the field survey and obtains the rest from existing literature. Although the study uses blue-tailed bee-eater as the test-bed species, the model is helpful for analyzing other avian species' behavioral property. The model as a tool can determine whether the primary helpers of blue-tailed bee-eater are the key to population dynamics. The model can also classify the adults' help as an addition or compensate to primary helpers' help. The model can predict any alteration in the cooperative breeding birds' hierarchy sizes for variable migration rates under changing climate.

1. Introduction

Cooperation between individuals is the yardstick for the population dynamics of group-living animals ranging from insects to birds in the evolutionary timeline (Holman, 2014; Brahma et al., 2018; Wong and Balshine, 2011; Cant, 2012; Grisevicius et al., 2017; Thorley, 2020). The substantial research work on birds' cooperation focuses majority on cooperative breeding, where non-breeding subordinate helps breeding pairs (Stacey and Koenig, 1990; Emlen, 1995; Kokko and Johnstone, 2001). Ornithologists and behavioral ecologists are interested in finding an association between the bird population dynamics and the helping rate of the subordinate cooperators (Reyer, 1980, 1984, 1989).

Identifying the most necessary social-group between breeders and different helpers is another exciting research arena to be explored for behavioral ecologists. Surprisingly, the existing mathematical framework poorly demonstrates the cooperative behavior associated with migration, breeding, and population dynamics.

Mathematical models on cooperative breeding determine the behavior's stability and frequency as the opposing force to the Darwinian selection from an evolutionary perspective (Reyer, 1989; Stacey and Koenig, 1990; Jennions and Macdonald, 1994). The cooperative breeding behavior is an essential driver of a group-living organism to eusociality over the evolutionary period (Cressi and Yaneva, 1995; Holman,

* Corresponding author.
 E-mail addresses: sinchanghosh110@gmail.com (S. Ghosh), fahadbasir@gmail.com (F.A. Basir), sabyabhattacha@gmail.com (S. Bhattacharya), santanu.ray@visva-bharati.ac.in (S. Ray).

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২০২১সালে প্রকাশিত ১৬পৃ.তালিকার (৩১৯টির মধ্যে) ৩ পৃ.৬০নং উল্লেখিত।

এবং মহুয়া

(বাংলা ভাষা, সাহিত্য ও গবেষণার্থী মাসিক পত্রিকা)

২৩তম বর্ষ, ১৪৩ সংখ্যা

ডিসেম্বর, ২০২১

সম্পাদক

ড. মদনমোহন বেরা

সহসম্পাদক

পায়েল দাস বেরা

মৌমিতা দত্ত বেরা

শব্দ দূষণরোধী ভাবনায় বিচারপতি
ভগবতী প্রসাদ বন্দ্যোপাধ্যায়
ড. মাল্যবান চট্টোপাধ্যায়

সারসংক্ষেপ :

ভারতের ইতিহাসের প্রেক্ষিতে শব্দ দূষণ এর বিরুদ্ধে আন্দোলনের ইতিহাস পূর্বে বেশি প্রাচীন নয়। এক্ষেত্রে বিজ্ঞানের উন্নতির সাথে পাশাপাশি দিয়ে উন্নত হচ্ছে প্রযুক্তি, যা সাথেই জুড়ে আছে শব্দের দূষণ হয়ে ওঠার বিঘ্নটিও। তবে ভারতের ইতিহাসের প্রেক্ষিতে এই শব্দ-কে সরাসরি দূষক হিসেবে দেখার শুরু পশ্চিমবঙ্গ রাজ্যের থেকেই, আর এর সাথেই জুড়ে আছে কলকাতা হাইকোর্টের বিচারপতি ভগবতী প্রসাদ বন্দ্যোপাধ্যায় এর যুগান্তকারী রায় টি, যাকে ভিত্তি করেই ভারতের মধ্যে পশ্চিমবঙ্গ রাজ্যের দূষণ নিয়ন্ত্রণ পর্দা তৈরি করে শব্দ বিধি- যা সারা দেশের মধ্যে ছিল প্রথম কোন শব্দ বিধি বা কেন্দ্রীয় কোন আইনের আগেই তৈরি হয়েছিল একটি আদালতের রায়ের প্রেক্ষিতে। কেমন ছিল এই রায়ের আগেকার শব্দ দূষণের সামাজিক প্রেক্ষিত আর কতটাই বা বদলেছিল তা আদালতের রায়ের পরে? মূল নিবন্ধে এই বিষয়টি আলোচনার সাথে সাথে খোঁজার স্টো করা হবে বিচারপতি ভগবতী প্রসাদ বন্দ্যোপাধ্যায়-এর মনভাবকেও। তিনি কি শুধুই আইনি পদক্ষেপকেই গুরুত্ব দিতেন? নাকি গুরুত্ব দিতে চেয়েছিলেন জন সচেতনতা বাড়াবার উপর। তাঁর মৃত্যুর পরে এই ভাবনা কিভাবে বিবর্তনের ধারায় এগিয়েছে তা তুলে ধরার প্রয়াস নেওয়া হবে মূল নিবন্ধে।

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Bipartite entanglement in Auger ionisation of N₂

S SEN¹ and M CHAKRABORTY^{2,*}

¹Department of Physics, Triveni Devi Bhalotia College, Raniganj 713 347, India

²Department of Physics, Asansol Girls' College, Asansol 713 304, India

*Corresponding author. E-mail: bminakshi@yahoo.com

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Abstract. Quantum entanglement and its paradoxical properties are of paramount importance in quantum information theory. In recent years, there has been an increasing interest in the studies of high-dimensional quantum states and their impact on quantum communication as it can encode and process more data. Photonic entanglement is usually an evanescent property as it is destroyed easily by its interaction with an external environment. Electronic qubits are stable and can store information for a long time. However, qudit systems are more efficient, stable and allow noise robustness than qubit system. In this article, we investigate bipartite entanglement between doubly ionised molecular qudit and electronic qubit in the Auger emission process for N₂ molecule following the absorption of a single photon without observing spin-orbit interaction (SOI). In the absence of SOI, Russell-Saunders coupling (L-S coupling) is applicable. The entanglement properties are estimated on the basis of negativity of partial transpose of the density matrix for Auger ionisation. We find that the entanglement depends on the spins of the singly ionised excited states and doubly ionised states of the molecules as well as on the directions of spin quantisation and of ejection of Auger electrons. A significant effect on the variation of negativity due to the linear dichroism (LD) has also been observed.

Keywords. Quantum entanglement; qudit; qubit; Auger ionisation; negativity; density matrix; linear dichroism.

PACS Nos 03.67.Bg; 33.90.+h

1. Introduction

Quantum entanglement [1] is the key resource of quantum information technology (QIT) [2–4]. The production and characterisation of entangled states [5] of two or more particles are drawing great interest recently. In QIT qubit is the basic unit of quantum computing [6,7]. Qubits, using properties of quantum entanglement and superposition, have enormous computing power [8–10]. There is currently a great interest in using high-dimensional (dimension $d > 2$) quantum states known as qudit for various communication and computational tasks [11,12]. High-dimensional quantum states provide

Theories have been developed for studying entanglement of electronic qubit and ionic qudit produced by single [19] and double photoionisation [20,21] of atoms. Bipartite as well as tripartite entanglement have been studied in qubit system for atoms in Auger decay process [22,23]. Here we present a theoretical analysis of high-dimensional quantum entanglement between electronic qubit and doubly ionised molecular qudit in the Auger emission process for N₂ molecule. For quantifying the degree of entanglement we use negativity [24,25] of partial transpose of the density matrix (DM) for Auger decay. Negativity is an additive and operational measure of entanglement and it can also be generalised to



A review on biogenic synthesis of ZnS nanoparticles and potential applications

Soma Gorai

Department of Chemistry, Asansol Girls' College, Asansol-713 304, West Bengal, India

E-mail: gorai_soma@rediffmail.com

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Applications of green chemistry perspective for nanoparticles (NPs) synthesis have gained much attention in recent years mainly to reduce the use of hazardous chemicals and also to eliminate the production of toxic materials. Green bio-based synthesis is an organic molecule mediated technique where nanoparticles are prepared by using naturally occurring reagents such as plant extracts, vitamins, biodegradable polymers, sugars, and microorganisms, etc. The nature of these biological entities influences the structure, size and morphology of synthesized NPs. During the past few decades, researchers have been paying more attention to the synthesis (both physically and chemically) of nontoxic semiconducting zinc sulfide nanoparticles for their diverse applications in different fields. This short review highlighted the alternative eco-friendly and cost-effective bio-based green techniques for the synthesis of ZnS NPs by using various biogenic sources and also focuses on some of the important properties of bio-synthesized ZnS NPs like photocatalytic activity, antimicrobial activity, cytotoxicity and seed germination ability.

Keywords: Green synthesis, zinc sulphide nanoparticles, applications.

Introduction

During the past few decades, nanoscale chalcogenide semiconductors have drawn much attention mainly for their interesting properties. The tiny dimension and high surface area to volume ratio of nanoparticles make their physico-chemical properties unique from those of the bulk materials. For this reason, a wide range of physical and chemical techniques have been developed for the past few years to produce nanoscale materials of different sizes, shapes, and compositions. Now-a-days, to reduce the rate of hazardous chemicals employed in these conventional techniques during the synthesis of these NPs, green bio-based methods using plant parts, fungus, bacteria, and algae or other bio-based molecules (protein, vitamin, molecules etc.) have been adopted¹⁻³. The organic compounds present in these naturally occurring sources act as reducing agents and also as capping agents^{4,5}.

Among the chalcogenide semiconductor NPs, zinc sulphide (ZnS), a large band gap (3.6 eV) semiconductor has been studied more intensively because of its unique properties and potential applications in the biomedical⁶ and opto-

electronic field, such as to prepare biosensors, biocomposites⁷, light-emitting diode (LED), screens, sensors, lasers⁸, or nanocomposites⁹ etc. Due to the non toxic nature of ZnS NPs, it is now utilized for the treatment of waste water where it acts as photocatalyst and degrades several pollutants like organic dyes, para-nitrophenol and halogenated derivatives¹⁰⁻¹². For these reasons, various physical and chemical methods have already been reported in the literature^{6,13-16} to fabricate various types of ZnS nanostructures. But in recent years, the eco-friendly and cost-effective green synthesis pathway for synthesizing ZnS NPs has drawn much attention. This review briefly summarizes the recently reported biogenic synthesis of ZnS nanoparticles using various bio-based sources and also focuses on the properties of these green synthesized ZnS NPs like photocatalytic activity, antimicrobial activity, cytotoxicity and seed germination ability.

Green synthesis of ZnS nanoparticles

Various types of plants/plant parts and bio-templated media which are used to synthesize ZnS NPs are discussed below:

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PHARMACEUTICAL IMPORTANCE OF MANGIFERA INDICA: A REVIEW

Pallavi Majumder¹, Surajit Das¹, Parimal Das², Kazi Monjur Ali³

¹Dept of Nutrition, Asansol Girls' College, Paschim Bardhaman, West Bengal, India

²Department of Zoology, Kabi Nazul College, Birbhum, West Bengal, India

³Department of Nutrition, M.U.C. Women's College, Parba Bardhaman, India

*Corresponding author: kazimonjur1984@gmail.com

ABSTRACT

Mangifera indica is a tree found in nature from ancient time and full of benefits to health and disease preventive strategies. It bears the botanical name as - *Mangifera indica* L. It has a lot of medicinal and nutritional importance as well as used in auspicious rituals. Having multiple health benefits *M. indica* has been proven a natural alternative medicine to many of life threatening disorders. Various research studies on *M. indica* have been reported remedial effect against different ailments including diabetes mellitus, certain bacterial diseases and oxidative stress induced disorders. In this context, the main aim of this review is to present various pharmacological activities of *M. indica*. From literature survey finally it is concluded that *M. indica* in its various forms are beneficial in multiple health aspects without having any adverse side effects. So it can be an effective way to minimize the complications of certain disorders as well as promotion of health.

Keywords: *Mangifera indica*, Health promotion, Disease prevention, Alternate medicine

1. INTRODUCTION

In last few decades' lots of lifestyle related disorders are capturing and engulfing a lot of fresh lives. Day by day its prevalence is increasing rapidly and peak of such incidence are also expanding. For such situation a lots of synthetic medicines are there for treatment purpose but apart from good effects a lots of side effects associated with the use of such medicines [1]. Hence, the need of natural alternative solutions and incorporation of such natural products in the synthesis of drugs and supplementation in health management is not in contradiction to environmental health. Out of so many herbs and plants, *Mangifera indica* is of very useful in various terms.

Mangifera indica (Mango Tree) is the plant since ancestral time prevailing in across various countries. Since ages, mango tree has been described as Kalpavriksha (wish granting tree) in India. It is known as the king of fruits and is the choicest fruit in India and abroad. Its long period of domestication in India is well evidenced from its mention in ancient scriptures. In Indian perspective its fruit, flower and leaves are used in various auspicious and religious rituals [2].

Literature indicated that different parts of *M. indica* like leaves, bark, stem, fruit, and seeds are having many natural beneficial effects on human health. Scientists

reported the different pharmacological properties of *M. indica* including antioxidant, anti diabetic, antimicrobial, antitumor, anticancer, anti inflammatory etc [3, 4]. In this review, we try to present the different pharmaceutical activities of this medicinally important plant.

2. GENERAL DESCRIPTION OF THE PLANT

There are over 1000 varieties but mostly *M. indica* species are generally known as Mango, others species are called wild Mangoes. The native range of the plant is the genus *Mangifera* originates in tropical Asia, with the greatest number of species found in Borneo, Java, Sumatra, and the Malay Peninsula. The most-cultivated *Mangifera* species, *M. indica* (mango), has its origins in India and Myanmar. Mango trees prefer a warm, frost-free climate with a well defined winter dry season. Rain and high humidity during flowering and fruit development reduces fruit yields. The tree generally flowers in mid to late winter, with fruit maturing in the early to mid-summer months. Mango trees are usually between 3 and 10 metre (10-33 ft) tall but can reach up to 30 metre (100 ft) in some forest situations.

Various names are there for this plant according to different region or country languages. Pacific islands names include mango, am (Fiji), mangko (Kiribati), mango

Characterization of Different Cell Types in the Pituitary Gland of Indian Fresh Water Spiny Eel *Mastacembelus armatus* (Lacepede)

Supriya Ray*

Department of Zoology, Asansol Girls' College, West Bengal, India

ABSTRACT

Mastacembelus armatus is an indigenous fish species of southern Asia that also resides in the Indian subcontinent. This fish species is facing an alarming decline in their number in the last decade. Due to its moderate cost, it is mainly taken by the lower income group of people within the society. The reproductive care, by artificial breeding, has been taken for those fish species having a high cost in the market or becoming less in number in nature for business purposes or preserving the biodiversity, respectively. The present study was undertaken to characterize different cell types in the pituitary gland because these are ultimately responsible for the maintenance of pituitary-gonadal endocrine cascade. This work has been done purely on histological techniques. In the present investigation the adenohypophysis is divisible into three component parts viz. antero – dorsal rostral pars distalis (RPD), the middle proximal pars distalis (PPD) and the posterior massive pars intermedia (PI). The acidophilic prolactin cells and ACTH cells are found in the RPD, basophilic GTH cells, TSH cells and acidophilic STH cells are found in PPD whereas MSH and MSH cells are found in PI regions. The neurohypophysis in *M. armatus* is composed of axonal fibers originating from neuronal cell bodies in the hypothalamus. Understanding the pituitary architecture and cell types for this fish species is of immense importance to save this indigenous variety by artificial breeding, which we are trying to discuss in the detail within this paper of ours.

KEY WORDS: ACIDOPHILIC, ADENOHYPHYPHYSIS, MASTACEMBELUS ARMATUS, NEUROHYPHYPHYSIS.

INTRODUCTION

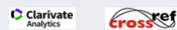
The function of pituitary is mostly controlled by the hypothalamus through the synthesis and release of gonadotropin-releasing hormone (GnRH), therefore, acting as a major initiator of the hormonal cascade controlling the reproductive axis. Gonadal activities

in teleost fishes primarily depend on the function of pituitary gonadotrophs and that the pituitary and the gonads exist in a mutual state of excitation and inhibition (Farbridge et al.1985; Kaneko et al., 1986). The hypothalamo-hypophysal complex in vertebrates with their neurosecretory nuclei and long axons, is a coordination point in the vertebrate brain and is known to involve in a complex interaction of a variety of neurotransmitters which modulate the influence of several trophic hormones by controlling their active secretion by releasing or inhibiting hormones within the hypophysis itself (Peter et al., 1991).

Pituitary gonadotrophic hormones and GnRH are important in implicating these hormones in gonadal

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GLOBAL DYNAMICS OF HIV INFECTION WITH TWO DISEASE TRANSMISSION ROUTES - A MATHEMATICAL MODEL

XIANBING CAO¹, AMIT KUMAR ROY², FAHAD AL BASIR³, PRITI KUMAR ROY^{2,*}

¹College of Science, Beijing Technology and Business University, China

²Centre for Mathematical Biology and Ecology, Department of Mathematics, Jadavpur University, Kolkata-700032, India

³Department of Mathematics, Asansol Girls' College, Asansol-4, West Bengal-713304, India

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Abstract. In this paper, we have studied the global dynamics of HIV model with two transmission paths: direct transmission through cells-to-cells contact and indirect transmission through virus. We have derived a four dimensional mathematical model including uninfected CD_4^+T cells, infected CD_4^+T cells, virus and the CTL immune response cells. The nonnegativity and boundedness property of the solutions the proposed mathematical system have been analysed, and the basic reproduction ratio R_0 has been derived with the help of next generation matrix method. We also discussed the local and global stability with respect to the basic reproduction ratio of both disease-free and interior equilibrium points under certain conditions. Through numerical simulations, we have validated the all analytical findings. We have established that the disease-free equilibrium is globally stable for $R_0 < 1$ and endemic equilibrium is globally stable for $R_0 > 1$ whenever exists. It is also observed that cells-to-cells transmission rate is more effective compare to virus-to-cells infection rate.

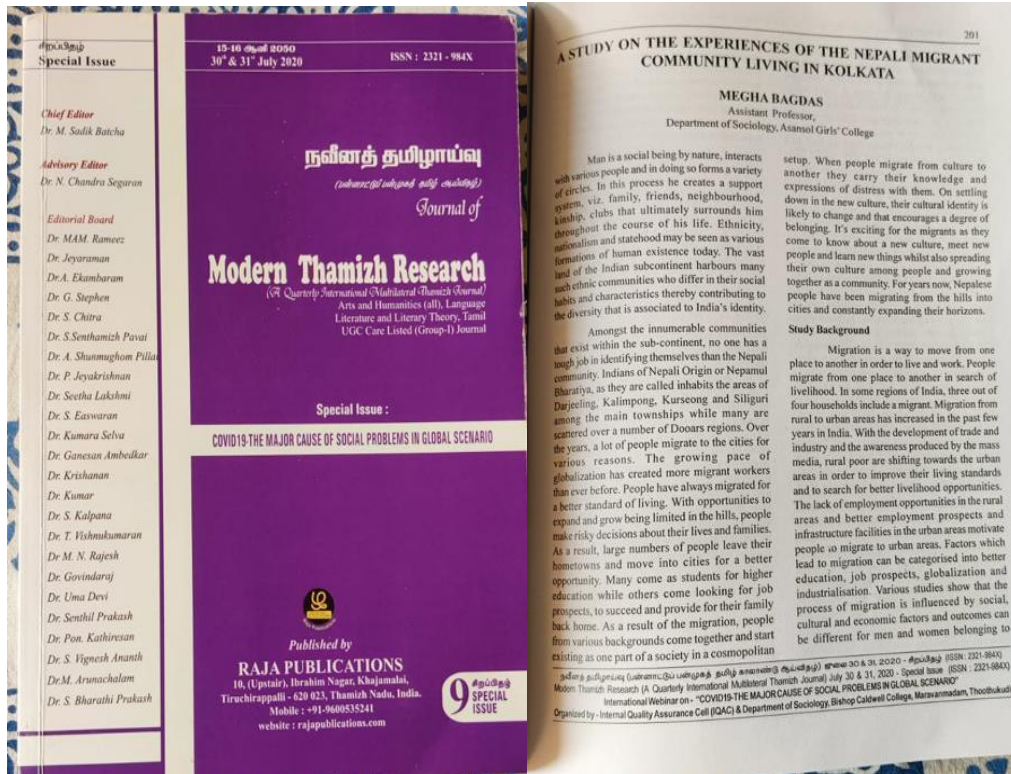
Keywords: HIV dynamics; mathematical model; basic reproduction ratio; Lyapunov function; global stability; numerical simulation.

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*Corresponding author

E-mail address: pritiju@gmail.com

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Fahad Al Basir*, Arnab Banerjee and Santanu Ray

Exploring the effects of awareness and time delay in controlling malaria disease propagation

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Abstract: In this article, a mathematical model has been derived for studying the dynamics of malaria disease and the influence of awareness-based interventions, for control of the same, that depend on 'level of awareness'. We have assumed the disease transmission rates from vector to human and from human to vector, as decreasing functions of 'level of awareness'. The effect of insecticides for controlling the mosquito population is influenced by the level of awareness, modelled using a saturated term. Organizing any awareness campaign takes time. Therefore a time delay has been incorporated in the model. Some basic mathematical properties such as nonnegativity and boundedness of solutions, feasibility and stability of equilibria have been analysed. The basic reproduction number is derived which depends on media coverage. We found two equilibria of the model namely the disease-free and endemic equilibrium. Disease-free equilibrium is stable if basic reproduction number (R_0) is less than unity ($R_0 < 1$). Stability switches occur through Hopf bifurcation when time delay crosses a critical value. Numerical simulations confirm the main results. It has been established that awareness campaign in the form of using different control measures can lead to eradication of malaria.

Keywords: basic reproduction number (R_0); disease awareness; Hopf bifurcation; media campaign; numerical stability analysis; time delay.

Research Article

A Model for SARS-CoV-2 Infection with Treatment

Amar Nath Chatterjee¹ and Fahad Al Basir²

¹Department of Mathematics, K.L.S. College, Nawada, Magadh University, Bodh Gaya, Bihar 805110, India

²Department of Mathematics, Asansol Girls' College, Asansol-4, West Bengal 713304, India

Correspondence should be addressed to Fahad Al Basir; fahadalbasir@yahoo.com

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The current emergence of coronavirus (SARS-CoV-2) puts the world in threat. The structural research on the receptor recognition by SARS-CoV-2 has identified the key interactions between SARS-CoV-2 spike protein and its host (epithelial cell) receptor, also known as angiotensin-converting enzyme 2 (ACE2). It controls both the cross-species and human-to-human transmissions of SARS-CoV-2. In view of this, we propose and analyze a mathematical model for investigating the effect of CTL responses over the viral mutation to control the viral infection when a postinfection immunostimulant drug (pilotimod) is administered at regular intervals. Dynamics of the system with and without impulses have been analyzed using the basic reproduction number. This study shows that the proper dosing interval and drug dose both are important to eradicate the viral infection.

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ORIGINAL ARTICLE



Modelling the Effect of Incubation and Latent Periods on the Dynamics of Vector-Borne Plant Viral Diseases

Fahad Al Basir¹ · Sagar Adhurya² · Malay Banerjee³ · Ezio Venturino⁴ · Santanu Ray²

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Abstract

Most of the plant viral diseases spread through vectors. In case of the persistently transmitted disease, there is a latent time of infection inside the vector after acquisition of the virus from the infected plant. Again, the plant after getting infectious agent shows an incubation time after the interaction with an infected vector before it becomes diseased. The goal of this work is to study the effect of both incubation delay and latent time on the dynamics of plant disease, and accordingly a delayed model has been proposed. The existence of the equilibria, basic reproductive number (\mathcal{R}_0) and stability of equilibria have been studied. This study shows the relevance of the presence of two time delays, which may lead to system stabilization.

Keywords Time delay model · Basic reproduction number · Stability · Bifurcation

Ezio Venturino: Member of the INdAM research group GNCS.

✉ Santanu Ray
sray@visva-bharati.ac.in

A multi-delay model for pest control with awareness induced interventions - Hopf bifurcation and optimal control analysis

Fahad Al Basir

*Department of Mathematics, Asansol Girls' College
Asansol-713304, West Bengal, India
fahadalbasir@yahoo.com*

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Farming awareness is an important measure for pest controlling in agricultural practice. Time delay in controlling pest may affect the system. Time delay occurs in organizing awareness campaigns, also time delay may take place in becoming aware of the control strategies or implementing suitable controlling methods informed through social media. Thus we have derived a mathematical model incorporating two time delays into the system and Holling type-II functional response. The existence and the stability criteria of the equilibria are obtained in terms of the basic reproduction number and time delays. Stability changes occur through Hopf-bifurcation when time delays cross the critical values. Optimal control theory has been applied for cost-effectiveness of the delayed system. Numerical simulations are carried out to justify the analytical results. This study shows that optimal farming awareness through radio, TV etc. can control the delay induced bifurcation in a cost-effective way.

Keywords: Mathematical model; Holling type-II functional response; delay differential equation (DDE); basic reproduction number; Hopf bifurcation; optimal control.

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A MODEL OF THE OPTIMAL IMMUNOTHERAPY OF PSORIASIS BY INTRODUCING IL-10 AND IL-22 INHIBITORS

PRITI KUMAR ROY* and AMIT KUMAR ROY†

*Centre for Mathematical Biology and Ecology
Department of Mathematics, Jadavpur University
Kolkata 700032, India
*pritiya@gmail.com
†amit_jamath@gmail.com*

EVGENII N. KHAILOV

*Faculty of Computational Mathematics and Cybernetics
Lomonosov Moscow State University
Moscow 119992, Russia
khailov@cs.msu.ru*

FAHAD AL BASIR

*Department of Mathematics, Asansol Girls College
Asansol-4, West Bengal 713304, India*

ELLINA V. GRIGORIEVA‡

*Department of Mathematics and Computer Sciences
Texas Woman's University, Denton, TX 76204, USA
egrigorieva@twu.edu*

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Psoriasis is a chronic skin disease in which the process of hyper-proliferation (excessive division) of skin cells starts. Externally, psoriasis appears as red papules, on the surface of which there are scales of white-gray color. There is substantial evidence that T-helper cells take vital accountability for creating the hyper-proliferation of keratinocytes (skin cells), which cause itching of skin patches. In this paper, we propose a mathematical model describing the concentrations of T-helper and keratinocyte cell populations to predict cellular behaviors for psoriasis regulation under normal or anomalous immune circumstances. Local and global asymptotic stabilities of the model equilibria are investigated. Additionally, by introducing two scalar bounded controls into the model, the effect of combined immunotherapy using IL-10 and IL-22 inhibitors is analyzed. The optimal control problem of minimizing the cost of immune therapy and simultaneous optimizing the effect of this therapy on T-helper cells and keratinocytes proliferation is formulated and solved by applying the Pontryagin maximum principle. Within the

†Corresponding author.



Impact of farming awareness based roguing, insecticide spraying and optimal control on the dynamics of mosaic disease

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Abstract

Control interventions and farming knowledge are equally important for plant disease control. In this article, a mathematical model has been derived using saturated response functions (nonlinear infection rate) for studying the dynamics of mosaic disease with farming awareness based roguing (removal of infected plants) and insecticide spraying. It is assumed that the use of roguing and spraying depend on the level of awareness about the disease. The model possesses three equilibria namely the trivial, which is always unstable, the disease-free equilibrium which is stable if the basic reproduction number is below unity and the coexisting which may be stable or can exhibit Hopf-bifurcation under certain condition. Finally, we have opted an optimal control problem introducing three control parameters for determining the optimal level of roguing, spraying and cost regarding media awareness for cost-effective control of mosaic disease. Numerical simulations establish the main results suggesting that the awareness campaigns through radio, TV advertisement are important for eradication of the disease. Also, awareness campaign, roguing and spraying should be incorporated with optimal level for cost effective control of mosaic disease.

Keywords Mathematical model · Saturated response functions · Basic reproduction

Control of mosaic disease using microbial biostimulants: insights from mathematical modelling

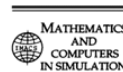
Konstantin B. Blyuss, et al. [full author details at the end of the article]

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Abstract

A major challenge to successful crop production comes from viral diseases of plants that cause significant crop losses, threatening global food security and the livelihoods of countries that rely on those crops for their staple foods or source of income. One example of such diseases is a *mosaic disease* of plants, which is caused by begomoviruses and is spread to plants by whitefly. In order to mitigate negative impact of mosaic disease, several different strategies have been employed over the years, including roguing/replanting of plants, as well as using pesticides, which have recently been shown to be potentially dangerous to the environment and humans. In this paper we derive and analyse a mathematical model for control of mosaic disease using natural microbial biostimulants that, besides improving plant growth, protect plants against infection through a mechanism of RNA interference. By analysing the stability of the system's steady states, we will show how properties of biostimulants affect disease dynamics, and in particular, how they determine whether the mosaic disease is eradicated or is rather maintained at some steady level. We will also present the results of numerical simulations that illustrate the behaviour of the model in different dynamical regimes, and discuss biological implications of theoretical results for the practical purpose of control of mosaic disease.

Keywords Mosaic disease · RNAi · Stability and bifurcations · Numerical simulations**Mathematics Subject Classification** 92C80 · 92D40 · 34C60



Original articles

Impact of incubation delay in plant–vector interaction

Santanu Ray^a, Fahad Al Basir^{a,b,*}^a Systems Ecology & Ecological Modeling Laboratory, Department of Zoology, Visva-Bharati, Santiniketan-731235, India^b Department of Mathematics, Asansol Girls' College, Asansol-713304, West Bengal, India

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Abstract

Knowledge of the incubation period of infectious diseases is crucial to our understanding of epidemiological phenomena and for the design of appropriate prevention and control policies. In this article, a mathematical model has been formulated for the transmission dynamics of vector-borne plant disease considering incubation period as the time delay factor. Existence of the equilibria and their stability has been studied on the basis of basic reproduction number. The region of stability of the steady states is presented in different parameter subspaces. Stability changes occur through Hopf bifurcation in both the delayed and nondelayed system. Analytical and numerical findings suggest that the role of incubation delay is stabilising the coexistence equilibrium and epidemics can be successful if host plant has shorter incubation period.

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Keywords: Vector-borne plant disease; Delay differential equation; Mathematical model; Basic reproduction number; Forward bifurcation; Hopf bifurcation

1. Introduction

Plants are very important as they are the survival foundation for all kinds of creatures. But they are affected by many pest and diseases. Among the plant diseases, vector borne plant diseases such as mosaic disease, *Citrus Huanglongbing*, *R. solani* etc. affect the host plants devastatingly. Transmission of the diseases depends on



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Institute of Science,
Banaras Hindu University, Varanasi, India.

Morphology Controlled Synthesis of Copper Sulphide Microparticles by using Various Copper Precursors

Soma Gorai¹Dept. of Chemistry, Asansol Girls' College, Asansol, India.
gorai_soma@rediffmail.com

Abstract: The present study revealed the effect of different copper salts on the morphological patterns of copper sulphide crystals. Different copper precursors such as copper chloride, copper nitrate, copper sulphate and copper acetate have been used for this purpose. Various morphologies of copper sulphide microparticles like different types of dendritic flowers, hexagonal, triangular, and spherical particles have been synthesized successfully. The product molecules were identified by using XRD and the morphological patterns of the crystals were observed by SEM.

Index Terms: Copper sulphide, Crystal morphology, Precursor effect, Solvothermal synthesis, X-ray diffraction pattern

1. INTRODUCTION

Research work on particle size and shape tailored synthesis of semiconducting metal chalcogenides has drawn much attention for the past few years due to their interesting properties and important applications in various fields. Among other chalcogenides, copper sulphide, a good prospective optoelectronic material, has been widely used for various applications like electro conductive coatings (Yamanoto et al., 1992), solar cell (Neville, 1995), electrodes (Minghui et al., 2010), catalysis (Li et al., 2011), low temperature gas sensor applications (Sagade & Sharma, 2008), selective radiation filters, photodetectors (Nair & Nair, 1991), nanoscale switches (Sakamoto et al., 2003), superionic materials (Balapanov et al., 1986), efficient photo catalyst (Peng et al., 2009), biosensors (Lee et al., 2007) etc. As the tuning of properties of copper sulphide can be done by varying the shape, size and stoichiometric composition of the molecule (Lee et al., 2007; Zhao et al., 2009), an array of techniques (Gorai et al., 2004 & 2005; Liu et al., 2005; Du et al., 2006; Lee et al., 2007; Peng

et al., 2009; Zhao et al., 2009; Mousavi-Kamazani et al., 2012; Li et al., 2016; Wei et al., 2016; Rahmani et al., 2017) have been utilized to synthesize copper sulphides having controllable nano/microstructures. In our previous paper (Gorai et al., 2005a) we reported the formation of dendritic flower like structure of copper sulphide crystals by employing $\text{Cu}(\text{NO}_3)_2$ as Cu-precursor and ethylenediamine (en) as solvent through solvothermal technique. In the present work, for the development of copper sulphide crystals with varying morphologies, a combination of various copper salts (as the source of copper) with thiourea in presence of ethylenediamine solvent under solvothermal condition were used. This is done for gathering an idea about the role of different copper precursors in controlling the shape of copper sulphide [Cu_2S (xCS)] in presence of ethylenediamine solvent. The experimental results indicate the formation of different morphological patterns as a function of the selection of copper precursors. The findings of the present paper may be applicable for the shape tailoring of nanoparticles also under suitable conditions. It was observed from the previous literature (Galdikas et al., 2000) that thick films of Cu_2S can be used for the detection of CH_3COCH_3 (acetone), $\text{C}_2\text{H}_5\text{OH}$ (ethanol), and ammonia (NH_3) gas at room temperature. Another study revealed that the gas sensing ability can be varied with the variation of stoichiometry and morphological patterns of Cu_2S materials (Setkus et al., 2001). Therefore, copper sulphides having different microstructures synthesized by the present method may be applied to detect CH_3COCH_3 , $\text{C}_2\text{H}_5\text{OH}$ and NH_3 gas.

II. EXPERIMENTAL

Copper sulphide synthesis was done by choosing four different Cu(II) precursors namely, $\text{Cu}(\text{NO}_3)_2$, $\text{Cu}(\text{CH}_3\text{COO})_2$, CuCl_2 and CuSO_4 . A mixture of 4 mM of one type of copper salt

¹ Corresponding Author



**DETERMINATION OF PROTEIN IN THE GERM LINE
CELLS OF ZIG-ZAG EEL *Mastacembelus armatus*, LACEPEDE
1800 (ACTINOPTERYGII: MASTACEMBELIDAE) FEMALE
IN THE DIFFERENT REPRODUCTIVE PHASES:
A HISTOCHEMICAL APPROACH**

SUPRIYA RAY^{1*}

¹Department of Zoology, Asansol Girls' College, Asansol, 713304, West Bengal, India.

AUTHOR'S CONTRIBUTION

The sole author designed, analysed, interpreted and prepared the manuscript.

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Original Research Article

ABSTRACT

Mastacembelus armatus, is an indigenous fish species of southern Asia, which also resides in Indian subcontinent. This fish species is facing an alarming declining in their number in the last decade. Due to its moderate cost, it is mainly taken by the lower income group of people of the society. The proteins play very important role in the oocytes specially in external fertilization. Maternally inherited proteins play pivotal role in pattern formation as well as in the growth and development of the embryo. Microscopic ovarian features with respect to accumulation of protein of *Mastacembelus armatus* were analyzed. Samples were fixed in Carnoy's fixative, mounted in 54° - 56° paraffin and cut into 8 µm-thick slices which were stained with Mercury - Bromophenol Blue (MBPB) method. After staining the thin sections with the thickness of approximately 8 µm were examined. Ovary of *Mastacembelus armatus* is extremely dynamic organ in which follicles underwent asynchronous development. The oocytes of ovary were observed in various phases. Accumulation of protein in the different stages of oocytes in zig-zag eel with the advancement of spawning season shows a positive correlation.

Keywords: *Mastacembelus armatus*; ovary; oocytes; protein.



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**Measures of Journal Quality and Impact tools,
techniques and methods: an overview**

Nandalal Mandal
Librarian,
Asansol Girls' College

Abstract :

Measuring and evaluating of quality of research journal, article, creator, publisher etc are now very much important in the age of digital era. Traditionally, journals are ranking using various traditional indicators like total citations, average citations and Journal Impact Factor (JIF). Due to advancement of S&T diverse tools, techniques and methods (indicators) like h-index, SJR, CiteScore etc. have been developed. To rank the journals and authors several indicators should be used to justify the quality of research performance. In this paper, discussed on various metrics with their strength, weakness and possibility of access to draw a guideline path for the researcher. Journal may be ranked based on different types of indicators at a time. No indicator is supreme as per study of their weakness, but desirable quality of the researcher, journal and other associated bodies should be measured based on quality of the article not the benefits in terms of money.

Keywords :

Journal indicator, h-index, JIF, CiteScore, SJR, SNIP, Eigenfactor, Journal ranking.

1. Introduction

Invented knowledge has its own platform to explore as nascent knowledge. To publish the research output, the scientific journals has a great role since 1665. To explore new development in research every article goes through as a journal article. So, Journal has a great role in the academic field as a mother of knowledge publication. The quality of a journal depends on articles as content. That means, maximum quality reflected by the quality of the articles published and the quality of creators. Every product quality is measured by the producer as well as society. The 'quality' depends on distinct attributes on it, which compares with others in respect of time and situations. The 'Journal quality' is very much important factor to published



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Third International Conference on Computing and Network Communications (CoCoNet'19)
Creating a Dynamic Real Time Green Corridor and Assessing its
Impact on Normal Traffic Flow

Biru Rajak^{a,*}, Shrabani Mallick^b, Dharmender Singh Kushwaha^c

^aMotilal Nehru National Institute of Technology Allahabad, Prayagraj, 211004, India

^bDr. B. R. Ambedkar Institute of Technology, Part Blaise, 744101, India

^cMotilal Nehru National Institute of Technology Allahabad, Prayagraj, 211004, India

Abstract

Emergency vehicles demand quick and safe passage as it aims at saving the life of a patient. But with rising bureaucracy and flaunting behavior of our leaders, the vehicles in which they travel in aspire for a green corridor. It is becoming a serious problem in our society and an optimal solution where normal traffic flow is least disrupted as well as emergency vehicles too could move quickly is highly desired. This research work proposes a framework for creating a dynamic real-time dedicated green corridor using Internet of Things (IoT) devices. The simulation results record the time taken for any vehicle to reach from source to destination during normal traffic flow and congestion hours. Later time is taken for an emergency vehicle to reach its destination when a green corridor is created and the impact of this on normal traffic flow is assessed. Finally, a dynamic real-time one hop and two-hop green corridor are created and its impact on general traffic movement is assessed. The results are able to establish that if an emergency vehicle is of very critical nature, one should go for a dedicated green corridor that reduces travel time by 2.76 times. If the emergency is not critical in nature, one can opt for the two-hop dynamic real-time green corridor. But, optimally if one demands the least disruption of normal traffic and at the same time creates a safer green corridor, results establish that one-hop dynamic green corridor is an optimal solution. In order to analyze the impact of various green corridors on the routes that intersect this corridor, simulation results are obtained for four different vehicles and the results are averaged. Only one intersection is considered in this simulation. With one hop dynamic real-time green corridor in consideration, the average travel time increases on an average by 129% as compared to normal traffic flow. It is maximum with a dedicated green corridor.

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An Efficient Congestion Avoiding Approach for Optimal Path Finding for Emergency Vehicle

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Authors:



Biru Rajak



Shrabani Mallick



Dharmender Singh Kushwaha

Motilal Nehru National Institute of Techno...



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Formulation of Metal Nanocomposite Model Structures with Gallic acid and Ellagic acid by Computational Method

Debraj Hazra and Rajat Pal*

Department of Microbiology and Biotechnology, Sister Nivedita University
DG 1/2, New Town, Action Area - I, Kolkata - 700156
West Bengal, India

Abstract: Nanoparticles are very attractive concern for scientists in recent years. Their different physical and chemical properties make them a very good vehicle for drug molecules for that reason their application in therapeutics and drug delivery research is remarkable. Many metals are already being used to formulate nanoparticles for this purpose. The flavonoids have also grabbed attention of many research groups for their tremendous efficiency for combating a huge variety of diseases. Hence, Metal nanoparticle drug composite formulation is one of the prime concerns in today's research. To understand the attachment of drug on nanoparticle, it is very much important to study the interaction between drug and the nanoparticle. That is why, here we are reporting the interaction between two flavonoids (Gallic acid and Ellagic acid) with eight metal atoms (gold, silver, iron, copper, nickel, zinc, platinum and palladium). We used Avogadro software to formulate the nanocomposite model structures and to minimize the energy level. From the results it can be concluded that the -OH groups present at the meta positions of Gallic acid are most suitable site for binding of metal atom and in case of Ellagic acid the binding site would be the -OH groups present at 2 and 7 positions. For both Gallic acid and Ellagic acid, platinum was found to be most suitable nanocomposite having lowest energy level.

Keywords: Nanoparticle, Nanocluster, Gallic acid, Ellagic acid and Avogadro Software.

1. INTRODUCTION:

Nanoparticle mediated drug delivery is one of the major interested area of research nowadays. There are mainly two types of nanoparticles are being synthesized for application in drug delivery (Jong and Boon, 2008); they are polymeric (Crucho and Barros, 2017) and metallic (Kumar et al., 2018). The polymeric nanoparticles entrap drug molecules inside their core (Vrignand et al., 2011) whereas metallic nanoparticles attach drug molecules on their surface (Levin et al., 2009). A huge variety of metallic nanoparticles are being used as a carrier of drug molecules for the treatment against many diseases and antimicrobial agents. Among these metals the most widely used and applied metals are gold (Au) (Duncan et al., 2010), silver (Ag) (Santos et al., 2014; Mandal, 2017), iron (Fe) (Mahdy et al., 2012), copper (Cu) (Kruk et al., 2015), nickel (Ni) (Guo et al., 2009), zinc (Zn) (Rojas et al., 2016), platinum (Pt) (Kim et al., 2010) and palladium (Pd) (Adams et al., 2014). Although amongst them, many have been recognized as heavy metals and reported to have toxic effects on living entity though the dose for treatment can be adjusted to minimize the adverse effect. To use the metallic nanoparticles as a vehicle for drug molecules, they must be attached to the surface of the nanoparticles, and to do so, the metal should be interacted with the drug molecule. So, before selecting a proper nanoparticle for a specific drug, it is necessary to have the idea about interaction pattern between the nanoparticle and the drug molecule.

Flavonoids are polyphenolic compounds having many therapeutic activities including antioxidant (Anjaneyulu and Chopra, 2004), anti-inflammatory (Guardia et al., 2001), anticancer (Ren et al., 2003), antihyperglycemic (Wu and Yen, 2005) and many more. Here we have taken Gallic acid and its dimer Ellagic acid for their extensive availability in daily diet and food materials. These two drug molecules have a variety of therapeutic applications as other flavonoids do possess (Soong and Barlow, 2006; Chen et al., 2007; Singh et al., 2014; Perchelet et al., 1992). Many research groups have worked on the Gallic acid - metal nanoparticle complex formation and their activity. In this research article, we are reporting the interaction study between Gallic acid and Ellagic acid along with eight metals as mentioned above to formulate nanocomposite model structures. This study will help us to select the best suitable metal nanoparticle for being used as carrier for Gallic acid and Ellagic acid.

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RESEARCH ARTICLE

SPECULATION OF METAL FOR SUITABLE LUTEOLIN - METAL NANOCOMPOSITE FORMULATION THROUGH *IN SILICO* APPROACH

Debraj Hazra and Rajat Pal

Department of Microbiology and Biotechnology, Sister Nivedita University, Kolkata, West Bengal, India.

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Key words:-
Flavonoid, Metal Nanoparticle, Luteolin,
Avogadro software

Abstract

Nanocomposite formulation has an impact on therapeutics and medical research as we are moving forward in these fields. During the formation of nanocomposite, the most important part is the mode of interaction between drug and nanoparticle. Hence the study about this interaction is necessary for understanding their binding nature. In our present study we selected luteolin as drug molecule because of its remarkable application in combating several diseases. To form nanocomposite, we choose metals which are widely used for nanoparticles synthesis such as gold, silver, copper, iron, zinc, nickel, palladium, platinum, ruthenium, rhodium, cadmium and antimony. Here we used Avogadro software for the formation of model structures and energy minimization of these nanocomposites. From the results, cadmium was found to be most suitable metal to form nanocomposite in association with luteolin having lowest energy level and antimony possesses highest energy level amongst all metals under consideration.

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Introduction:-

The study of nanoparticle is being attractive area of research for last few decades. The increased use of nanoparticle in research and biomedical application is due to its wide range application in food additives (Weir et al., 2012) to drug delivery system (Sing and Lillard, 2009), Polymers (Rao and Geckeler, 2011) and metals (Kumar et al., 2018) are the main constituents that are widely being used in the synthesis of nanoparticle. Before implication of nanoparticles in various fields, it is very much important to know about its synthesis process as well as its characterization. The metals we have used here in the synthesis of nanoparticles are gold (Au) (Duncan et al., 2010), silver (Ag) (Santos et al., 2014; Mandal, 2017), copper (Cu) (Kruk et al., 2015), iron (Fe) (Mahdy et al., 2012), nickel (Ni) (Guo et al., 2009), zinc (Zn) (Rojas et al., 2016), platinum (Pt) (Kim et al., 2010), palladium (Pd) (Adams et al., 2014), rhodium (Rh) (Xu et al., 2019), ruthenium (Ru) (Viau et al., 2003), cadmium (Cd) (Qi et al., 2001) and antimony (Sb) (Yin et al., 2019).

These metals have lots of role in the field of medical and therapeutics. Among the various uses of gold nanoparticles, therapeutic (Aziz et al., 2012) and biomedical applications (Zhang, 2015) are much renowned. Silver nanoparticles have a broad area in the application of herbicide detection (Dubas and Pimpan, 2008), biosensor (Ma et al., 2005), cancer treatment (Thapa et al., 2017), protein sensing arrays (He et al., 2014), degradation of environmental pollutants (Rastogi et al., 2012) etc. Alike silver, the copper nanoparticles have also a variety of applications in antimicrobial activity (Zain et al., 2014), metal ion sensing (Guo et al., 2016) etc. Zinc nanoparticles have a capacity to destroy tumour cells selectively and they have potentiality for drug delivery as well (Rasmussen

Corresponding Author:- Rajat Pal

Address:- Assistant Professor and Head, Department of Microbiology and Biotechnology, Sister Nivedita University, DG 1/2, New Town, Action area - I, Kolkata - 700156, India.

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Modelling the Effect of Incubation and Latent Periods on the Dynamics of Vector-Borne Plant Viral Diseases

Fahad Al Basir¹ · Sagar Adhurya² · Malay Banerjee³ · Ezio Venturino⁴ · Santanu Ray²

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Abstract

Most of the plant viral diseases spread through vectors. In case of the persistently transmitted disease, there is a latent time of infection inside the vector after acquisition of the virus from the infected plant. Again, the plant after getting infectious agent shows an incubation time after the interaction with an infected vector before it becomes diseased. The goal of this work is to study the effect of both incubation delay and latent time on the dynamics of plant disease, and accordingly a delayed model has been proposed. The existence of the equilibria, basic reproductive number (\mathcal{R}_0) and stability of equilibria have been studied. This study shows the relevance of the presence of two time delays, which may lead to system stabilization.

Keywords Time delay model · Basic reproduction number · Stability · Bifurcation

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ORIGINAL PAPER



Impact of Combined Therapy in HIV-1 Treatment: A Double Impulsive Approach

Xianbing Cao¹ · Fahad Al Basir² · Xue-Zhi Li³ · Priti Kumar Roy⁴

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Abstract

The major class of antiretroviral drugs used in the treatment of HIV positive patients are fusion inhibitors (FIs) and protease inhibitors (PIs). The fusion inhibitor enfuvirtide is effective in early viral life cycle and prevents viral entry into host cells. Protease inhibitors efficiently reduce the number of infectious virus particles. In this article, a mathematical model has been derived to study the effect of enfuvirtide in combination with protease inhibitors in HIV treatment. The dynamics of the two drugs have been analysed with a double impulsive control approach. We have considered different impulse interval for each drug and determine the threshold value for the dosages and dosing intervals to ensure the stability of disease free equilibrium. This study suggests that FIs-and-PIs combination therapy can have a better outcome than single drug activity; furthermore it can also be a better treatment strategy than the current combination of drugs when applied with proper dose and dosing intervals.

Keywords Human immune deficiency virus (HIV) · Acquired immunodeficiency syndrome (AIDS) · Mathematical model · Combined therapy · Basic reproduction number · Impulsive differential equation

Tripartite Entanglement for Qubits and Qudit in Double Photoionization of Xenon Atom

M. Chakraborty¹ and S.Sen²

¹Department of Physics, Asansol Girls' College, Asansol -713304, India
²Department of Physics, Triveni devi Bhalotia College, Raniganj- 713347, India
bminakshi@yahoo.com; sandip_sn@yahoo.com

ABSTRACT

Quantum entanglement holds the key to an information processing revolution. In this article, we study the entanglement properties of tripartite states of two electronic qubits and ionic qudit, without observing spin orbit interaction (SOI), produced by single-step double photoionization from Xenon atom following the absorption of a single photon. The dimension of the Hilbert space of the qudit depends upon the electronic state of the residual photoion Xe^{+} . In absence of SOI, Russel-Salunders coupling (L-S coupling) is applicable. As the estimations of entanglement, we consider Peres-Horodecki condition and negativity. In case of L-S coupling, all the properties of a qubit-qudit system can be predicted merely with the knowledge of the spins of the target atom, the residual photoion, emitted electrons and state of polarization of the incident photons.

Keywords – entanglement, quantum information, qubit, qudit, Peres-Horodecki condition, negativity

1 Introduction

Quantum entanglement is a key prediction of quantum mechanics and one of the resources needed in quantum information (QI) processing [1, 2]. In analogy to the classical information, QI also needs bits, called qubits. But, a bit in QI is a quantum system which has, at least, one observable requiring two-, or higher-, dimensional space for its characterization. A two-dimensional quantum system (e.g., a spin- $\frac{1}{2}$ particle) is called in QI as a quantum bit or qubit [3, 4]. In general, a d-dimensional quantum system (with $d \geq 2$) is called a qudit [5].

Availability of two or more qubits with entanglement is an essential ingredient for any quantum information related studies. Quantum entanglement is a nonlocal property that allows a set of qubit to express higher correlation that is not possible in classical systems.

Research into quantum entanglement was started in 1935 by A. Einstein, B. Podolsky and N. Rosen

HUMANITARIAN CRISIS IN CONTEMPORARY ARAB WORLD: A STUDY OF SYRIA WITH SPECIAL REFERENCE TO PALESTINE

Dr. Ghazala Parveen
Ph.D. in Political Science with specialization in International Relations
Department of Political Science
Aligarh Muslim University (AMU), Aligarh, India

Abstract: The struggle for an ideology, the longing for freedom, the lusts for power, the love for one's homeland or simply the need to survive are some of the reasons for people's eternal war with each other. Conflict in the contemporary Arab world displaced millions of people from their homes mainly from Syria and Palestine and become a hallmark of the contemporary Middle East. This paper discusses the civil war in- The Cradle of Civilizations- Syria with special reference to the serious challenges in the goal of a two- state solution in Palestine. In addition to this, it also focuses on the current situation of the Occupied Palestinian Territory, world's largest open-air prison Gaza Strip and humanitarian crisis in Syria. While the Arab Spring in Syria led to biggest humanitarian crisis now a day, the Palestinian refugee crisis is the most complicated matter in the contemporary world.

Key words: Middle East, Palestine, Syria, Arab Spring, civil war, humanitarian crisis, refugee crisis.

1. INTRODUCTION

Conflict has become a hallmark of the contemporary Arab World, displaced millions of people from their homes and country. Of the sixty million displaced people worldwide, close to forty per cent originated from the Arab regions, mainly Syria and Palestine. Internationally, the scale of the crisis has highlighted the failings of international agreements for addressing the political and humanitarian effects of mass population movements. Regionally, it has placed forefront countries

MAJOR TRENDS IN U.S. AND SAUDI ARABIA RELATIONS WITH SPECIAL REFERENCE TO OIL DIPLOMACY

Ghazala Parveen

Oil and diplomacy over it, is an international game in which all the countries of the world participate. In terms of wealth those countries would be very rich in the future who can achieve control over it. Oil is a very important factor in the international relations of the West Asian states, both with respect to inter-Arab states and with respect to relation with industrial and other developing countries. In this study it has been tried to show that how oil influenced West Asian politics and what has been the response of major powers. The main focus of this paper is on the U.S. – Saudi relationship in terms of oil and their role in various West Asian crises. Saudi Arabia is the largest oil producer in the world and an influential member of OPEC and continues to play a central role in OPEC's decisions. The major points of convergences between these two countries have also been explored.

Oil and diplomacy over it, is an international game in which all the countries of the world participate. In terms of wealth those countries will be very rich who can achieve control over it. Oil is a very important factor in the international relations of the West Asian states, both with respect to inter-Arab states and with respect to relation with industrial and other developing countries. In this study it has been tried to show that how oil influenced West Asian politics and what has been the response of major powers. The main focus of this paper is on the U.S. – Saudi relationship in terms of oil and their role in various West Asian crises. Saudi Arabia is the largest oil producer in the world and an influential member of OPEC and continues to play a central role in OPEC's decisions. The major points of convergences between these two countries have also been explored.

From the very beginning, oil stands as the world's most important commodity. Today, oil is considered as a 'strategic commodity', without which no industrialized society can run smoothly. The availability of oil should be guaranteed by any useful and forceful means, for example, by military force and this make this commodity as a valuable energy resource. In future, it may be possible, that the world will be able to find something more useful and environmentally friendly other than oil to fuel our vehicles and machines, but as of now the world needs oil. "indeed, according to one expert on military and security matters, 'of all the resources... none is more likely to provoke conflict between states in the twenty first century, than oil'."

Dr. Ghazala Parveen, Guest Faculty, Kazi Nazrul University, Asansol, Burdwan (West Bengal)

In our present day, Saudi Arabia possesses the world's largest crude oil production capacity and second largest proven crude oil reserves.² Saudi Arabia is the major driving force within OPEC (Organisation of Petroleum Exporting Countries) and as the world's largest producer is the most important oil supplier. In world markets, Saudi Arabia is an ultimate oil supplier and United States which is considered as an insatiable consuming nation in the world, views that there is no other oil supplier like Saudi Arabia.³ The oil business of Saudi Arabia began with the United States and with the May 1933 agreement.⁴ From early times in Saudi Arabia's existence, a relationship with the United States was seen by the Saudis as important, which was based on oil and security and considered as key to maintaining Saudi's independence.⁵

Strategic Importance Of Saudi Arabia

On September 23, 1932, Ibn Saud created Saudi Arabia in its modern form and ordered officially that his country should be known as the Kingdom of Saudi Arabia and by this the Kingdom officially got its present name.⁶ The Kingdom is said to be a leader in the Muslim and Arab worlds. It is custodian of the two most important holy cities of Islam i.e. Mecca and Medina. Compounded with the oil wealth of the Kingdom, leadership of Saudi in the Muslim and Arab worlds has acted a moderating role between Islam and West. Saudi Arabia is a member of the Arab League, the Organization of Islamic Conference, the GCC and Organization of the Petroleum Exporting Countries (OPEC) that fixes the general character for regional

Distribution of Different Cells with Special Emphasis on Seasonal Changes of Gonadotrophs in the Pituitary Gland of *Gudusia Chapra* (Hamilton, 1822) in Relation to Testicular Maturation

Shrabani Barun
Asansol Girls' College, Asansol, Pashim Bardhaman, Pin-733304, West Bengal

Abstract: Pituitary gland of *Gudusia chapra* is initially small in size, but with the approach of maturation and spawning season it enlarges on its dorsoventral axis. According to different histological features of its cell types, the adenohypophysis is divided into rostral pars distalis (RPD), middle proximal pars distalis (PPD) and the pars intermedia (PI). In the RPD, PPD and PI regions acidophilic or basophilic cells were identified with the help of various staining methods. The maximum part of the RPD was occupied by prolactin cells (PRL). The adrenocorticotrophic cells (ACTH) were less in number and were distributed among PRL cells. The anterior and middle part of PPD were occupied by basophilic gonadotrophs (GTH) and thyrotrophs (TSH). The only acidophils identified were somatotrophs (STH). Melanophore stimulating hormone (MSH) secreting cells and melanocyte concentrating hormone (MCH) secreting cells were identified in PI. Both GTH and TSH cells showed maximum diameter, intense staining reaction and dense homogenous granules with advancement of reproductive cycle specially during growth and maturation phases. Gradual changes in the testicular cycle have been correlated with changes of both GTH and TSH cells in the pituitary of *G. chapra*.

Keywords: Adenohypophysis, *Gudusia chapra*, GSI value, testes, reproductive phases, various
Corresponding author: Shrabani Barun, Email id: shrabanibarun@gmail.com

1. Introduction

Reproduction is a natural phenomenon performs under the influence of exteroceptive factors that mediate their effects through the hypothalamo-hypophyseal-gonadal subsystem. Environmental factors influence pituitary gland to produce and release the gonadotrophic hormones^[1]. Gonadal activities depend on the function of pituitary gonadotrophs and pituitary and gonads exist in a mutual state of excitation and inhibition^[2,3]. The identification and orientation of the different cell types in the hypophysis of different teleosts by histochemical, ultrastructural and immunocytochemical methods have been investigated earlier^[4,5]. The secretory cells of the pituitary gland exhibit different patterns of distribution in the different zones of adenohypophysis^[6]. The present study is undertaken to localize and identify the different cell types specially GTH cells in the pituitary gland of male *Gudusia chapra* (Hamilton) at all stages of testicular development by using modern staining techniques.

2. Materials and Methods

Ten adult male of *G. chapra* with average length of 11.00 ± 1.12 cm and mean body weight of 10.30 ± 2.10 g were collected throughout the year from a particular area of Panchet dam (23°40'41"N, 86°44'49"E) of Jharkhand, India during second week of every month from January 2017 to December 2018.

2.1. Gonado-somatic index

Total body weights of the fish and of testes were taken separately at every month to calculate the Gonado-Somatic Index (GSI) with the following formula:

Mini-Review of the Organozinc Hydroxylamide and Their Derivatives

Surajit Jana

Assistant Professor, Department of Chemistry, Asansol Girls' College, Asansol- 713304 India

ARTICLE DETAILS

Article History
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Organozinc, hydroxylamide,
pentanuclear, fluxional

ABSTRACT

Main group organometallic compounds containing ligands with donor functions in α - and β -positions relative to the metal show varieties of structural motifs. The group 13 metal hydrazide clusters have already been discussed and show the different structural motifs. Later, the hydrazide chemistry of zinc is also studied and show mostly tetranuclear aggregation motifs in the cluster. The chemistry of hydroxylamide is almost parallel to that of hydrazide one. Hausen and co-workers first synthesised the tetranuclear aluminium hydroxylamide cluster $[\text{Me}_2\text{Al}(\text{ONMe}_2)_4]$ with Al_2O_3 core by the reaction of trimethylaluminum with $\text{Me}_2\text{N}-\text{OH}$. Mitzel group extended the hydroxylamide chemistry of group 13 and 14 metal extensively and report a large number of different structural motifs for those classes of compounds. Later, this group published group 12 organometallic (Zn & Cd) hydroxylamide cluster. Pentanuclear aggregation is most common type of binding motifs of such compounds. The aggregation modes are strongly influenced by the binding partner through different donor-acceptor interactions and the steric effects of the substituents on the backbones. Till date, very less number of organozinc hydroxylamides and its derivatives are reported. Here, this report will give the up-to-date discovery in this field.

1. Introduction

Realising different stoichiometries of metal:non-metal atoms is a crucial requirement for the rational design of new molecular precursor compounds for many areas of material synthesis. The so far unknown zinc oxynitrides or nitrogen containing zinc oxide are promising but so far hardly accessible semiconductor materials.^[1] Thus, a chemical synthesis route via thermolysis of molecular precursor compounds with suitable Zn:N:O stoichiometries would be highly desirable, but so far lack the accessibility of molecular precursor compounds. Compared to organometallics of the trivalent group 13 elements, zinc requires further contact to a donor atom to reach coordination number (CN) four because of its divalent nature. In metal alkoxide/aryloxy chemistry,^[2] an increase in aggregate dimensionality is already well established [compare the Al_2O_3 ring $\{(\text{Me}_2\text{Al})[\text{O}(2,6\text{-Pr}_2\text{-C}_6\text{H}_3)]\}_2$ ^[3] with the "double cube" $\{[\text{Me}_2\text{Zn}(\text{OMe})_2]_2\text{Zn}\}$ (CN = 4, 6)].^[4] The highly diverse chemistry of the O-N double-donor array (hydroxylamines or oximes) provides a plethora of aggregation motifs, for example in group 13 complexes,^[5] and ought to be transferable to zinc for the exploration of similar extensions [compare the six-membered ring dimer $\{(\text{Me}_2\text{Al})[\text{CN}(\text{CMe}_2)]\}_2$ ^[6] with the tetrahedral oximate $\{[\text{Me}_2\text{Zn}(\text{CN}=\text{CMe}_2)]_4$ (CN = 4)]^[6]. The high coordination flexibility of the hydroxylamide ligands that is demonstrated in Al and Ga organometallics (e.g. in the readily fluctuating tetracyclic Al_3 cluster $\{[(\text{Me}_2\text{Al})[\text{ON}(\text{Me})_2]\text{CH}_2\}_2(\text{AlMe})\}$ ^[7] can be expected by hypothesis to allow for the construction of highly dynamic Zn-based multinuclear cluster compounds. Zinc, on its own accord, has a very rich alkoxide chemistry. However, hydroxylamide derivatives of divalent metals are rather poorly understood till 2006 and encompass merely inorganic coordination compounds of zinc (e.g. $\{[\text{H}(\text{N}(\text{OH})_2)\text{ZnCl}_2]\}$, Crisner's salt.^[8]

A closer view on hydroxylamides reveals that the picture here is very sophisticated since, on top of the different aggregate types in the solid state,^[9-16] dynamic coordination processes between these types may come into play in solution. A likely reason for this flexible binding is that the O-N unit has an inferior bridging capability compared to hydrazines (N-N unit) due to Lewis basicity measures. Organo-earth metal hydrazides^[12] generally do not exhibit related coordination dynamics. They feature structures based on four-membered Al_2N_2 rings that may be further cross-linked by the N-N moieties, like the ladder-type tetranuclear compound $\text{Al}_4(\text{N}-\text{NMe}_2)_2(\text{N}-\text{NMe}_2)_2$ ^[13]. In solution, two types resemble the resting states of a readily fluctuating molecule, based on the unique ability of the O-N unit for flexible coordination.

Hausen and co-workers first synthesised the tetranuclear aluminium hydroxylamide cluster $[\text{Me}_2\text{Al}(\text{ONMe}_2)_4]$ with Al_2O_3 core by the reaction of trimethylaluminum with $\text{Me}_2\text{N}-\text{OH}$.^[9] G. Lustig and M. Woski from Mitzel group found a large number of different structural motifs for these classes of compounds.^[14] Representative examples of the hydroxylamide chemistry of group 13 metals include simple dimers like $[\text{Bu}_2\text{Al}(\text{ONMe}_2)_2]$ with four-membered Al_2O_2 core, $[\text{Me}_2\text{Ga}(\text{ONMe}_2)_2]$ with $\text{Ga}_2\text{O}_2\text{N}_2$ core,^[15] $[\text{Me}_2\text{Al}(\text{ONMe}_2)_2]$ with six-membered Al_2O_3 core^[16] and $[\text{Bu}_2\text{Ga}(\text{ONMe}_2)_2]$ with five-membered $\text{Ga}_2\text{O}_2\text{N}$ core.^[16] Besides group 13 metal hydroxylamide complexes, hydroxylamides of other main group and transition metals have been established. Representative examples include the silicon hydroxylamides $\text{H}_4\text{Si}(\text{ONMe}_2)_4$, $\text{H}_2\text{Si}(\text{ONMe}_2)_2$,^[17] $\text{F}_3\text{Si}(\text{ONMe}_2)_3$,^[18] $\text{F}_2\text{CF}_2\text{Si}(\text{ONMe}_2)_2$,^[11] the tin hydroxylamides $[\text{Me}_2\text{Sn}(\text{ONMe}_2)]_2$,^[12] $[\text{Me}_2\text{Sn}(\text{ONEt})_2]$,^[13] $[\text{Me}_2\text{Sn}(\text{ONMe}_2)]_4$,^[14] the titanium hydroxylamide $[\text{Cp}^*\text{Me}_2\text{Ti}(\text{ONMe})\text{Bu}]_4$ ^[15] and the eight-coordinate $[\text{Ti}(\text{ONEt}_2)_4]$,^[16] $[\text{Ti}(\text{ONMe}_2)_4]$, $[\text{Zr}(\text{ONMe}_2)_4]$.^[17]

The hydrazide chemistry of Group 12 metals shows mainly two types of aggregation motifs as A and B shown in Scheme 1.

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A Review on Subvalent Mg(I)-Mg(I) Single Bonded Chemistry

Surajit Jana

Assistant Professor, Department of Chemistry, Asansol Girls' College, Asansol

ARTICLE DETAILS

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Organometallic, Mg-Mg single bond,
Magnesium(I), Low valent metal

ABSTRACT

In recent times, complexes containing metal-metal single bonds are one of the synthetic challenging areas of chemistry. The interest also stems from several perspective including synthetic methodology, structure, reactivity, and theoretical involvement. Compared to group 12, 13 and 14 metals, the alkaline earth metals (group 2) is still its infancy. However, recent years have witnessed major achievements of organo-alkaline earth compounds for catalytic utilization. These include hydrometallation, hydrophosphination, hydroxylation, hydrogenation, and polymerization reactions. After the most important breakthrough of the organometallic low-valent stable Zn(I) \sim Zn(I) compound by Carmona and co-workers, this field of research gets new direction. In 2007, Jones and co-workers were successful in isolating a group 2 metal Mg(I) dimer containing a Mg-Mg single bond. This review article provides the recent development on this Mg(I) dimeric chemistry reported till today and also will highlight their various reactivities.

Introduction

Metal-metal bonding as an important dimension of chemistry has attracted much attention in the past two decades. Besides the concept of multiple bonds between transition metals developed by Cotton,¹ several metal-metal bonds involving both p- and d-block metals have been reported in recent years, such as the silicon-silicon triple bond² and the chromium-chromium quintuple bond.³ In 2004, the first stable compound containing a Zn(I)-Zn(I) bond, $\text{Cp}^*\text{Zn}-\text{Zn}-\text{Cp}^*$, was synthesized by Carmona and co-workers.⁴ Consequently, various researchers have started computation studies about the various possibility to stabilize metal-metal single bonded compounds not only Zn-Zn but also relevant till then unknown Mg-Mg bond. The chemistry of the s-block metals is dominated by the (+1) oxidation state for the Alkali metals and the (+2) oxidation state for the Alkaline Earth metals (group 2). Several theoretical studies have predicted that thermally stable compound of the type LM-ML (where M= Group 2 elements, Be, Mg, Ca) would be possible. But till today, only few Mg(I)-Mg(I) bonded compounds stabilized by various organic ligands have been synthesized and characterized. A number of magnesium(I) compounds, for example, $\text{HMg}-\text{MgH}$ have previously been studied under, for example, matrix isolation conditions,⁵ and mononuclear compounds, for example, $\text{Mg}(\text{NC})$, have been detected in circumstellar clouds.⁶ Moreover, the formation of synthetically important Grignard reagents, RMgX (where X is a halide), has been proposed to proceed via magnesium(I) compounds of the type RMgMgX .⁷ In addition, related cluster compounds, RMg_2X , of undetermined structure have been investigated by using mass spectrometry experiments.⁸ From these investigations it can be concluded that Mg-Mg bonds are stable, and that the formation of magnesium metal has to be avoided. Employing bulky groups should shield the reactive Mg-Mg unit to prevent metal liberation.

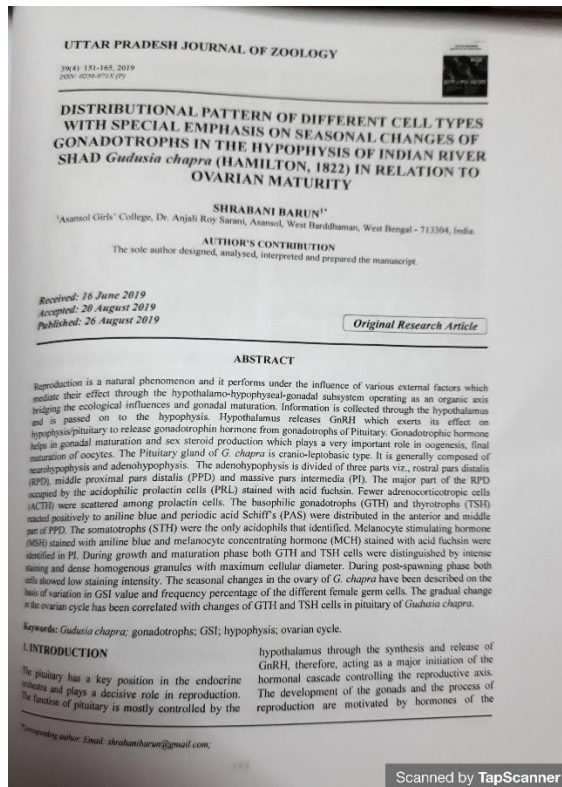
In recent years, several dimeric Mg(I) compounds containing Mg-Mg single bond has been prepared and their chemistry have been developed. These compounds are mostly stabilized by sterically demanding and chelating anionic N-ligands that prevent their disproportionation. Such molecule can be used as a reducing agent for various reduction processes. Focusing on such perspective, the synthesis of stable molecular compound of type LMg-MgL have been going on. In this report, the chemistry of such low valent Mg(I) dimer till date will be highlighted.

Synthesis of stable Mg(I)-Mg(I) low valent compound formation

First such stable Mg(I) dimer compound reported by Green et al. prepared and characterized in 2007. Reduction of $(\text{Priso})\text{Mg}(\text{t}j\text{-Bu})_2\text{Mg}(\text{OEt})_2(\text{Priso})$ and the known compound, $\text{Mg}(\text{OEt})_2(\text{Nacnac})$, with an excess of potassium metal in toluene over 24 hours led to the crystalline magnesium(I) compounds $[\text{Mg}(\text{Priso})]_2$, **1** (colorless, yield of 28.5%) and $[\text{Mg}(\text{Nacnac})]_2$, **2** (yellow, yield of 56.5%), respectively (Scheme 1).⁹ Although both compounds are air- and moisture sensitive, they are thermally stable and fully decompose only at temperatures in excess of 170°C and 300°C, respectively. The X-ray crystal structure shows that both **1** and **2** possess distorted trigonal planar coordination geometries with delocalized ligand backbones. Despite the paucity of Mg-Mg bonds for comparison, the lengths of those interactions in **1** and **2** are similar 285.08(12) and 284.57(8) pm, respectively. Nevertheless, these values agree very well with Mg-Mg distances predicted by quantum chemical methods in $\text{RMg}-\text{MgR}$ with R being H (288.4 pm),¹⁰ $\text{h}^{\eta^5}\text{-C}_5\text{H}_5$ (280.9 pm),¹¹ C_6H_5 -2,6-Ph (283.8 pm),¹¹ F (284.1 pm),¹² and Cl (284.6 pm).¹² Figure 1 shows the crystal structure of compound **2**.

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Gonadosomatic Index as a Determinant of Spawning Season in the Milieu of Ovarian Dynamics of Indian Freshwater Spiny Eel *Mastacembelus armatus* (Lacepede)

Supriya Ray

Department of Zoology, Asansol Girls' College, India

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Abstract Gonadosomatic index is a less expensive and alternative method than histological observation for the determination of spawning season in fish species. *Mastacembelus armatus*, an indigenous fish species of southern Asia, also resides in Indian subcontinent. This fish species is facing an alarming declining in their number in the last decade. Due to its moderate cost, it is mainly taken by the lower income group of people of the society. Reproductive care, by artificial breeding, has been taken for those fish species having a high cost in the market or becoming less in number in nature for business purposes or preserving the biodiversity, respectively. The present study was undertaken to understand the spawning season of the fish *Mastacembelus armatus* by calculating the gonadosomatic index, so in recent future artificial breeding can be done in this fish species. The mean GSI value for testes is 0.95 ± 0.06 , 1.42 ± 0.22 , 2.10 ± 0.38 and 0.72 ± 0.08 in growth, maturation, spawning and resting phase respectively. The mean GSI value for ovary is 1.38 ± 0.4 , 2.86 ± 0.84 , 12.50 ± 1.70 and 1.80 ± 0.15 in growth, maturation, spawning and resting phase respectively. In this study it was found that spawning season include one peak in a year and mainly it falls in the months of June to August in both the sexes.

Keywords Gonadosomatic Index, *Mastacembelus armatus*, Spawning Season

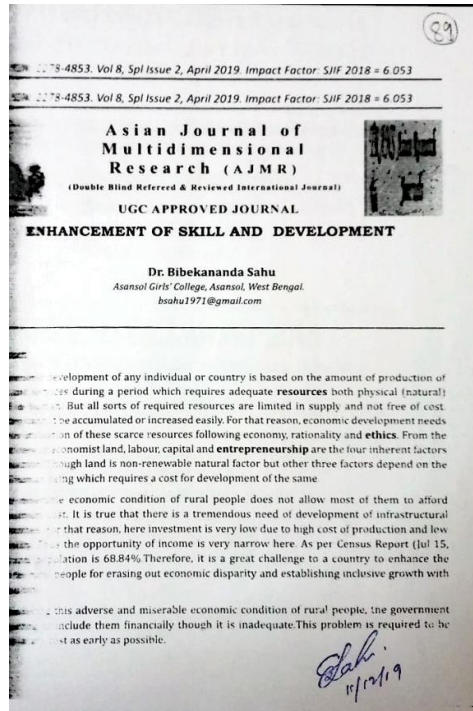
1. Introduction

In recent years man has to depend more on aquaculture opposed to wild fish and this has led to the commendable

scientific effects to achieve sustainability in aquaculture production. Management and conservation of fish together with its breeding biology are essential for successful culture and mobilization of seed resources. Both environmental and hormonal factors are extremely important in regulating reproductive behaviour and spawning in fishes. Various central mechanisms translate environmental cues into chemical messengers which function to activate and maintain the reproductive organs. In this regard the functional relationship between the hypothalamus and pituitary gland is important, and the pineal gland plays a positive role in regulating sexual maturation. Therefore environment, hypothalamus, pituitary and gonad are the four principle factors which are interrelated and behave together (Lal and Pandey, 1998). The function of pituitary is mostly controlled by the hypothalamus through the synthesis and release of gonadotropin-releasing hormone (GnRH), therefore, acting as a major initiator of the hormonal cascade controlling the reproductive axis.

Pituitary gonadotrophic hormones and GnRH are important in implicating these hormones in gonadal maturation and sex steroid production which plays a very important role in gametogenesis, final maturation of oocytes and spermiation (Parhar et al., 2003; Lethimonier et al., 2004). Gonadal activities in teleost fishes primarily depend on the function of pituitary gonadotrophs and that the pituitary and the gonads exist in a mutual state of excitation and inhibition (Farbridge et al., 1985; Kaneko et al., 1986).

Mastacembelus armatus is an indigenous fish species of Southern Asia, also resides in Indian subcontinent belonging to the family mastacembelidae under the order Synbranchiformes. It is popular as a table fish in rural parts



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Mangalakavyas and Its Tryst with Islam: The Creation of a Unique Regional Tradition in Bengal

Rohini Kar

The Mangalakavya literature evolved during the somewhat violent cross currents of competing religious cultures during the political ascendancy of Islam in the region, hence the functional meanings of these texts cannot be grasped without underlying their relationship with the threats posed by Islam. Basically Mangalakavyas are seen as texts composed to contain Islamic influence, but in the process of resisting Islam how it contributed in the creation of a unique regional tradition of Bengal, that is actually an amalgam of myriad beliefs and cultures, shall be the scope of this present discussion.

Keywords: Mangalakavyas, Islam, Bengal, Brahmanism, Buddhism.

I

The Mangalakavya literature arising from a hybrid religious culture of Bengal, combining the folkish with the Puranic, was intended in a way as texts of containment of Islam. This argument can be sustained by a closer look at the larger social and political context between the fifteenth and the eighteenth centuries when most of these devotional poems were composed. Usually written by high caste poets, a large majority hailing from priestly communities, well-informed in the Puranic tradition, the Mangalakavyas can be studied at one level as the vernacularization of the Puranas. Yet at another level, this genre of literature touches on a 'religious process' of co-option of local folk deities within the rubric of Brahminical religious culture. It was in a sense a continuation of a similar process at work earlier in early medieval times, an aspect of the religious history of Bengal on which Kunal Chakrabarty has written persuasively in a significant work.¹ By writing the Mangalakavyas and reciting them before the illiterate public, the custodians of the Brahminical religious culture sought to integrate the relatively less Brahmanized rural folks within the Brahminical fold at a time when its existence was somewhat threatened by the rise of the Islamic political power in the region. The discussion shall try to offer a contextualist explanation for the Mangalakavyas keeping the aspect of religious devotion in mind. David Curley however has cautioned against using the Mangalakavyas as historical documents arguing that such compositions, as it always happens in fictional literature, allowed free play of fantasies.² Curley further reinforces that before these were poetic compositions, they had remained as forms of popular entertainment for the rural folks. Indeed Mangalakavyas were always intended to be performed, not read in solitude.³ The author's main content however brought into sharper focus different facets of social relations between the rulers on the one hand and social classes including traders and agriculturists and forest dwellers on the other.⁴ Even if one assumes that the literary

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In Collaboration With Department of Philosophy

The Jaina Concept of Self (ātma): A Critical Analysis
Tapas Roy
Assistant professor of philosophy, Asanul Girls' college

Abstract : One of the most important subjects of discussion in Indian philosophy is the self (ātma). It is very often argued that Indian philosophy is mainly spiritual since the discussion aims at achieving the liberation of the self which is the highest goal of human life. All most all the schools of Indian philosophy discuss the self. But the self is different from school to school. Therefore, the soul is directly perceived (by introspection) just as the external things are perceived. These souls are infinite in number they are substances and eternal. According to Jaina conception self-expand and contract themselves according to the dimension of the body which they occupy at any time. The present paper I will be trying to discuss how the different self, the Jaina self and

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In Collaboration With Department of Philosophy

বৌদ্ধ দর্শনের 'শূন্যবাদ'-এর একটি বিশ্লেষণধর্মী আলোচনা
কৌরী ঘোষ
সহকারী অধ্যাপিকা, দর্শন বিভাগ, আসানসোল গার্লস কলেজ

বেদ প্রাচীনতম অর্থ সাহিত্য। বেদকে ভিত্তি করেই ভারতীয় দর্শন চিন্তার উদ্ভব। ভারতীয় সমাজ, সাহিত্য, দর্শন সম্প্রদায় প্রত্যক্ষভাবে অথবা পরোক্ষভাবে, ইতিবাচকভাবে অথবা নেতিবাচকভাবে, কোন না কোন ভাবে বেদ-এর দ্বারা প্রভাবিত। বেদের প্রামাণ্যের বিশ্বাসকে কেন্দ্র করে ভারতীয় দর্শন সম্প্রদায় সাধারণত দুটি ভাগে বিভক্ত হয়ে যায়, যথা— আন্তিক ও নাস্তিক। যারা বেদের প্রামাণ্য বিশ্বাসী অর্থাৎ যারা বৈদিক জীবনচর্চা ও দৃষ্টিভঙ্গিকে গ্রহণ করে

শূন্যবাদের প্রধান প্রবক্তা হিসেবে গণ্য করা হয়। নাগার্জুন 'মূল মাদামিক কারিকা' এই সম্প্রদায়ের উৎস্রষ্ট। শূন্যবাদ অনুযায়ী সং-অসং, শাস্ত-অশাস্ত, অজ্ঞা-অজ্ঞান কোনকিছুই চূড়ান্তভাবে সত্য নয়। সবকিছুই পরিবর্তনশীল। মানসিক বিষয় এবং বাহ্যিক বিষয় কোন কিছুই সত্য না। সবকিছুই শর্তাধীন আর যা কিছু শর্তাধীন তা নিত্য নয়, যা নিত্য নয়, সনাতন নয়, তা নিজস্ব কোন স্বভাব ধারণে



Ficus Hispida: A Novel Emetogen In Dog, A Step Toward Zoopharmacognosy

Supriya Ray

Asansol Girls 'College, Asansol, West Bengal, India

Abstract

Dogs are frequently observed eating grass and other plants of no apparent nutritional value. From evolutionary standpoint, it seems illusion, but definitely plays important function on biological perspective. Grasses are said to be responsible for vomiting in dog and a number of plants are reported time to time those are toxic to dogs. The present paper aims to focus on *Ficus hispida*: a novel emetogen in dog, a search toward Zoopharmacognosy.

Key Words: Emesis, *Ficus hispida*, Vomiting, Zoopharmacognosy

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Corresponding author: Supriya Roy; Mailing address: ray.supriya@gmail.com

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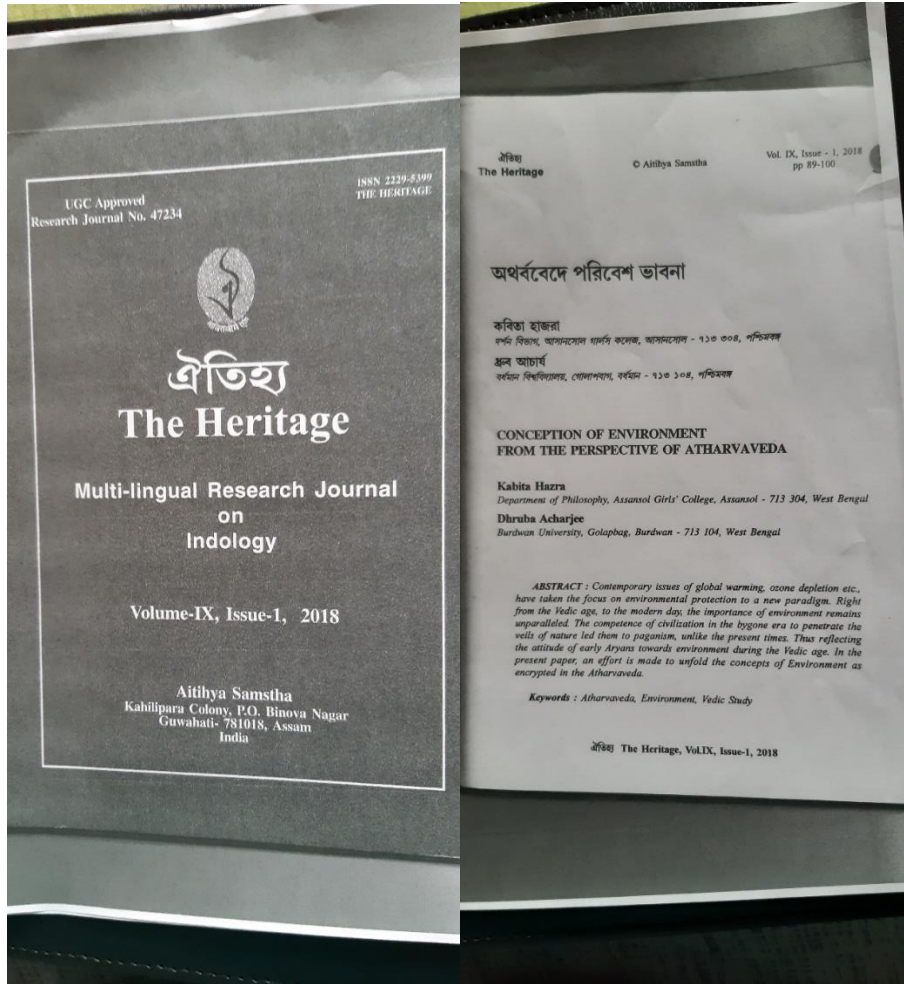
हिंदी विभागों का कच्चा चिट्ठा
'रजिस्ट्रार ही सही..'
* डॉ. कृष्ण कुमार श्रीवास्तव

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Prediction of Alzheimer from Imbalanced Mild Cognitive Impairment Samples

Dr. Pradip Ghanty*

*Assistant Professor in Computer Science Asansol Girls' College Asansol, West Bengal, India

Abstract : The disease of Alzheimer is a progressive neurological disease. It is responsible to shrink the brain and it dies brain cells. Dementia is the most important and primary concern for Alzheimer's disease - there is deterioration in memory, thinking, behaviour and the ability to perform everyday activities. In the early stage of memory loss is the result of Mild cognitive impairment (MCI) and it also jeopardise the individual ability of performing his/her independently daily living activities. So in later stage MCI patients may develop to AD. In this paper a well known Computational Intelligence tool called Artificial Neural Networks (ANNs) is used to predict AD from MCI samples. There are two types of A NNs variant - multilayer perceptron (MLP) and radial basis function (RBF) network. They are used for prediction. We have used oversampling algorithm with cross-validation for imbalanced MCI datasets to predict the developing of Alzheimer's or another dementia. In terms of prediction accuracy our findings are more relevant and it gives better results compared to previous studies which considered without imbalanced scenarios.

Keywords : Mild cognitive impairment, Alzheimer's disease, Imbalanced datasets, Artificial Neural Networks etc.