

Research Journal

Half Yearly Double Blind Peer Reviewed Journal of Humanities,
Social Sciences, Science and Commerce & Management

RESEARCH DEVELOPMENT CELL



Estd. 1932

Women's Education Society's

**Lady Amritbai Daga College for Women of Arts,
Commerce & Science and Smt. Ratnidevi Purohit College
of Home Science & Home Science Technology**

NAAC-Re-Accredited 'A' Grade

[Identified as College with Potential for Excellence (CPE) by U.G.C., New Delhi]

Research Journal

Half Yearly Double Blind Peer Reviewed Journal of Humanities,
Social Sciences, Science and Commerce & Management

Co-ordinator

Dr. Pooja Pathak

Editor-in-Chief

Dr. Ruta Dharmadhikari

Co-Editor

Dr. Bhavana Khapecar

Editorial Board

Dr. Milan Nimbalkar

Dr. Shilpa Sarode

Dr. Shivani Balkundi

Dr. Shreeja Kurup

Dr. Swapnali Charpe

Advisory Board

Dr. P. Chande	Retd. Vice-Chancellor, Kavikulguru Kalidas Sanskrit University, Ramtek
Dr. M. Kashikar	Prof. PGTD, Political Science, RTM Nagpur University, Nagpur
Dr. A. S. Ukhalkar	Retd. Principal, G.S. College of Commerce & Economics, Nagpur
Dr. A. D. Welankar	Retd. Head, Dept. of Marathi, Smt. Binzani Mahavidyalaya, Nagpur
Dr. H. Aher	Retd. Principal, Dr. Wankhede College of Education, Nagpur
Dr. R. Kubalkar	Head, PGTD, Psychology, RTM Nagpur University, Nagpur
Dr. S. Johari	Retd. Prof. & Head, PGTD, History, RTM Nagpur University, Nagpur
Dr. S. Bapat	Retd. Lecturer in Geography, VNGIASS, Nagpur
Dr. A. V. Deshmukh	Associate Prof. & Head, Dept. of Political Science, S.B. City College, Nagpur
Dr. V. Dadhe	Associate Prof. & Head, PGTD, Hindi, RTM Nagpur University, Nagpur
Dr. N. Singh	Associate Prof. & Head, Dept. of Hindi, S. B. City College, Nagpur
Dr. M. Maind	Associate Prof. & Head, Dept. of Hindi, C. J. Patel College of Arts, Commerce & Science, Tiroda

Research Journal

**Half Yearly Double Blind Peer Reviewed Journal of Humanities,
Social Sciences, Science & Commerce and Management**

RESEARCH DEVELOPMENT CELL



Estd. 1932

Women's Education Society's
**Lady Amritbai Daga College for Women of Arts,
Commerce & Science and Smt. Ratnidevi Purohit College
of Home Science & Home Science Technology**

NAAC-Re-Accredited 'A' Grade

[Identified as College with Potential for Excellence (CPE) by U.G.C., New Delhi]

Research Journal

**Half Yearly Double Blind Peer Reviewed Journal of Humanities,
Social Sciences, Science & Commerce and Management**

Editorial Office

Research Development Cell
L.A.D. & Smt. R. P. College for Women,
Shankar Nagar, Nagpur-440010
Phone : 0712-2247192, 2246623
Email : ladcollege@yahoo.co.uk
url : <https://sites.google.com/site/ladresearchjournal2/>

Publishers

Swaprakashan Publication Cell
L.A.D. and Smt. R.P. College for Women, Nagpur

Printer

Facit Xeroprinters,
Dharampeth, Nagpur

© Research Journal Vol. 21 No, (1) 2025. All rights reserved. No part of this publication may be reproduced in any form or by any means or used by any information storage and retrieval system without written permission from the copyright owner.

Opinions expressed in the articles, research papers are those of contributors and do not necessarily reflect the views of the publisher. The publisher is not responsible (as a matter of product liability, negligence or otherwise) for any consequences resulting from any information contained therein.

Subscription Rates

Institutional : Rs. 2000/- (per annum two issues)
Individual : Rs. 1000/- (per annum two issues)

EDITORIAL

We are very happy to present Volume 21 Issue (1) of the *Research Journal* to the broad academic readership. The interdisciplinary nature of the Journal assures readers of a variety of subjects presented with academic rigour and fortitude. The journal has received submissions from across the country. The double-blind peer review process was thorough and ethical, with plagiarism reports duly submitted by each author. Peer review suggestions were incorporated by the authors into the final submissions. We acknowledge the hard work put in by the peer reviewers and the authors. The editorial team worked on the production of this publication with sincere dedication and hard work. I am truly grateful for their total commitment to the *Research Journal*.

We received a large number of submissions from the Humanities, with science following close. We hope to have more representation from the streams of Social Sciences, Law, Performing Arts and Commerce in the upcoming issues.

Research papers in the Humanities section reflect diverse areas of critical examination. The politics of gender and geopolitics and their representation in cinema, the reassessment of the representation of a mighty river in two separate genres of literature and music, changing representations of animals in mid-to-late twentieth century Anglophone poetry are some of the subjects of enquiry. Others encompass multilingualism as a critical resource for cultural adaptation, postcolonial analysis of survival narratives, critical comparisons between two collections of short stories, posthumanist and cyborg literature, Nature and mythological literature, human rights perspectives and the relation between yoga and happiness.

The lone paper from the Social Sciences is a well-researched proposal to preserve the archaeological sites at Pauni, in Vidarbha, and which aims to deliver paths to both heritage protection and social welfare for the local community. This important research will garner serious attention through this publication.

The Science section features excellent research in the fields of life sciences and material science. The innovative method of turning agricultural waste into protease for further use in food, textile and pharmaceutical industries is well presented. The research on sickle cell anaemia is promising, as is the research comparing standard antibiotics with clinical pathogens. A case study on noise pollution has thrown up interesting results. The study on the Duffing map is equally riveting. The research undertaken to determine the origin of blood is an exciting read.

The Commerce Section represented by a bibliometric analysis to map market growth and consumer perception toward generic medicine is an important study, comprehensible to even lay readers.

The research papers have drawn on the findings of established theoreticians, scientists and researchers to put forth new and valuable paths to further research and understanding. Interrogating the politics of established imaginaries and traditional perspectives is a key characteristic of all the papers in this volume. The research papers have followed the MLA 9th edition and the APA 7th edition. This volume of the multidisciplinary *Research Journal* is a valuable addition to the corpus of important research publications.

Editor- in- Chief

Contents

Sr.No.	Title	Page No.
1.	The Politics of Not Knowing: Narrative Ambiguity and Gendered Judgment in <i>Aattam</i> Jyothy C R.....	1
2.	Bollywood's Frontier Imagination: Exoticising Arunachal Pradesh in <i>Bhediya</i> Luku Morang.....	8
3.	The Interplay of Multilingualism and Cultural Identity in Abdulrazak Gurnah's Narratives Cinto Jose.....	19
4.	Blurring Boundaries: Cyborg Identity and Techno-Political Resistance in <i>Rosewater</i> Aysha Farhana S.M; J. Pinky Diana Evelyn,.....	25
5.	Negotiating Identity and Liberty: A Human Rights Perspective on Elif Shafak's <i>Three Daughters of Eve</i> Purushottam Manikrao Gajbhiye	33
6.	Brahmaputra as the Silent Observer of Assam's Legacy: A Study through Literature and Lyrics Jimi Bora	44
7.	The Divine Dance of Science: Lord Shiva's Role in Understanding the Laws of Nature in Mythological Literature Archana Nilesh Shelke	52
8.	Harriet Jacobs' <i>Incidents in the Life of a Slave Girl</i> : A Post-Colonial Analysis of Slavery, Resistance and Survival Aliya Halim	58
9.	Revolt Against Patriarchal Subjugation: Women's Resistance in the Works of Banu Mushtaq and Rohinton Mistry Abdul Shamim	66

10. Preserving the Past, Sustaining the Future: Archaeological Tourism Potential of Pauni Heritage
Neha Dubey; Priyadarshi Khobragade..... 73
11. Animal Agency in Hughes' and Kinnell's Select Poems
Gurjit Singh..... 86
12. योग आणि आनंद - तैत्तिरीय उपनिषदाच्या अनुषंगाने
अबोली व्यास 95
13. Production of Protease from *Bacillus species* Using Agricultural Waste by Submerged Fermentation
Ashwini Shivankar; P.M. Tumane; D. Wasnik..... 100
14. Antibacterial Activity of Coleoptile of Germinating Seeds of *Arachis Hypogaea* Against Clinical Pathogens
Priti Shrivastava; P. M. Tumane; Durgesh Wasnik 116
15. Evaluating Noise Pollution in an Academic Environment: A Case Study
Swapnali W. Charpe; Shital Dhangar; Varsha Patel; Poornima Tandekar 130
16. Chaotic Dynamics and Multistability in the q-deformed Duffing Map
Priyanka D. Bhojar 143
17. A Comparative Study of Haemin Crystal Characteristics in Common Animal Source Bloodstains
Dewashree Nagarkar; Gayatri Chawhan; Zafer Khan..... 153
18. Azocompounds as a Potential Hope in Sickle Cell Anemia: In-Vitro Modulation of Hematological and Renal Parameters
Pallavi Mehere 158
19. Mapping Global Research on Market Growth and Consumer Perception Towards Generic Medicines: A Bibliometric Analysis (2000–2025)
Avinash Sahu; Ajit Shringarpure 163

The Politics of Not Knowing: Narrative Ambiguity and Gendered Judgment in *Aattam*

Dr Jyothy C R

Assistant Professor of English, NSS College Pandalam
Pathanamthitta, District Kerala,
jyotydileep@gmail.com

Abstract

Anand Ekarshi's *Aattam* (2023) interrogates the politics of not knowing in situations of gendered accusation, where uncertainty itself becomes a mechanism of power. Rather than resolving the question of whether sexual assault occurred, the film withholds narrative certainty, exposing how ambiguity is mobilized unevenly within patriarchal structures of judgment. This article argues that *Aattam* reveals not knowing as a gendered condition that protects male credibility while rendering women's testimony fragile and contestable. Drawing on feminist film theory, theories of power-knowledge, hegemonic masculinity, and epistemic injustice, the analysis examines how collective masculine deliberation transforms uncertainty into ethical delay, institutional self-preservation, and moral deflection. Set within an amateur theatre troupe-an ostensibly progressive space-the film demonstrates how appeals to rationality, fairness, and objectivity reproduce patriarchal authority rather than dismantle it. By shifting attention from the pursuit of factual truth to the ethics of judgment under uncertainty, *Aattam* critiques cultural frameworks that demand evidentiary certainty from women while granting men the privilege of doubt. The article positions the film as a significant feminist intervention in contemporary Indian cinema, offering a critique of how narrative ambiguity functions as a political tool in the regulation of gendered credibility and responsibility.

Keywords: narrative ambiguity, gendered judgment, epistemic injustice, hegemonic masculinity, feminist film theory, ethics of not knowing.

Introduction

Anand Ekarshi's *Aattam* belongs to a recent tradition of Malayalam cinema committed to interrogating social systems rather than confirming them. The film does not merely represent patriarchy; it dramatizes the mechanisms through which patriarchy produces and regulates narratives,

especially those involving women's bodies and sexualized vulnerability. By situating its conflict within an amateur theatre troupe-normally imagined as a liberal, progressive space, the film exposes how patriarchy permeates even supposedly enlightened domains.

The central incident around which *Aattam* revolves is deceptively simple:

after a night of performance, drinking, and camaraderie, the lone woman in the troupe, Anjali, claims she was sexually assaulted by Hari, one of the troupe members. What follows is not a linear pursuit of justice but a chaotic multiplication of stories, excuses, doubts, denials, revisions, hesitations, and self-serving recollections. The film becomes a study of how truth is negotiated rather than discovered.

Feminist film theory has long emphasized how women become the objects of narrative control. Laura Mulvey's foundational critique of the male gaze explains how classical cinema structures women as spectacles to be interpreted, evaluated, and regulated by men (Mulvey 18). *Aattam* takes this idea further by showing that the male gaze is not simply visual-it is epistemic. It regulates who is believed, who is doubted, and who gets to define what counts as "truth." Similarly, R. W. Connell's framework of hegemonic masculinity demonstrates that patriarchy maintains dominance not merely through violent men but through everyday performances of male solidarity, rationality, and order (Connell 79). *Aattam* shows precisely this: men who believe they are harmless, liberal, and progressive unconsciously become complicit in silencing Anjali.

Threaded throughout the narrative is what scholars commonly call the Rashomon effect, in which conflicting testimonies render any singular truth

impossible. Yet in *Aattam*, the effect does not romanticize subjectivity; rather, it exposes how power shapes memory itself. By examining the film's narrative strategies, character dynamics, and philosophical implications, this study situates *Aattam* within contemporary feminist discourse while highlighting its contribution to debates on gender, truth, and spectatorship in Indian cinema.

Aims and Objectives of the Study

The study aims to undertake a sustained feminist analysis of *Aattam* (2023) to examine how narrative ambiguity operates as a gendered political strategy within contemporary social and cultural contexts. Rather than approaching ambiguity as a limitation of representation or an inevitable feature of subjective perception, this research treats not knowing as an active condition produced and managed by patriarchal structures. *Aattam* foregrounds the unequal distribution of epistemic authority in situations of gendered accusation, where uncertainty consistently advantages male subjects while destabilizing women's credibility.

In particular, the film reconfigures conventional cinematic approaches to sexual violence by refusing visual confirmation, narrative closure, or juridical resolution. By withholding the factual truth of the central incident, it shifts attention away from verification toward the social processes through

which judgment is formed. This narrative strategy challenges dominant cultural expectations that women must produce incontrovertible proof in order to be believed, while men are afforded the ethical luxury of doubt, delay, and rational deliberation.

The film also provides a lens for analysing hegemonic masculinity, especially as it manifests through collective male behaviour rather than individual acts of aggression. Male characters perform rationality, fairness, and moral responsibility while simultaneously reproducing patriarchal authority. Progressive, educated, and artistically inclined men are shown sustaining gendered power relations through discussion, consensus-building, and reputational self-protection.

Moreover, *Aattam* engages feminist theories of gaze, power-knowledge, and epistemic injustice, expanding classical film theory by shifting the focus from visual objectification to epistemic control. The regulation of belief replaces the regulation of looking, and the woman's testimony becomes the object of scrutiny rather than her body, revealing a contemporary mode of patriarchal surveillance operating through credibility assessment rather than spectacle.

Finally, the film examines the ethical implications of silence, refusal, and minimal speech. The protagonist's restrained articulation challenges

assumptions that feminist resistance must be vocal, confessional, or emotionally expressive. Silence is theorized as a form of agency that disrupts coercive demands for narrative clarity and emotional transparency. Situated within the broader landscape of contemporary Indian cinema, *Aattam* demonstrates how regional films engage in global feminist debates while addressing culturally specific configurations of patriarchy, liberal masculinity, and institutional ethics. Ultimately, the film reframes the politics of truth as a question of responsibility rather than certainty, exposing the moral consequences of deferring judgment under the guise of objectivity and contributing to critical conversations on gendered credibility, narrative ethics, and feminist interventions in contemporary visual culture.

Analysis

Unlike many films that attempt to depict sexual harassment, *Aattam* is radical because it withholds a central fact: the truth of what happened to Anjali is never shown. That omission is not a narrative gimmick; it is a political stance. As Michel Foucault argues, power produces knowledge, and knowledge in turn reinforces power (Foucault 27). The absence of a visual flashback denies male characters-and viewers-the power to adjudicate Anjali's experience. Instead, we witness a cascade of narratives from the troupe

members, each subtly manipulating the incident to serve their interests. In *Aattam*, every version of the story claims neutrality yet betrays bias. One character insists the situation was “not that serious,” another blames alcohol, another frames it as a misunderstanding. Each retelling pretends to illuminate the incident but actually obscures it.

The troupe’s attempt to “investigate” Anjali’s claim becomes a theatre of pretence: “We must get to the truth,” one insists. “Yes, but we cannot destroy a man’s life over an exaggeration,” another responds. “She might have misunderstood. Hari is not that kind of person.” “We were all drunk. No one remembers clearly.”

These lines, seemingly reasonable, reveal how patriarchal rhetoric mobilizes ambiguity against survivors. Ambiguity becomes a weapon. The Rashomon effect in *Aattam* differs from Kurosawa’s *Rashomon*: in Kurosawa’s film, conflicting testimonies highlight the subjectivity of truth; in *Aattam*, conflicting testimonies highlight the politics of truth. The men’s narratives form a collective epistemic block, reinforcing Connell’s idea that hegemonic masculinity is maintained by men who see themselves as rational protectors of order (Connell 89). The more they deliberate, the more Anjali’s voice recedes under the weight of their “reasonable doubts.”

Mulvey argues that classical cinema grants men epistemic authority, making women legible only in terms of male desire or judgment (Mulvey 22). *Aattam* dramatizes this principle: Anjali does not tell her story repeatedly; men do. While she remains silent, withdrawn, and tense, the men reconstruct her feelings, intentions, and motives, claiming interpretive authority over her interiority. This is an example of what Spivak calls epistemic violence—the process by which dominant voices erase or appropriate subaltern voices (Spivak 284). A significant scene shows Anjali physically present but epistemically invisible as the men debate whether to call a meeting. The camera holds her in a long static shot while the men occupy the soundscape, their dialogue drowning any attempt she might make to speak. This aesthetic choice visualizes what Butler calls the politics of intelligibility—only certain voices are culturally legible as “truthful,” and patriarchal institutions determine whose voices these are (Butler 33). In *Aattam*, Anjali’s truth is intelligible only insofar as it does not threaten the troupe’s public image; when inconvenient, it is reclassified as confusing, emotional, or exaggerated.

The inversion at the heart of patriarchy is clear: women’s suffering is secondary to men’s reputations. One character articulates the troupe’s anxiety: “If this comes out, people will think we’re monsters. We know who we

are. But society will think otherwise.” Connell defines hegemonic masculinity as a culturally exalted form of manhood that maintains the subordination of women and non-dominant masculinities (Connell 77). The men in *Aattam* perform this idea precisely—they present themselves as progressive, artistic, and egalitarian, yet collectively reproduce patriarchy. Hari, the accused, is not monstrous; he is ordinary-articulate, friendly, self-deprecating, and socially competent. When he narrates his version, his tone is calm and managerial: “I touched her shoulder only to support her. She was slipping. I thought she might fall. I had no other intention.” Such reframing-transforming harm into caretaking, aggression into benevolence—is a hallmark of hegemonic masculinity, and the troupe’s insistence on objectivity reveals what feminist scholars call false neutrality. Objectivity becomes a strategy for maintaining male privilege.

Anjali’s silence is one of the film’s most striking elements. It is not a silence of submission but a silence of refusal. By withholding her narrative, she destabilizes male desire for certainty. Butler argues that silence can be a mode of agency when speech is demanded under coercive conditions (Butler 44). Anjali’s flat, unornamented assertion “I know what I felt”—challenges every epistemic structure the men attempt to impose. Her interiority becomes a counter-discourse. Yet the men treat her

feelings not as knowledge but as instability, suggesting she is “overreacting,” “sensitive,” or “misreading signals.” These dismissals exemplify gaslighting, a psychological method of invalidating women’s perceptions, which *Aattam* demonstrates as often systemic rather than intentional.

The theatre troupe setting is significant. Theatre is a space of performance, rehearsal, improvisation, and illusion-mirroring how individuals construct narratives about themselves. Butler’s concept of gender performativity helps explain this: masculinity is enacted through rationality, control, and unity; femininity through patience, composure, and silence (Butler 54). These performances shape the narrative more than any objective truth. The troupe’s final decision—to handle the incident internally and move on—reveals that maintaining collective identity matters more than justice. The film’s climax reinforces the truth that, in patriarchal systems, power is a negotiated performance rather than an unbiased revelation.

Aattam exposes how patriarchal systems manipulate ambiguity to delegitimize women’s testimonies, extending Mulvey’s critique of the male gaze (Mulvey 21), Butler’s politics of intelligibility (Butler 33), Connell’s hegemonic masculinity (Connell 89), Foucault’s idea that truth is produced

through power structures (Foucault 27), and Spivak's concept of epistemic violence (Spivak 284). While Mulvey focused on visual objectification, *Aattam* shows that the gaze can be epistemic-governing belief rather than desire. Foucault's insights on diffuse power are expanded: power circulates without formal institutions, operating through conversation, appeals to fairness, and ethical deferment. Ambiguity is unevenly distributed, benefiting men while destabilizing women, revealing uncertainty as a gendered political tool.

Ultimately, *Aattam* shifts the feminist question from truth to responsibility. Rather than asking what definitively happened, the film asks what ethical obligations exist in the absence of certainty. The demand for absolute proof becomes a precondition for disbelief, particularly regarding women's claims of sexual harm. By refusing narrative closure, *Aattam* critiques cultural insistence on evidentiary certainty before moral response, articulating a feminist ethics that engages with vulnerability, risk, and care. The film demonstrates that power now operates through civility, ambiguity, and collective hesitation, and that justice cannot depend solely on proof-it requires accountability, ethical attentiveness, and recognition of embodied experience.

Conclusion

Aattam stands out as one of the most intellectually and politically rigorous films in contemporary Indian cinema. By deliberately refusing narrative certainty, it critiques the patriarchal compulsion to control truth and challenges audiences to reckon with the power dynamics embedded in everyday interactions. By centering a woman whose silence destabilizes male authority, the film foregrounds how gendered power structures shape perception and determine whose voice is heard, believed, or dismissed. Its engagement with the male gaze, hegemonic masculinity, and epistemic violence demonstrates that patriarchy is not sustained by overt villains but by ordinary men performing reasonableness, civility, and ethical deliberation. In this sense, *Aattam* becomes a mirror-not of what occurred that night, but of how society responds when a woman asserts that something has happened. In refusing to provide comfort, closure, or clarity, the film emerges as a feminist document of enduring relevance, exposing both the fragility of the truths men construct and the resilience of the truths women must safeguard.

The study concludes that *Aattam* functions as a powerful feminist intervention, critiquing patriarchal control over truth, representation, and epistemic authority. The film resonates with Mulvey's theorization of visual

and narrative authority (Mulvey 18) and Butler's insights on gendered vulnerability and intelligibility (Butler 44), while illustrating how hegemonic masculinity operates through performative rationality and collective male self-preservation (Connell 77). It also affirms Foucault's argument that power shapes knowledge (Foucault 27) and Spivak's claims regarding the silencing of subaltern voices (Spivak 284).

Future research may build on this analysis by comparing *Aattam* with other contemporary Indian films that employ narrative ambiguity to critique patriarchal structures, or by exploring how audience reception mediates interpretations of feminist cinema. Such studies could further illuminate how Indian regional cinema negotiates global feminist debates while addressing culturally specific configurations of gender, authority, and ethics.

Works Cited

Butler, Judith. *Gender Trouble: Feminism and the Subversion of Identity*. Routledge, 1990.

Connell, R. W. *Masculinities*. 2nd edition, Polity Press, 2005.

Ekarshi, Anand. Director. *Aattam*. Joy Movie Productions, 2023.

Foucault, Michel. *Power/Knowledge: Selected Interviews and Other Writings, 1972–1977*. edited by Colin Gordon, Pantheon Books, 1980.

Mulvey, Laura. "Visual Pleasure and Narrative Cinema". *Screen*, vol. 16, no. 3, 1975, pp. 6–18.

Spivak, Gayatri Chakravorty. *Can the Subaltern Speak? Marxism and the Interpretation of Culture*, edited by Cary Nelson and Lawrence Grossberg, University of Illinois Press, 1988, pp. 271–313.

Bollywood's Frontier Imagination: Exoticising Arunachal Pradesh in *Bhediya*

Dr. Luku Morang

Assistant Professor, Department of English
D.H.S.K. Commerce College, Dibrugarh
morangluku@gmail.com

Abstract

Northeast India covers eight states, including Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, and Sikkim. It is situated in the easternmost part of the country. The region is recognized as one of the most culturally and ethnically diverse parts of the country. Its geographical positioning and immediate proximity to five Southeast Asian nations have rendered the entire region strategically significant regarding security regimes. Bollywood movies frequently resort to tokenism in depicting Northeast India as an exotic "other" territory inhabited by underdeveloped, illiterate, violent, and primitive tribal groups. Furthermore, Bollywood films resort to stereotyping, cultural appropriation, and exoticification of the nation's periphery region under the guise of a realistic portrayal of life in the region. Such depictions of the region in Bollywood films have contributed to the escalating marginalization and estrangement of the peripheral region from the collective consciousness of the nation-state. In this way, the "visual regime" of popular Bollywood films has exacerbated the alienation and detachment of the region from the collective imagination of mainland India. This paper examines the representation of Arunachal Pradesh as an exotic setting in the narrative of Bollywood movie *Bhediya* (2022). The paper undertakes a close analysis of the plot, setting, narrative, and characterization of the movie.

Key-Words: Northeast India, Setting, Exotic, Other, Marginalization, Appropriation.

Introduction

Bollywood films are a prominent mass media platform in mainland India. They play a crucial role in upholding the values, cultural identity, and social obligations of the nation state. Bollywood films hold the position of a cultural artefact and the soft power of India, portraying various aspects of the nation-state and its diverse population. According to Rachel Dwyer,

Bollywood Hindi movies enjoy the status of national cinema because of their language, which is one of the most spoken languages in the country. Jyotika Viridi also contends that Bollywood movies act as a national cinema due to their construction of a unified nation. Bollywood movies are national cinema because of "inheriting and circulating notions of national identity, negotiating conflicts

experienced by the imagined community, producing new representations of the nation, and constructing a collective consciousness of nationhood through special cultural referents” (Viridi 7). Tejaswini Ganti shares similar observations regarding the status of Bollywood Hindi cinema as a national cinema, as it functions independently without the support or promotion of any state film industry. “The fact that cinema in Hindi language developed in multi-lingual Bombay, rather than in the Hindi-speaking north, dissociated Hindi films from any regional identification, imbuing them with a more “national” character” (Ganti 11).

From the earliest days of the industry, the protagonists and lead characters in Bollywood movies are the Hindi-speaking population of North and Central India. In addition, the “default setting” of Bollywood movies is mainland Indian. This is primarily because Bollywood movies mostly address the Hindi-speaking audiences of mainland India:

Although the Hindi cinema industry itself has never been located in the Hindi Belt of north India, the north, largely Uttar Pradesh and Punjab, has remained the imaginary homeland for many Bombay-based Hindi films. While the films of the last twenty years may be set in Mumbai or overseas, often in London or New York, the main characters of the films reveal by their

language and their names that they are north Indians. (Dwyer 80)

Bollywood movies frequently marginalise and diminish the socio-political concerns of minority groups and communities in their cultural discourse. As a result, Bollywood movies frequently resort to stereotypes, caricatures, and typecasting to depict peripheral cultures, individuals, and communities. In addition, substantial populations from marginalised regions are noticeably absent from the narrative structure of this mass media platform. Petra Lenihan uses the term “hegemonic nationalism” to describe this phenomenon. According to her, “Indian cinema has sought to articulate a hegemonic nationalism through the exclusion and marginalization of specific bodies, cultures, religions, and practices”. (Lenihan 14).

Northeast India has traditionally been beyond the narrative scope of Bollywood films. In its century-long history, there have been a limited number of Bollywood movies depicting Northeast India, its culture, and people in the narrative. There are only a handful of Bollywood movies in which Northeast India has been used as the setting of the narrative. The region has been used as a filming site in a handful of films. Furthermore, there has been a limited representation of characters from Northeast India in the narrative of Bollywood movies. Therefore, there are only limited endeavours in Bollywood

in which the region appears as a setting in the plot, characterization, or backdrop of the narrative. Bollywood filmmakers prefer to travel to other regions of the nation and locations abroad, although the rich topography, diversity, and cultural heritage of the region make it an immensely potential shooting destination and a prospective setting for big Bollywood films.

Mainland Indian Bollywood filmmakers attribute the inadequacy of their film productions in the Northeast to the region's insufficient infrastructure, logistical shortcomings, and connectivity issues. As such, Bollywood movies project marginal region of Northeast India as "other" regions and its marginal population as the exotic "other" group of people from the margins of the nation-state. Hence, Bollywood movies frequently marginalise, exoticize, stereotype, and homogenise Northeast India and its indigenous population through the discourse of "othering."

Methodology of the Study

A film is an intricate form of audio-visual art that employs a formal narrative structure and visual language to tell a story. The film constructs its distinct visual universe through unique cinematic language and storytelling patterns. David Bordwell proposed the formalist approach to studying a film because it recommends a close examination of various formal,

narrative, and stylistic elements of the filmic representational system. David Bordwell contends that the film is an art form with a unique visual language, stylistic choices, and aesthetic with the cinematic techniques of the shot, mise-en-scene, cinematography, editing, and sound. According to David Bordwell and Kristin Thompson, every filmmaker creates a distinctive artistic and stylistic system to tell a story through the film medium. "Every film develops specific techniques in patterned ways. This unified, developed, and significant use of particular technical choices is called style" (Bordwell and Thompson 111). Christian Metz developed Cine Semiotics, which studies signs in cinematic language. Metz draws on structural linguistics to assert that film may be considered a language but not a complete language system. According to Metz, "The cinema is language...it is not because the cinema is language that it can tell such fine stories, but rather it has become language because it has told such fine stories" (47). He contends that cinematography and composition are vital in film for creating a filmic universe through "image discourse."

The formalist and semiotic theories of film emphasise the study of the formal structure and visual language of the film. The visual language of film includes various visual and aural elements such as cinematography, camera angles and movements, mise-en-scene, shots, composition, framing,

colour scheme, sound design, music, props, lighting, editing, and the on-screen performances of actors. The research work examines the visual language of the selected film.

In the theoretical discourse, the paper relies on the theories of postcolonialism and neocolonialism to examine the depiction of Northeast India as an exotic “other” region in Bollywood movies. The chapter explores how the region is marginalised from the national imaginary due to its geographical remoteness from mainland India. In this regard, the paper examines debates surrounding the concept of “exoticism” in various theoretical discourses. Furthermore, the paper will be analytical and descriptive in nature and explore issues that foregrounds projection of Northeast India as a faraway exotic land in the narrative of the movie.

The Exotic Northeast in the Setting:

The etymology of the term exotic is the Greek word “exo” denoting “outside” and “foreign.” According to the Oxford English Dictionary, the word “exotic” refers to an individual, location, or community that originates from or is situated in a foreign country, predominantly one with a tropical climate, and is perceived as intriguing and extraordinary. The term “exotic” categorises an individual or a group as uncommon and enigmatic. According to Judy Sund, the term “exotic” has been

used since the early seventeenth century to connote a captivating sense of unfamiliarity and fascination with cultural differences. She observes that “fascination with the Other...who are not ‘us’ and that which is not ‘ours,’” has been a subject of interest that has been embellished, exaggerated, and presented in an outlandish manner, often depicting unsettling and disagreeable distinctions” (Sund).

The concept of exoticism elicits diverse viewpoints. Graham Huggan attributes the act of exoticizing one culture by another to ideological and cultural construction. Graham Huggan argues that the notion of exoticism is not an innate trait but rather a socially constructed phenomenon.

For the exotic is not, as is often supposed, an inherent quality to be found ‘in’ certain people, distinctive objects, or specific places; exoticism describes, rather, a particular mode of aesthetic perception—one which renders people, objects, and places strange even as it domesticates them, and which effectively manufactures otherness even as it claims to surrender to its immanent mystery. (Huggan 10)

Adiba Hayat contends that Hollywood movies reassert a colonialist perspective by exaggerating cultural differences between the East and West. She is quite critical of the ways Hollywood movies depict Asian culture through stereotypical images as

dangerous, violent, exotic, odd, bizarre, sensual, or barbaric.

Leveraging the West's depiction of the East as inferior, uncivilised, and, for the most part, weird, the stereotypical portrayal, simultaneously, was about defining the West as the Orient's opposite - superior, civilised, and all around wonderful. Such representation of Asian culture in films is regarded as embodying a colonialist attitude. (www.tbsnews.net)

The commercial Bollywood films, as a derivative of Hollywood, exhibit a similar imagination of marginalised cultures and the tribal population in their narrative. Debashree Dattaray contends that Bollywood films do not grant Northeast India "political and cultural agency" in the narrative (Dattaray). Most Bollywood films about the Northeast region depict it as an exotic land of hilly terrain inhabited by indigenous people unaffected by modernization. Bollywood films continue to uphold this visual narrative about the region as an exotic tribal territory on the margins of the nation-state.

According to David Spurr, Western journalistic writing carries an ideologically charged "postcolonial gaze," which functions as an "active instrument of construction." He argues that the postcolonial gaze "offers aesthetic pleasure on the one hand and information and authority on the

other." "This combination of pleasure and power gives the commanding view a special role in journalistic writing, especially in the colonial situation, for it conveys a sense of mastery over the unknown and over what is often perceived by the Western writer as strange and bizarre" (Spurr 15).

Bollywood movies set in the Northeast often exhibit a commanding and ideologically charged "postcolonial gaze" towards marginalised regions and cultures. This gaze on the exotic "other" manifests in the form of exotification and stereotyping of marginal communities. This gaze on Northeast India reveals as a novel form of neocolonialism and cultural imperialism.

Bollywood movies frequently incorporate long shots of scenic geography, including snow-capped mountains, picturesque valleys, dusty roads, rivers, paddy fields, verdant vegetation, and expansive stretches of uninhabited land. This frequent use of long shots and bird's-eye-view shots enhances the exotic ambience of the setting. This depiction of picturesque landscapes and rugged mountainous terrain elicits the perception of a perilous and foreign wilderness located on the outskirts of the nation-state. As such, Bollywood movies frequently highlight the visually captivating and aesthetically appealing landscapes in the Northeast. Therefore, mountainous landscapes, picturesque terrains, and tea

gardens comprise most of the settings in Bollywood films that depict the Northeast region. Here, Bollywood films frequently homogenise, stereotype, and exoticize the vast Northeast region by categorising it under the single term “Northeast” irrespective of the decade in which the films are released.

Furthermore, Bollywood films frequently depict Northeast India as an enigmatic territory situated on the periphery of the nation-state. In the visual regime of Bollywood movies, Northeast India appears as a picturesque region situated at a considerable distance from the mainland and inhabited by marginalised tribal communities that remain largely unaffected by modernization, development, and progress. The narrative of Bollywood movies often alludes to the region’s apathetic road connections, inadequate infrastructure, insufficient medical services, and a lack of educational facilities. Therefore, Bollywood movies tend to depict Northeast India as a primitive, exotic, underdeveloped, and perilous tribal region. This is a fictional realm that Bollywood movie narratives frequently create while depicting Northeast India as the setting. In addition, Bollywood movies frequently resort to geographical appropriation, as scene locations, settings, and geographies are seldom identified in the narrative.

Exotic Arunachal Pradesh in *Bhediya*

Amar Kaushik’s 2022 comedy-horror film *Bhediya* is one of the recent Bollywood endeavours to depict Northeast India. *Bhediya*, starring Varun Dhawan and Kriti Sanon, was entirely set in Ziro, Papum Pare, and Pakke-Kessang districts of Arunachal Pradesh. The film was one of the first Bollywood endeavours to be entirely shot in Arunachal Pradesh. The film featured more than sixty percent of the local actors.

The film revolves around the experiences of two individuals from mainland India, Bhaskar (Varun Dhawan) and his cousin Janardhan (Abhishek Banerjee), in the state of Arunachal Pradesh. The two mainland Indian men, Bhaskar and Janardhan, are in Ziro, in Arunachal Pradesh, to undertake a highway construction project as contractors.

The film begins with a bird’s-eye shot of a mountainous region before zooming into a dense forest and a rock cavern. The opening scene establishes the setting of the narrative as an exotic, treacherous, and underdeveloped, mysterious landscape. The film presents Arunachal Pradesh as a strange place where there is the practice of black magic and constant dread from mysterious creatures. The film also depicts Arunachal Pradesh as an underdeveloped, exotic, and hazardous

tribal territory. In numerous sequences, long shots are extensively used to capture the scenic plateau and picturesque landscapes, verdant hills, snow-capped mountains, dense vegetation, green paddy fields, hanging bridges, rivers, traditional bamboo huts, and wildlife.

In multiple sequences of the film, Arunachal Pradesh is mentioned as a remote area, a faraway territory, and an exotic land. The authenticity of the film's setting is established in several scenes featuring mileposts displaying the names of real locations in the state, such as Itanagar, Ziro, and Kheel. Moreover, the film depicts representative tribal characters wielding spears and wearing traditional costumes, including bamboo caps, tribal multi-coloured outfits, and beaded jewellery. The inclusion of folk tribal humming as a background score in different scenes serves to evoke the sense of an exotic tribal land. In numerous scenes, the camera captures elevated bamboo houses where swords are prominently displayed on the walls and animal heads serve as showpieces.

The protagonists from mainland India are seen embarking on air travel and a road trip to reach their destination in Ziro, in Arunachal Pradesh. A scene depicts the protagonist Bhaskar and his cousin Janardhan departing from the airport with their baggage. They then embark on an extended car trip to their destination via a treacherous, muddy,

and hilly road. A song sequence of five minutes duration is played during their car ride. The song "*Hey, baki sab thik?*" (Is everything good?) tends to depict Arunachal Pradesh as a hazardous, underdeveloped, inaccessible, and exotic tribal terrain. Empty and deteriorated roadways amidst the lush and vibrant natural environments are captured in the song sequence. In addition, numerous scenes in the film showcase wild animals, including wolves, snakes, bats, frogs, and wild oxen.

The film depicts the *Apatani* tribe of the region as a forest-dwelling, highly perilous group that is not welcoming to outsiders in their region. The tribal group is portrayed as illiterate, primitive, and one of the many dangerous tribes living on the hilly terrain. Therefore, the film depicts Arunachal Pradesh as an exotic hilly terrain where a mainland Indian man is on a progressive mission.

The film features a tribal man from Arunachal Pradesh as one of the lead characters in the narrative. The man Jomin (Paalin Kabak) is a local boy of Ziro and a college friend of mainland Indian man Bhaskar. The film perpetuates stereotypes about the tribal boy Jomin as a man from China and Korea. The film portrays that he has a strong taste for Chinese fast-food items such as "Chow-mein" and "Momo." In some scenes, Jomin is depicted eating such Chinese-origin fast-food items.

According to Dovidio et al., “language plays an important role in the transmission of stereotypes” (8). In the film, Jomin’s poor Hindi accent and casual use of tribal slang words also cast him as a tribal stereotype.

The narrative incorporates representative scenes where Jomin encounters racist slurs and microaggressions from Bhaskar’s cousin Janardhan. In their first encounter, Janardhan greets Jomin with a caricatured expression. Janardhan also mimics Jomin and deliberately mispronounces the name Jomin as “*Chow-mein*.” In other scenes, Janardhan keeps asking Jomin to speak in Hindi when Jomin speaks broken Hindi. Janardhan says to Jomin, “Speak in Hindi. Do not speak Chinese.” Janardhan considers Jomin a Chinese man because he cannot fluently converse in Hindi. In another scene, Janardhan says to Jomin, “Stop listening to Korean songs” and “Stop thinking only about Chinese food.”

Jomin is frustrated at the perpetual casual racism of mainland Indian man Janardhan. In an important scene, Jomin vents his anger at Bhaskar and Janardhan. Jomin blames Bhaskar and Janardhan as outsiders to the Northeast who are reaping the resources of the region. In the scene, Jomin highlights the persistent oppression of Northeast India and its tribal population.

JOMIN: The local folks are right. You outsiders are the virus. You are leeching off the local folks. Even everyone out there feel the same way. Janardhan discriminates against me casually over every little thing! Even you laugh at his jokes. Do you think I do not feel bad? He has been pestering me to show kung-fu. Do you want to see kung-fu now? I do not know kung-fu. For you folks, all of Northeast is a Shaolin temple and we are Jackie Chan and Bruce Lee’s children. Right? When people call us Chinese in our own country it feels so bad! It really hurts! And Janardhan, if one’s Hindi is weak, it does not make him any less Indian! (*Bhediya* 01:34:32-01:35:17)

The film portrays Arunachal Pradesh as an exotic “other” land on the margins of the nation-state. In addition, the film resorts to othering and stereotyping people from Northeast India as exotic tribal “others.” The stereotyping and othering are manifested in the form of representative scenes of racist slurs and microaggression encountered by tribal people. In addition, the filmmaker uses the poor Hindi accent and unique culinary practices of indigenous individuals in Northeast India to perpetuate stereotypes.

In multiple sequences of the film, Arunachal Pradesh is mentioned as a remote area, a faraway territory, and an exotic land. In a particular scene, Bhaskar’s father, Mr. Sharma (Manoj

Bakshi), refers to Arunachal Pradesh as an “unfamiliar country” and “far-off region.” In an important scene, the way Janardhan discusses Arunachal Pradesh suggests that the region exists beyond the collective consciousness of the nation-state. Janardhan, who is currently preparing for the IAS examination, is utterly ignorant about Northeast India. The remarks made by him allude to the way the mainland Indian narrative marginalises the region. In the scene, when Bhaskar informs Janardhan that they are travelling to Arunachal, Janardhan expresses utter ignorance regarding the region.

- JANARDHAN: I See! So, we are going to Imphal?
- BHASKAR: Imphal is in Manipur.
- JANARDHAN: Oh! You are right. Sorry! Our ticket must be for Meghalaya.
- BHASKAR: Meghalaya is a different state. We are going to Guwahati.
- JANARDHAN: Oh! Sorry. Guwahati is the capital of Arunachal Pradesh, right?
- BHASKAR: Guwahati is in Assam. The capital of Arunachal Pradesh is Itanagar.
- JANARDHAN: Since when? (*Bhediya* 00:07:35-56)

The film further exoticizes the Northeast region by introducing the character of a medicine man or shaman (traditional healer) who practices black magic and witchcraft to help the villagers. The narrative introduces this character as an old man who has reached the age of 120 and who can even interact with wild animals. The filmmaker incorporates this character to refer to rampant superstition in the region. Moreover, the film highlights the insufficiency of medical services and facilities in the geographically remote region.

The film addresses the issue of deforestation and the need for environmental conservation in the narrative. However, the film also portrays the local administration, forest officers, and engineers as corrupt individuals who accept bribes from mainland Indian contractor Bhaskar and assist him in the road construction project. Therefore, the film addresses the corrupt practices of both mainland Indian administration and local administration in the Northeast region in exploiting the region’s verdant landscapes under the guise of progress and development.

Conclusion

Stuart Hall asserts that representation normally involves construction, substitution, production, and displacement of meaning. Representation does not encompass a

“true reflection or imitation of reality” (59). According to him, the act of representation involves the construction of cultural identity through binary divisions. Hall describes exoticism in the following terms:

“...people who are in any way significantly different from the majority- “them” rather than “us”-are frequently exposed to the binary form of representation. They seem to be represented through sharply opposed, polarised, binary extremes-good or bad, civilised or primitive, ugly or excessively attractive, repelling because different, or compelling because strange and exotic.” (Hall 229)

Bollywood movies with a Northeast setting frequently resort to geographical, cultural, linguistic, and tribal appropriation. Hence, Bollywood movies exoticize, stereotype, and marginalise people from Northeast India in the narrative. As a film directed by someone from mainland India, *Bhediya* continues the tradition of exoticizing Northeast India in the narrative. It has portrayed the Northeast region as an exotic, underdeveloped, hazardous, and remote tribal territory on the margins of the nation-state. The idealistic hilly terrain, picturesque landscape, valleys, rivers, and tea gardens shown in the film tends to exoticize the Northeast region to a greater extent. Furthermore, the movie does not have a proper depiction of the specific places and locations of the

region. In the narrative of this movie, neither the story’s setting nor its locations are adequately identified. In addition, the region is depicted as a remote region associated with insecurity and peril and populated by hazardous tribal groups. Moreover, the movie alludes to an abundance of corruption, the state of underdevelopment, and the prevailing infrastructural deficit in the region.

In this context, this Bollywood routinely resorts to clichéd images while depicting Northeast India. It tends to uphold the popular prejudices surrounding Northeast India and its vast population. In doing this, *Bhediya* endorses Northeast India as an exotic land located in the margins of the nation-state. Although the filmmaker has declared it as a work of fiction, the film tends to homogenize and appropriate the Northeast region as the wild “Northeast” frontier. In this context, the movie tends to promote a mainstream nationalist ideology that fails to integrate the Northeast region and its marginal culture into the narrative. It merely aggravates the “communication gap” that exists between mainland India and Northeast India. The portrayal of the vast population of the Northeast as a potentially hazardous tribal population residing on the periphery of nations in the movies such as *Bhediya* has adverse consequences for the community’s identity. This intensifies the cultural and

emotional divide that exists between the mainland Indian population and the marginalised communities of Northeast India.

Works Cited

Bhediya. Directed by Amar Kaushik. Maddock Films, 2022.

Dattaray, Debashree. "Rearticulating Bollywood: Through the Indigenous Lens of the North East." *MZU Journal of Literature and Cultural Studies*, edited by Cherrie Lalnunziri Chhangte, vol. IV, no. 1, Mizoram University, 2017, pp. 39–50.

Dovidio, John F., et al., editors. *The SAGE Handbook of Prejudice, Stereotyping and Discrimination*. Sage Publications Ltd., 2010, doi:10.4135/9781446200919.

Dwyer, Rachel. *Bollywood's India - Hindi Cinema as a Guide to Contemporary India*. First, Reaktion Books, 2014.

Ganti, Tejaswini. *Bollywood - A Guidebook to Popular Hindi Cinema*. Second, Routledge, 2013.

Petra Lenihan. *Rethinking Indian Cinema: Toward a Cinema of Multiplicity*. University of Otago, 2014.

Spurr, David. *The Rhetoric of Empire: Colonial Discourse in Journalism, Travel Writing, and Imperial Administration*. Duke University Press, 1993.

Viridi, Jyotika. *The Cinematic Imagination*. Permanent Black, 2007.

Web Sources

Exotic - a Fetish for the Foreign by Judy Sund. <https://www.gdcinteriors.com/exotic/>. Accessed 3 July 2023.

Hayat, Adiba. *From Entrapment to Extraction: The Subtle Art of Orientalism in Films | The Business Standard*. <https://www.tbsnews.net/panorama/entrapment-extraction-subtle-art-orientalism-films-82288>. Accessed 22 Dec. 2023.

Huggan, Graham. *The Postcolonial Exotic: Marketing the Margins*. Routledge, 2001, <http://books.google.com/books?id=KDeDAgAAQBAJ>.

The Interplay of Multilingualism and Cultural Identity in Abdulrazak Gurnah's Narratives

Mr. Cinto Jose

Research Department of English, Sacred Heart College (Autonomous)
Thirupattur-635601, Thiruvalluvar University, Serkadu-632115
cintojose1@gmail.com

Abstract

Abdulrazak Gurnah- the Tanzanian-born British novelist and 2021 Nobel laureate, is acclaimed for his intricate explorations of migration, exile, memory and identity. A distinctive feature of his fiction is the nuanced use of multilingualism, particularly the interplay between Swahili and English, which is closely tied to cultural identity. In Gurnah's narratives, language functions as more than a communicative tool; it shapes subjectivity, negotiates power and expresses belonging. This paper examines how multilingualism in Gurnah's works, including *By the Sea*, *Desertion*, *The Last Gift*, and *Afterlives*, operates as a mechanism for cultural adaptation. Through strategies such as code-switching, Africanized English, and the integration of indigenous expressions, Gurnah's characters navigate liminal spaces between homeland and host society, creating hybrid identities that resist cultural erasure. Drawing on postcolonial theory, especially Homi K. Bhabha's concept of the "third space," the study highlights how linguistic hybridity facilitates identity reconstruction, memory preservation and cultural continuity in contexts of displacement. The analysis also underscores how Gurnah transforms English into a vehicle for African expression, challenging colonial linguistic dominance while articulating the complexities of diaspora experiences. Ultimately, multilingualism in Gurnah's fiction emerges as a vital means of negotiating exile, memory and belonging, reflecting the dynamic and fluid nature of cultural identity in postcolonial contexts.

Keywords: Multilingualism, Postcolonial literature, Code-switching, Swahili, Liminality, Hybrid Identities.

Abdulrazak Gurnah, the Tanzanian-born British novelist and Nobel laureate of 2021, is widely celebrated for weaving complex narratives about migration, exile, memory and identity. One of the most compelling aspects of his fiction is his nuanced use of language' his characters frequently move between Swahili, English and other linguistic registers and this multilingualism is deeply

entangled with cultural identity. In his novels, language is not a neutral medium but an active force in shaping subjectivity, negotiating power and expressing belonging. This paper argues that in Gurnah's oeuvre, multilingualism functions as a critical resource for cultural adaptation: it enables hybrid identities, liminal belonging and resistance to cultural erasure. Through a close reading of texts

such as *By the Sea*, *Desertion*, *The Last Gift*, and *Afterlives*, and by drawing on postcolonial theory (especially Bhabha's notions of hybridity and "third space"), I explore how Gurnah uses language to dramatize the experience of exile and the cultural negotiation of displaced lives.

To understand Gurnah's multilingualism, it helps to situate him in the broader context of postcolonial literature and theory. Postcolonial writers often grapple with inherited colonial languages and indigenous tongues, producing hybrid linguistic landscapes. Theorists like Homi K. Bhabha describe hybridity as a "third space" of enunciation, where subjectivities are neither wholly native nor entirely colonial but situated between, in a dynamic process of negotiation (Bhabha, *The Location of Culture*). In Gurnah's work, this third space is not only cultural but linguistic: characters inhabit languages that mediate their histories and their present.

Gurnah's use of English, in particular, is significant. According to an analysis in *Postcolonial Text*, even though English becomes his literary medium, Gurnah recalls it as a "spacious and roomy house, accommodating writing and knowledge with heedless hospitality." This metaphor suggests that English for Gurnah is not merely a colonial inheritance but a tool he reclaims,

transforming it into a site of cultural negotiation rather than domination.

One of Gurnah's frequent techniques is code-switching between Swahili and English. This is not superficial ornamentation - it is woven into the fabric of character, memory and belonging. For example, in *By the Sea*, characters occasionally speak Swahili short phrases, underscoring their origin, their emotional world and their cultural memory. These linguistic inflections offer authenticity and continuity with the past even as characters navigate foreign lands. Scholar Ma Jun argues that Gurnah's selective use of Kiswahili in his English prose evokes cultural memory and roots. This echoes the way diaspora subjects use native languages to reaffirm identity in displacement.

Although English dominates the narrative language, Swahili's persistent presence challenges colonial linguistic hierarchy. By refusing to fully translate or explain every Swahili word. It shows the privilege of the Privileges local knowledge, forces the reader to engage with linguistic difference and resists the assumption that English is a universal medium of meaning. In *The Last Gift*, Gurnah's characters are caught in between inherited "codes" (traditions from their homeland) and imposed "patterns" (norms of the host culture). Their linguistic practices reflect this liminality: they negotiate belonging by adopting some hostculture idioms while

retaining fragments of their cultural tongue.

Rather than choose between their homeland and their host society, they form a hybrid self through Ngugi views language as the storehouse of a people's culture and worldview. According to him, when a community abandons its native language in favour of a colonial one, it risks losing its cultural memory and self-definition. Multilingualism, in colonial contexts, is therefore not neutral; it often involves unequal power relations. Ngũgĩ argues that reclaiming indigenous languages is an act of cultural resistance and self-affirmation.

Gurnah disrupts the dominance of standard English by "Africanizing" it in his prose. Nanjinja and Xu's study of *Afterlives* reveals how he uses code-mixing, local idioms and structural reshaping to infuse English with African speech rhythms and expressions. This is not simply a stylistic choice but a political one, by Africanizing English, Gurnah reclaims a colonial language, rendering it expressive of his characters' cultural world. This strategy resonates with postcolonial calls for linguistic decolonization. Gurnah does not reject English outright but repurposes it to articulate cultural hybridities and resist cultural erasure. In *Afterlives*, scholars note the presence of Kiswahili words like "wanyamwezi," "wachagga," "wameru," "mnafiki," and "kanga" interspersed throughout the narrative to

represent ethnic groups, moral judgments, and local material culture - essentially code-switching reflecting the multilingual Swahili coast.

In *By the Sea*, the refugee protagonist Saleh Omar's language practices reflect his cultural dislocation. His Swahili past weighs on him even as he navigates the English-speaking asylum system. Through his memories and the fragments of Swahili he utters, language becomes a way for him to sustain a link to his homeland. Meanwhile, English is his tool for survival. His hybrid linguistic identity mirrors his social position, neither fully accepted nor wholly alien, he occupies a "third space." Xu's study shows how this third space fosters identity reconstruction: the characters' narratives, told partly in English and punctuated by Swahili, demonstrate how hybridity is not a simple compromise but a creative negotiation. Gurnah writes all his novels in English but regularly incorporates Swahili words and phrases to reflect East African speech patterns, cultural concepts, and situated meanings that English alone would not capture. He has explained that sometimes "*the right word in English just doesn't exist*," so he will use the original Swahili and then provide context or a gloss.

In *Desertion*, Gurnah's multilingual strategy is more subtle but no less significant. The novel reflects on the layered histories of Zanzibar's

coastal communities, where Arabic, Swahili and English coexist. These linguistic layers represent overlapping cultural identities- religious, ethnic and colonial. The characters' speech patterns subtly reveal these tensions and intersections: their cultural identity is not monolithic but multiple and language dramatizes this multiplicity. As noted, *The Last Gift* explicitly explores liminality and hybridity. The immigrant characters are haunted by "inherited codes" - memories, cultural habits - even as they try to adapt to Western norms. Their linguistic practices, described by scholars are central to this tension. They sometimes slip into Swahili, sometimes adopt English idioms and sometimes even rework English to reflect their cultural sensibilities. This negotiation of languages mirrors their negotiation of identity and belonging.

In *Desertion*, storytelling itself reflects Swahili oral traditions, even when rendered in English prose. The rhythms of speech, proverbial expressions, and indirect narration echo Swahili conversational styles. Elders' speech often carries oral cadence, shaped by Swahili narrative conventions. Memories of the past are frequently framed through Swahili expressions that emphasize collective memory rather than individual confession.

In *Afterlives*, set in colonial East Africa, Gurnah's characters inhabit a

multilingual world: German, English, Swahili and local languages intermingle. Through "Africanized English," Gurnah resists monolithic colonial discourse and asserts a culturally rooted voice even within a colonial context. The linguistic hybridity here is not just about personal identity but about historical memory and resistance.

By mixing languages, Gurnah's characters resist the erasure of their cultural past. Multilingualism becomes a site of agency: to speak Swahili, even in an English-dominated context, is to assert presence. Similarly, to reshape English is to challenge colonial linguistic authority. Language in Gurnah's work is deeply tied to memory. Swahili phrases evoke childhood, community and homeland. Even when characters cannot return physically, they return linguistically, using their native speech as a way to relive and preserve their past. The linguistic hybridity of Gurnah's fiction aligns with his thematic concerns of exile and diaspora. Characters rarely belong wholly to either their origin or their host culture. Instead, they inhabit a liminal space, negotiated and performed through language. According, to Sreya Mallika Datta, Gurnah's novels articulate what she terms a "Swahili transmodernity" - a form of communal being shaped by the Indian Ocean's flows and cross-cultural relations. Through multilingual practices, Gurnah's characters enact this

transmodern ethic: they are part of a community that is both local and global, rooted and mobile.

Edward Said emphasizes that language plays a central role in how cultures are represented and understood. Multilingualism exposes the imbalance between dominant and marginalized languages, especially in colonial discourse. For Said, cultural identity is often shaped by who controls language and narrative. Knowing multiple languages allows individuals to move between perspectives and challenge imposed representations. Stuart Hall views cultural identity not as something fixed or inherited but as something constantly produced and reproduced. Multilingualism illustrates this fluidity, as individuals shift between languages depending on context, audience, and experience. Each language activates a different cultural memory, making identity dynamic and situational rather than stable.

Applying postcolonial theory helps illuminate why Gurnah's multilingualism is more than stylistic. Bhabha's "third space" provides a lens to see how hybrid identities form not in pure binaries but in between. Through language, Gurnah's characters create this third space. Their use of English and Swahili is not a fixed marker of origin but a dynamic means of cultural remaking. Furthermore, Gurnah's linguistic choices reflect a decolonial

orientation. Rather than rejecting English entirely - which might risk invisibility on the global literary stage - he transforms it, making it speak from his cultural standpoint. As Maria Joao Ferreira argues, Gurnah's work engages with decolonization not only in terms of land or social structures but also in knowledge production: language is a site where epistemic injustice can be challenged.

Conclusion

In Abdulrazak Gurnah's narratives, multilingualism is not a peripheral aesthetic; it is central to his exploration of cultural identity in exile. By weaving Swahili and English and by transforming English into a vehicle for African expression - he constructs a linguistic space where hybrid identities emerge, negotiate and persist. This linguistic hybridity reflects and reinforces his broader themes of displacement, memory and belonging.

Through his characters' speech, Gurnah dramatizes how cultural identity is not fixed but fluid. Multilingualism in his work becomes a powerful form of cultural adaptation: a way to resist colonial erasure, preserve memory and affirm presence in liminal spaces. In doing so, Gurnah offers a literary vision of belonging that is as linguistically as it is culturally plural - a testament to the creative, resistant, and deeply human possibilities of language.

Works Cited

Primary Sources

Gurnah, Abdulrazak. *By the Sea*. Bloomsbury Publishing, 2001.

Gurnah, Abdulrazak. *Desertion*. Bloomsbury Publishing, 2005.

Gurnah, Abdulrazak. *The Last Gift*. Bloomsbury Publishing, 2011.

Gurnah, Abdulrazak. *Afterlives*. Bloomsbury Publishing, 2020.

Gurnah, Abdulrazak. *Admiring Silence*. Bloomsbury Publishing, 1996.

Secondary Sources

Agri, Fikret Güven. "Liminal Margins and the Appropriation of the Inherited Codes and Imposed Patterns in Abdulrazak Gurnah's *The Last Gift*". *Journal of Narrative and Language Studies*, 2024. nalans.com

Ashcroft, Bill; Gareth Griffiths, Helen Tiffin. *The Empire Writes Back: Theory and Practice in Post-Colonial Literatures*. Routledge, 1989.

Datta, Sreya Mallika. "Swahili Transmodernity and the Indian Ocean: Abdulrazak Gurnah's Ethic of Community" in *By the Sea, Desertion, and Gravel Heart*. *Postcolonial Texts*, vol. 14, no. 3 & 4, 2019. postcolonial.org

Du, Yujin, and Dan Cui. "A Study of Gurnah's Memory Narrative and Diaspora Identity". *Communication, Society and Media*, Vol. 5, No. 2, 2022. Scholink

Ferreira, Maria João. "A Language Spoken with Words: Decolonization, Knowledge Production and Environmental Injustice in the Work of Abdulrazak Gurnah". *Journal of Narrative and Language Studies*. nalans.com

International Journal of Narrative and Language Studies, ISSN 2148-4066.

Jiarui, Xu. "Identity Construction in the Post-colonial Period: Hybridity and Third Space in Abdulrazak Gurnah". *Academic Journal of Humanities & Social Sciences*, vol. 6, no. 19, 2023. Francis Academic Press.

Journal of Narrative and Language Studies (NALANS). *Journal of Narrative and Language Studies*, Vol. 13, No. 27, June 2025, nalans.com.

Kavinkumar, P. and M. Selvam. *Cultural Deconstruction in Abdulrazak Gurnah's Refugee Narratives: A Postcolonial Reading*. IJRASET Journal. IJRASET

Nanjinja, Geniva Clement, and Shiyun Xu. *Africanizing of the English language in African Novels: Analysis of Abdulrazak Gurnah's Afterlives*, 2020. *International Journal of Linguistics*. IPRJB.

Soleymanzadeh, Laya. *Hospitality, Multiculturalism and Narrative Agency in Abdulrazak Gurnah's By the Sea, The Last Gift and Gravel Heart*. (Master's thesis, METU, 2021). OpenMETU

Thakur, Khushboo, and Navreet Kaur Sahi. *Exile, Belonging, and the Post-colonial Imagination in the Novels of M.G. Vassanji and Abdulrazak Gurnah*. *International Journal of English Language, Education and Literature Studies*. Ijeel

Web Sources

gyy.snnu.edu.cn.

nalans.com.

postcolonial.org.

Blurring Boundaries: Cyborg Identity and Techno-Political Resistance in *Rosewater*

Aysha Farhana S.M,

Ph.D. Research Scholar,
Department of English, St.John's College, Palayamkottai
Affiliated to Manonmaniam Sundaranar University, Abishekapatti, Tirunelveli
ayshafarhana200@ gmail.com

Dr. J. Pinky Diana Evelyn,

Assistant Professor and Research Supervisor, Department of English,
St.John's College, Palayamkottai
Affiliated to Manonmaniam Sundaranar University, Abishekapatti, Tirunelveli

Abstract

This study examines the formation of cyborg subjectivity and the dynamics of techno-political oppression represented in Tade Thompson's *Rosewater*. Thompson's narratives delve into the future Nigeria, where an alien dome is formed in the town of Rosewater and disrupts human society. Due to the alien contact, hybrid-like beings named sensitives are formed. Employing Haraway's cyborg theory, this research investigates Kaaro as a cyborg subject who challenges the conventional boundaries between humans and machines. It also explores the tension between cyborgs and power structures by navigating more into the themes of hybridity, shifting identity, and power play. Additionally, this paper highlights the importance of maintaining agency and resisting the exploitation, stating cyborg as a symbol of resistance against technological and political oppression of power structures.

Keywords: Cyborg, Oppression, Surveillance, Hybridity, Agency

Mankind has been pushed forward to unprecedented levels with the development of science and technology. This ambition of techno-science anticipates a shift towards the Posthuman paradigm. The term Posthumanism was coined by the postmodern theorist Ihab Hassan in an

article entitled "Prometheus as Performer: Towards a Posthumanist Culture?" where he defines Posthumanist culture as "sudden mutation of the times" (834). The potential of technoscience to enhance human survival in a posthuman world inspired writers to produce Cyborg

Literature. The word ‘cyborg’ is a combination of cybernetics and organism, which was coined in 1960 by two NASA scientists, Nathan Kline and Manfred Clynes in their essay *Cyborgs and Space*, where they envisioned to enhance the abilities of mankind to survive in the extreme conditions of outer space:

For the exogenously extended organisational complex functioning as an integrated homeostatic system unconsciously, we propose the term “Cyborg”. The Cyborg deliberately incorporates exogenous components extending the self-regulatory control function of the organism in order to adapt it to new environments. (27)

According to Darwin, evolution is categorised by adaptation for survival. In *The Origin of Species*, Darwin writes, “Natural Selection, as we shall hereafter see, is a power incessantly ready for action, and is immeasurably superior to man’s feeble efforts, as the works of Nature are to those of Art” (51).

In literature, cyborg has been used to examine the boundaries of identities. In Mary Shelley’s *Frankenstein*, the monster can be viewed as a kind of cyborg, created as a result of fusion of human and animal and struggles with the identity crisis. In science fiction literature like *Bionic Commando* by Marc Cerasini and *Do Androids Dream of Electric Sheep* by Philip K. Dick, cyborgs are used as a metaphor for

human enhancement and its ethical considerations. Cyborg Literature investigates the intersection of humanity and technology and studies how humans define humanness in relationship to machines and their effects on culture and society. It gives insights into a wide range of texts and explores the themes of identity, power relations, and ethics of human enhancement. It plays a vital role in shaping, refining and reflecting the cultural attitudes toward technology and identity contributing to a deeper understanding about constructive identity and power relations.

Bruno Latour states that human and non-human actors should co-act in dynamic networks as the interaction between human and technology helps to reform and rebuild a constructive society. Latour in *Reassembling the Social: An Introduction to Actor-Network-Theory* puts it,

Using a slogan from ANT, you have ‘to follow the actors themselves’, that is try to catch up with their often wild innovations in order to learn from them what the collective existence has become in their hands, which methods they have elaborated to make it fit together, which accounts could best define the new associations that they have been forced to establish. (12)

Latour’s approach insists the importance of tracing the associations and interactions among diverse actors

for entirely contributing to collective existence. The role of advanced technological development is inevitable to maintain the political stability of a country. As societies evolve more towards interconnected and digitalised systems, the cyborg technologies provide possibilities to enhance governance efficiency, decision-making, and security. However, this integration has also led to the ethical questions regarding autonomy, privacy, and so on.

Tade Thompson is a British-born Nigerian psychiatrist and writer. He is also an illustrator and artist. He is best known for his work *The Wormwood Trilogy. Rosewater*, the first book in *The Wormwood Trilogy*, was published in 2016. Tade Thompson's *Rosewater* is a blend of science fiction and Afrofuturism which deals with the autocratic government in futuristic Nigeria. It talks about the effects of the influence of alien technology on mankind. Due to the alien contact, hybrid-like beings named sensitives are formed, which helped the Nigerian government sustain their control over people. The present study utilises the concept of cyborg explained by Donna Haraway in her work *A Cyborg Manifesto: Science, Technology, and Socialist Feminism in the Late Twentieth Century* published in 1991. Donna Haraway is an American professor and an eminent scholar in the field of science and technology studies.

She has contributed to information technology and feminist theory. The increase in curiosity among individuals about becoming cyborgs inspired Neil Harbisson and Moon Ribas to start the Cyborg foundation. Its vision is to improve human abilities through cybernetic extension to the body.

According to Haraway, "A cyborg is a cybernetic organism, a hybrid of machine and organism, a creature of social reality as well as a creature of fiction. Social reality is lived social relations, our most important political construction, a world-changing fiction" (149). Haraway viewed cyborg as an organism whose abilities and functions are enhanced by a cybernetic system. She also argues that the cyborg disrupts the fixed boundaries between humans and machine, nature and technology, self and other. Similarly, in the novel *Rosewater*, when the people come into contact with the alien biodome formed in the town of Rosewater the alien technology interacts with human physiology, which leads to the development of psychic abilities. Kaaro, a sensitive and the protagonist of the novel, is a blend of human and machine. Thompson has talked about the Xenosphere, through which all the sensitives can access and manipulate information. Xenosphere serves as a web for the sensitives to access people's thoughts, emotions, and memory. It symbolises a blurred boundary between

human consciousness and alien technology. Kaaro along with other sensitives acts as a hybrid nexus between humanity and alien entity. His abilities like telepathy, mind reading and Extrasensory perception are partial human and partial alien placing him in a cyborgian liminality.

Haraway claims, “The cyborg does not dream of community on the model of the organic family” (67). Kaaro is not entirely independent as well as not wholly subjugated to the alien entity. Though having fractured identity, Kaaro chooses to operate within the system that rejects human exceptionalism, acknowledging that intelligence and consciousness extend beyond traditional humanist models. This aligns with Haraway’s assertion that Cyborgian identity must be understood as fluid, adaptive and co-evolving with technology.

Through the concept of reconstructive surgery, Thompson has talked about the fusion of human biology and alien technology. People who are diseased get healed when they are exposed to the biodome. The healed characters in the novel are biological cyborgs, transformed by alien technology that blur the line between the human and the other. Due to the reconstructive surgery, their identities are constructed, raising questions about the nature of humans. The self-imposed desire of people towards reconstructive

surgery has been explained through the following lines:

Every year, though, the bio dome opens for twenty or thirty minutes in the south, in the Kehinde area. Everyone in the vicinity of the opening is cured of all the physical and some mental ailments. It is also well known and documented that the outcome is not always good, even if diseases are abolished. There are reconstructions that go wrong, as if the blueprints are warped. Nobody knows why this happens, but there are also people who deliberately injured themselves for the sole purpose of getting “reconstructive surgery”. (Thompson 9)

Being sensitive, Kaaro faces psychological issues and an identity crisis. Haraway points out, “The main trouble with cyborgs, of course, is that they are the illegitimate offspring of militarism and patriarchal capitalism, not to mention state socialism. But illegitimate offspring are often exceedingly unfaithful to their origins. Their father’s, after all, are inessential” (151). Kaaro is a secret agent of S45 working for the Nigerian government. His psychic abilities are used for interrogating criminals and manipulating the thoughts of the anarchist. They play a vital role in sustaining the governance. But they are affected psychologically too. One such incident is when Kaaro was forced to interrogate a criminal suspected of killing his wife. As a sensitive Kaaro

probes into the memory of the suspect to extract information about the murder, where he experiences the killer's thoughts and emotions.

"My wife is dead. I should be sad, right?" I ask.

"Kaaro, you have never been married. You never even met Lydia. You spent time in her homicidal husband's mind. The experience was so intense that you can't disconnect. The pills aren't working. I'd like to try something else". He slides across consent forms for shock treatment. (Thompson 29-30)

Kaaro visualises and witnesses not only the murder but also feels the killer's lack of guilt and brutal mindset. Kaaro is affected intensely as he experienced the murder through the mind of the person who committed it and he viewed himself as the murderer. Though his psychic abilities are powerful, painful thoughts and emotions make him vulnerable, emotionally drained, and psychologically damaged. Throughout the novel, his human nature and technologically enhanced abilities blur his identity. Thompson has explained it through the following lines:

The temptation to look into her head is overwhelming, but I resist. This is one of the reasons I do not date. Once you've been in the xenosphere, you get used to rapid familiarity. You scan

quickly and know that the person in front of you is hiding a second wife or has a secret vice. The usual mutual self-disclosure, which regular people do, is plodding and inaccurate, but this equality is necessary for a real relationship. Patience. (38)

As a sensitive, Kaaro is boastful of his psychic abilities and never misses an opportunity to utilise them. Even when he is clueless about the lineage about Aminat, his lover, Kaaro has not used his psychic abilities. However, the more he tries to deny his identity, the more he is drawn to it due to his nature.

Haraway says, "The Cyborg is a creature in a post-gender world; it has no truck with bisexuality; pre-oedipal symbiosis; unalienated labor, or other seductions to organic wholeness through a final appropriation of all the powers of the parts into a higher unity" (150). Haraway demonstrates cyborg as a symbol of resistance against traditional structures of power and hierarchy. She rejects the conventional categories and fixed boundaries that reinforce oppressive systems. In the novel *Rosewater*, Kaaro stands as a symbol of resistance against the autocratic government and alien entities. Initially, he performed his duty out of fear and compulsion, but later he understood the manipulation of his skills by the government agency to fulfil their agenda.

According to Haraway, “The cyborg skips the step of original unity, of identification with nature in the Western sense. This is an argument against the myth of original unity, the belief that the world once existed in a pure state before being tainted by technology, capitalism, or patriarchy” (67). Haraway argues that resistance is not about returning to pure or natural identity rather about embracing hybridity, contradiction and new ways of living. The concept of being biologically pure to maintain agency is a flawed notion and it is proved through the journey of Kaaro, a human-alien hybrid from a coward, self-centred man to the saviour of human race. His growing resistance is evident in his reluctance to blindly follow the superior’s orders. The establishment of alien dome can be metaphorically considered as the Western Colonial influence in Africa which leads to the infiltration of the land, restructure in power dynamics, and formation of hybrid beings. Unlike the other colonial narratives where the colonized are entirely enslaved, Thompson has presented the cyborgian form of defiance where adaptation becomes a means of survival and subversion. His resistance against aliens has begun after knowing their true intentions in the establishment of the biodome. As the deaths of sensitives increase, Kaaro investigates and is shocked to find that during every opening the aliens take over the human bodies by altering

human DNA. Thompson has explained the threat faced by the human race through these lines:

This body is one hundred percent alien; the only part that remains from the human called Anthony is the specific electrical pattern of my brain, and even that is entangled with Wormwood. This body dies, I just build a new one. Some of the people in here vary from ten to forty percent Xeniform because their internal organs or limbs or some part of their body has been slowly replaced. This is not only happening here- think of Opening Day, the healings. Ultimately, all the bodies will be replaced. Kaaro, the human race is finished. It’s just a matter of time, and we are very patient. (357)

Haraway has discussed the idea of networked, hybrid identities resisting domination and states, “Cyborg unities are monstrous and illegitimate; in our present political circumstances, we could hardly hope for more potent myths for resistance and recoupling” (72). In *Rosewater* the sensitives gain power through the shared consciousness obtained from the Xenosphere, thereby using it against those who creates it. Kaaro chooses to navigate and manipulate Xenosphere instead of being a passive participant. His ability to access the hidden knowledge and disrupt information threatens Wormwood, as it exists outside his direct control. Also, Bicycle girl and other sensitives do not surrender to the

alien influence rather they function as a new kind of collective intelligence by using their altered state. Thus, all the modified human characters in *Rosewater* reject the idea of pure human identity by embracing their hybridity and reinventing the future.

In *Rosewater*, the agency establishes coercion control over people through Techno-Governance which includes using the mind reading abilities of sensitives, surveillance, data collection, and control of information. Governance in *Rosewater* solely relies on alien technology which is evident through the effort from the Nigerian government by continuous surveillance and the establishment of restricted areas around the biodome to harness Wormwood's abilities to consolidate their power and maintain stability. The Nigerian government is discontented about the emergence of sensitives, individuals with abilities beyond those of humans. People are forced to report if there are sensitives in their family and they are being monitored. The Nigerian security system uses sensitives to maintain psychic surveillance to control the citizens who pose threat to the society. Although through this surveillance method, crime detection and prevention has been enhanced, the invasion of privacy eliminates the traditional privacy rights leading to fear and distrust among people.

The government has even imposed relationship constraints where personal

choice, freedom, and identity are restricted. To explain the fate of gay couple Thompson writes, "There is a rumour that government agents have cracked the encryption used by homosexuals to hide the identification signal they use to recognise each other in public spaces" (105). Another tactic handled by the government is keeping the people under surveillance. This is achieved through the sensitives, but it also keeps tabs on sensitives to ensure that they stay within the government's influence and control.

To conclude, the present paper has explained how characters like Kaaro represent cyborgs blurring the boundaries between human and machine, alien and earthly, reality and illusion. These characters are detached from the world, struggling to distinguish the real from the unreal due to their alien-induced transformation. However, this uncertainty has never left cyborgs powerless. Realising the potential of cyborg identity, Kaaro has transformed into a figure of resistance. Therefore, cyborgs bridge the gap between biological and technological governance. Their presence not only ensures efficiency for governing bodies but also gives way to ethical and societal dilemmas about autonomy, privacy, and freedom. In *Rosewater*, the power structures use technology not merely as a tool for governance but as a mechanism for despotism. As individuals become more dependent on technology, there is a parallel fear that

the same tool will be used to oppress the people. But the transition of Kaaro from subjugation to defiance brings hope that technology can be reclaimed and redesigned as a tool for resistance.

Works Cited

Darwin, Charles. "Struggle for Existence". *The Origin of Species*. Global Grey, 1872, 6th ed., pp.51, labgenmol-fo-unam.com/wp-content/uploads/2019/04/the-origin-of-species_charles-darwin.pdf.

Haraway, Donna. *A Cyborg Manifesto: Science, Technology, and Socialist Feminism in the Late Twentieth Century*. Routledge, 1991.

Hassan, Ihab. "Prometheus as Performer: Toward a Posthuman Culture?". *The Georgia Review*, 1977. pp. 834.

Latour, Bruno. *Reassembling the Social: An Introduction to Actor-Network-Theory*. Oxford University Press, 2005.

Thompson, Tade. *Rosewater*. Orbit, 2016.

Web Sources

Clynes, Manfred E., and Nathan S. Kline. "Cyborgs and Space". *Astronautics*, Sept. 1960, pp. 27, <https://web.mit.edu/digitalapollo/Documents/Chapter1/cyborgs.pdf>. Accessed 23 May 2025.

Negotiating Identity and Liberty: A Human Rights Perspective on Elif Shafak's 'Three Daughters of Eve'

Purushottam Manikrao Gajbhiye

Assistant Professor, Department of English
Sevadal Mahila Mahavidyalaya, Nagpur,
gajbhiyepurushottam38@gmail.com

Abstract

This paper examines Elif Shafak's novel *Three Daughters of Eve* using the intersecting frameworks of human rights, social justice and freedom of speech. It argues that Shafak stages a sustained critique of socio-political constraints by dramatizing the inner life of Peri, a diasporic Turkish woman whose intellectual curiosity, sexual autonomy and spiritual questioning put her at odds with family, state and religious authorities. Through close readings of pivotal scenes and narrative strategies, the study shows how Shafak represents gendered power, secularist-nationalist discourses and conservative religious mores as mutually reinforcing forces that curtail individual agency and marginalize dissenting voices. The analysis situates Peri's personal conflicts within broader historical and institutional structures, including Turkey's contested secularism, gender norms and transnational pressures on freedom of expression. The paper further examines how Shafak uses polyvocal narration and memory to create ethical empathy for minority subjects and to expose the limits of majoritarian claims to truth. Concluding sections consider the novel's political implications. It presents literature as a site for defending pluralism, protecting conscience and renewing everyday practices of justice and speech.

Keywords: Three Daughters of Eve, human rights, social justice, freedom of speech, gender, secularism, Turkey, diaspora and narrative ethics.

Introduction

Elif Shafak's *Three Daughters of Eve* (2016) is a layered novel that interweaves questions of faith, identity, gender and politics. The narrative centers on Peri whose life choices and inner struggles become a prism through which the novel explores the tensions between private conscience and public expectation. This paper reads the novel as a literary intervention that engages ongoing debates about human rights,

women's freedoms and freedom of speech in contemporary Turkey and in transnational contexts. By combining close textual analysis with theoretical perspectives from human rights theory, feminist critiques and studies of freedom of expression, the paper demonstrates how Shafak stages both critique and alternative visions of justice.

The paper employs close reading of the novel's language, characterization

and narrative strategies, coupled with contextual analysis of relevant social and political conditions through analytical sections.

Peri's Development and the Politics of Conscience in Elif Shafak's *Three Daughters of Eve*

Peri, the protagonist of *Three Daughters of Eve*, is constructed as a deeply conflicted yet intellectually vibrant character whose personal development mirrors the larger political and ideological struggles of modern Turkey. Her journey from a silenced child in a divided household to a woman negotiating competing spiritual, cultural and emotional loyalties reveal how conscience becomes a political battleground in a society where belief and identity are closely policed.

Peri's upbringing is marked by the intense ideological clashes between her parents. Her mother's rigid religiosity and her father's secular liberalism and their opposing worldviews instil in Peri a fractured sense of self. She grows up internalizing the belief that she must choose sides between faith and reason, tradition and modernity, obedience and autonomy. Shafak uses Peri's childhood to dramatize how conscience is shaped by conflicting social expectations. Instead of developing a stable moral centre, Peri becomes a vessel of insecurity, guilt and longing traits that resurface throughout her adult life. The domestic space thus becomes a

microcosm of Turkey's wider ideological polarization. Peri's years at Oxford University mark a transformative stage in her development. Under the mentorship of Professor Azur, she is encouraged to interrogate inherited beliefs and to recognize the legitimacy of doubt. Azur's "God debate" classroom symbolizes freedom of thought: a space where questioning, disagreement and ambiguity are permitted. Yet, this intellectual liberation is accompanied by emotional turbulence. Peri's fascination with Azur reflects her longing for intellectual validation and spiritual clarity. Their connection forces her to confront suppressed questions about identity, morality and desire. Through this relationship, Shafak explores how conscience is not merely philosophical but also emotional intertwined with fear, love, guilt and shame.

Peri's internal conflict is intensified by the pressures of a society that polices women's choices and moral reputations. Her guilt over her sexuality, independence and intellectual curiosity reveals how conscience in patriarchal contexts is shaped not only by personal belief but also by societal judgment. Shafak depicts Turkey's sociopolitical environment as one in which social, religious, political surveillance creates a culture of fear. Peri's eventual retreat from academic life and her withdrawal into domestic respectability illustrate how societal norms can silence and

suppress women who fail to conform. The novel's nonlinear structure, moving between past and present, frames Peri's development as a continuous process of recollection and re-evaluation. Her memories of Oxford return not as resolved experiences but as wounds that shape her adult identity. The mugging incident in Istanbul serves as a catalyst for these memories, symbolizing the sudden eruption of repressed conscience. The politics of conscience in Peri's life are ultimately about reclaiming agency learning to acknowledge her fragmented past while seeking new forms of identity that do not require choosing between imposed binaries. On a symbolic level, Peri becomes a literary embodiment of modern Turkey: divided, searching, conflicted, yet yearning for a space where belief and freedom can co-exist. Her "confused" identity is not a weakness but a mirror of a nation struggling with its inherited dichotomies. Shafak uses Peri to advocate for a politics of conscience built on openness, doubt, empathy and the right to question. In this sense, Peri's development is not just personal, it is political.

Gender, Family and Social Control in Elif Shafak's *Three Daughters of Eve*

In *Three Daughters of Eve*, Elif Shafak exposes the subtle and overt mechanisms through which gender norms, familial expectations and socio-political structures regulate women's

identities. Through Peri's experiences and the contrasting lives of women around her, Shafak presents a powerful critique of patriarchal control and the gendered moral codes that shape Turkish society. Shafak portrays the family as the first institution where gender roles are imposed. Peri grows up in a household dominated by conflicting ideologies. Her mother's devout religiosity and her father's secular liberalism but in both systems, the daughter occupies a subordinate position. Regardless of ideological difference, Peri is expected to embody modesty, obedience and moral restraint. Her mother enforces traditional expectations: a "good girl" must safeguard the family's honor, avoid questioning patriarchal rules and uphold religious duties. Even her liberal father, though affectionate, remains emotionally distant and assumes male superiority as a natural order. Shafak uses this duality to show that patriarchy transcends ideological boundaries women endure control even in seemingly progressive households.

The novel foregrounds the gendered double standards that shape women's behaviour. Peri is constantly reminded that her actions: how she dresses, whom she befriends, what she studies carry moral weight. The concept of honor, heavily gendered in many Middle Eastern societies, becomes a form of social surveillance. Peri's mother represents this moralizing gaze.

She fears that deviation from religious norms will tarnish the family's reputation. Through such portrayals, Shafak illustrates how honor becomes an instrument of emotional coercion, compelling young women to internalize guilt, fear and self-censorship. Men, meanwhile, remain largely exempt from these moral expectations. Peri's move to Oxford exposes her to greater personal freedom, but this freedom is burdened by internalized guilt and social conditioning. Her intellectual awakening and the emotional attachment to Professor Azur reveal the conflict between desire and duty between the freedoms she seeks and the standards she has been taught to uphold. Shafak uses Peri's romantic and intellectual struggles to show how female autonomy is framed as deviance. The tension between personal freedom and cultural expectations demonstrates how patriarchal societies police not only women's actions but also their aspirations, thoughts and self-perceptions.

The novel highlights a critical insight: women often participate in maintaining patriarchal control. Peri's mother, though a victim of the same system, becomes its agent by policing her daughter's behavior. Socially, women scrutinize each other's morality, reinforcing community norms. At a charity dinner in Istanbul, Peri encounters upper-class women whose conformity to elitist expectations

reflects another form of patriarchal reinforcement. Their discussions about marriage, motherhood and propriety reveal how elite circles uphold rigid gender performances masked by modernity and wealth. Shafak thus shows how patriarchy survives not only through men's authority but through societal complicity and internalized norms among women themselves.

The broader political environment in Turkey marked by rising conservatism, nationalism and ideological polarization intensifies gendered pressures. Women's bodies and behaviour become symbolic battlegrounds where larger debates about religion, secularism and cultural identity are fought. Shafak suggests that women's freedom is limited not merely by family but by institutional and political structures that dictate how a "respectable Turkish woman" should live. Peri's inability to navigate these contradictory expectations traps her between public judgment and private longing.

Peri's life becomes a testament to the emotional consequences of patriarchal conditioning. Her anxiety, self-doubt and fractured identity reflect the psychological toll of constant moral surveillance. Instead of developing a unified sense of self, she becomes a mosaic of expectations imposed by family, society, religion and politics. Shafak uses this psychological fragmentation to emphasize that

gendered social control is not merely external. It becomes internalized, shaping how women think, choose and imagine their futures. Through Peri and the women surrounding her, *Three Daughters of Eve* exposes the intricate ways gender, family and society regulate women's identities and restrict their freedoms. Shafak's narrative reveals that social control is both structural and intimate: it operates through institutions, cultural norms and familial expectations, ultimately shaping the boundaries of female agency. The novel stands as a critique of patriarchal systems that silence women while urging a more equitable reimagining of gender and freedom.

Secularism, Nationalism and Limits on Speech in Elif Shafak's *Three Daughters of Eve*

Elif Shafak's *Three Daughters of Eve* critically examines the complex relationship between secularism, nationalism and freedom of expression in modern Turkey. Through Peri's personal conflicts and the ideological tensions surrounding her, Shafak exposes how both secular and religious forces can impose restrictions on individual autonomy and public speech. The novel becomes a literary space where competing narratives of identity, history and belief confront one another, revealing the fragility of pluralism within polarized societies.

Shafak situates Peri's upbringing against the backdrop of Turkey's longstanding struggle between Kemalist secularism and rising religious conservatism. While secularism in Turkey historically aimed to modernize and democratize society, Shafak highlights its contradictions, particularly how it has sometimes been enforced through top-down state authority rather than democratic consensus. Peri's father embodies a rationalist, secular worldview, yet even he reproduces forms of intolerance when confronted with differing beliefs. His rigid dismissal of religious expression demonstrates how secularism, when wielded dogmatically, can marginalize devout identities. Through this, Shafak challenges the assumption that secularism inherently guarantees freedom. Rather, it can become a hegemonic ideology that silences alternative moral and spiritual voices.

Nationalism in the novel appears as a powerful force shaping social norms, collective memory and political loyalties. It manifests through expectations of loyalty to the "nation," a concept often intertwined with masculine authority, cultural uniformity and suspicion toward dissent. Shafak portrays nationalism as a double-edged force: while it claims to unify the nation, it simultaneously suppresses complexity, ethnic diversity and ideological plurality. Peri's sense of

identity, as someone exposed to multiple cultural influences, clashes with a narrow nationalist ethos that demands conformity. The nation becomes an imagined community that allows little room for ambiguity, hybridity or critique. The charity dinner in Istanbul offers a microcosm of elitist nationalism: wealthy individuals discuss politics through clichés and prejudices, revealing how nationalism thrives not only in state structures but also in social circles shaped by class privilege and ideological conformity.

One of the novel's most profound concerns is the danger of speaking freely in a polarized society. Peri's hesitation to articulate her beliefs whether spiritual, political or personal reflects the broader culture of censorship. Shafak shows how both formal and informal mechanisms restrict speech. Shafak's own experience as a writer accused of "insulting Turkishness" resonates with the narrative's caution around speech. The novel suggests that when public discourse becomes hostile, individuals retreat into silence, privatizing their doubts and fears rather than engaging openly.

Peri's time at Oxford introduces her to an academic environment where debate, doubt, and critical inquiry are encouraged. Professor Azur's "God debate" course stands in stark contrast to Turkey's constrained intellectual climate. Yet, even in this environment,

Peri is unable to fully transcend the internalized limits she carries from her homeland. Shafak illustrates that freedom of speech is not simply a matter of external conditions; it is also psychological. A lifetime of social regulation makes it difficult for Peri to speak authentically, even in spaces that welcome dissenting voices.

The novel's structure interweaving past and present underscores how memory becomes a form of counter-speech. In revisiting the suppressed events of her past, Peri is engaged in a quiet act of resistance. Through memory, she articulates experiences and emotions that her society discouraged her from voicing. Shafak implies that speech is not limited to public declarations. Storytelling itself is an act of reclaiming agency. By narrating Peri's inner world, the novel models an alternative form of truth-telling that bypasses the censors of society.

Ultimately, *Three Daughters of Eve* argues for a vision of society where secularism is not enforced dogmatically, nationalism is not weaponized and speech is not policed. Shafak advocates a pluralistic model of coexistence one that honors complexity rather than erasing it. Peri's struggle to articulate her identity mirrors Turkey's struggle to balance secular reforms, religious diversity and democratic freedoms. The novel critiques ideological extremes on both sides,

calling for an open, dialogic public sphere.

Through its exploration of secularism, nationalism and freedom of speech, *Three Daughters of Eve* emerges as a nuanced critique of authoritarian tendencies within both state institutions and cultural norms. Shafak reveals how political ideologies whether secular or religious can become oppressive when intolerant of dissent. By centering Peri's conflicted conscience and silenced voice, the novel urges readers to recognize the value of intellectual freedom, pluralism and ethical speech in building a just society.

Polyvocality, Memory and Testimony in Elif Shafak's *Three Daughters of Eve*

Elif Shafak employs a rich and multilayered narrative structure in *Three Daughters of Eve* that deepens the novel's exploration of identity, faith, gender, and political conflict. Through polyvocal narration, complex memory sequences, and testimonial storytelling, Shafak creates a narrative architecture that mirrors the fragmented consciousness of the protagonist, Peri, while simultaneously challenging dominant cultural narratives. These strategies become essential tools for representing marginalized voices and exposing the silences produced by social, political, and ideological constraints.

Polyvocality, the coexistence of multiple voices, perspectives and ideological viewpoints lies at the heart of Shafak's narrative technique. Rather than presenting a single authoritative truth, the novel creates a dialogic world where conflicting ideas about religion, identity, modernity and morality collide. The characters surrounding Peri her religious mother, secular father, conflicted brothers, Oxford peers and charismatic Professor Azur embody divergent worldviews. Their voices do not merely coexist; they shape Peri's consciousness, destabilizing the boundaries between faith and doubt, East and West, self and society. By staging these ideological clashes, Shafak emphasizes that identity is not singular but constructed through continual negotiation.

Polyvocal narration also reflects Shafak's broader commitment to narrative empathy. By giving space to multiple perspectives, even those flawed or biased, she models an ethical practice of listening a counter to polarized political environments where opposing voices are often silenced or dismissed. The novel's structure is built on a continuous interplay between past and present. Memory functions not merely as recollection but as an active narrative force through which Peri reevaluates her identity and reconstructs her fragmented past.

Peri's memories often emerge as unbidden flashbacks triggered by

sensory details or emotional shocks, such as the mugging incident in the opening scene. These recollections expose unhealed traumas involving family conflict, intellectual suppression, social judgment and forbidden desire. Shafak uses memory as testimony to the emotional consequences of patriarchal and ideological pressures. In a society where political repression produces collective silences, memory becomes a form of resistance. By retrieving suppressed experiences, Peri challenges the cultural and political amnesia that seeks to erase dissenting voices or uncomfortable truths about national identity. Peri's introspective narration reveals the contradictions and crises she could never publicly articulate. Her unspoken doubts about faith, her guilt over desire, her ambivalence toward national identity and her psychological wounds become a form of narrative testimony. These interior confessions illuminate the limits placed on women's speech in conservative and nationalist cultures.

Azur's "God debate" seminars function as a controlled environment where students from diverse backgrounds share their beliefs, doubts, and intellectual struggles. These classroom discussions serve as miniature testimonies that expose the plurality of religious experience and demonstrate the possibility of civil discourse in the face of ideological difference.

In a political climate where freedom of expression is under threat, storytelling becomes a subversive act. Shafak uses the narrative to challenge systems social, familial and political that restrict speech. Through the act of remembering and narrating, Peri reclaims a voice denied to her in public life. The fragmented narrative form mirrors Peri's fractured identity. The juxtaposition of competing memories and voices reflects her internal chaos and inability to reconcile inherited ideologies. Shafak deliberately avoids linear coherence to highlight the multiplicity of identity, the instability of truth, the enduring impact of unresolved trauma. This fragmentation becomes a metaphor for a nation torn between secular and religious impulses, modernity and tradition, nationalism and pluralism.

Shafak positions storytelling as not just a literary technique but an ethical and political practice. The first one is healing. By revisiting her past, Peri begins to understand the roots of her guilt, confusion, and silence. Narrative becomes a means of emotional integration. Resistance as an act of narrating one's truth especially in a society that polices speech is a statement of autonomy and solidarity in which polyvocality and testimonial exchange allow marginalized voices to come together, creating a pluralistic alternative to authoritarian narratives.

Through polyvocal narration, fragmented memory structures, and testimonial storytelling, Elif Shafak's *Three Daughters of Eve* constructs a narrative that is both aesthetically rich and politically resonant. These strategies allow Shafak to explore the complexities of identity, faith, gender and political repression while challenging the silences imposed by patriarchal and nationalist structures. The novel ultimately suggests that storytelling is a powerful tool for reclaiming agency, preserving memory and fostering pluralism in deeply divided societies.

Human Rights and Social Justice Implications in *Three Daughters of Eve*

Elif Shafak's *Three Daughters of Eve* offers a layered examination of human rights and social justice by revealing how political pressures, gendered expectations and moral policing shape the lives of individuals in contemporary Turkey. At the core of the novel lies Peri's lifelong struggle to negotiate conflicting ideologies within her family; the secularism of her mother and the religiosity of her father. This conflict illustrates how women's rights and personal freedoms are often determined by patriarchal structures that deny them autonomy over their identity, beliefs and futures. The novel portrays this ideological tug-of-war not merely as a private family matter but as a systemic violation of women's right to

self-determination, a human rights issue that Shafak subtly critiques through Peri's psychological turmoil and fragmented selfhood.

Human rights concerns also emerge through the contrasting lives of the three daughters: Shirin, Mona, and Peri who symbolize secular activism, religious feminism and spiritual confusion. Shirin's unapologetic liberalism reveals the social penalties imposed on women who choose to speak freely, highlighting how freedom of expression is often selectively allowed depending on cultural expectations. Mona, on the other hand, embodies the right to religious expression, challenging the simplistic binaries that restrict Muslim women either to objects of oppression or symbols of resistance. Through these characters, Shafak emphasizes the importance of pluralism and the danger of ideological absolutism, which marginalizes women who do not conform to dominant narratives.

Social justice is further explored through the portrayal of class inequalities and political authoritarianism in Istanbul. The novel contrasts elite dinner parties, spaces of wealth, power, and hypocrisy with the broader atmosphere of fear, corruption and restriction outside these insulated social circles. This juxtaposition underscores how social justice is unevenly distributed, with marginalized communities disproportionately affected by censorship, surveillance and insecurity. The recurring motif of public

violence and political instability reflects the erosion of civil liberties in Turkey, suggesting that democratic rights cannot flourish under authoritarian nationalism or moral policing.

Academic freedom, another essential human right, becomes a central conflict through the character of Professor Azur. His philosophical explorations of God and morality create a space for intellectual diversity, yet the scandal that surrounds him reveals how education systems can become battlegrounds for ideological control. Azur's persecution demonstrates how truth seeking and critical inquiry are vulnerable when institutions sacrifice academic independence for political convenience. The students' fear of association with him echoes the mechanisms of self-censorship prevalent in authoritarian societies, where the right to think freely is replaced by the need to conform.

Ultimately, *Three Daughters of Eve* argues that social justice requires the protection of individual rights gender equality, freedom of thought and freedom of expression within a society that embraces complexity rather than suppresses it. Shafak exposes the profound psychological and social cost of living in environments shaped by fear, intolerance, and polarization. The novel urges a universal recognition of human dignity, suggesting that only through empathy, dialogue, and pluralism can societies move toward greater justice and authentic freedom.

Conclusion

Elif Shafak's *Three Daughters of Eve* ultimately stands as a powerful literary meditation on the fragility of human rights and the persistent struggle for social justice within societies marked by ideological division and political turbulence. Through the intertwined journeys of Peri, Shirin and Mona, Shafak foregrounds the conditions under which women attempt to assert their agency in environments that police their identities, silence their voices and dictate their moral boundaries. The novel exposes how patriarchal families, nationalist politics and religious conservatism collectively restrict the fundamental rights of women, rights to autonomy, equality, belief and self-expression. These constraints reveal that the private and public spheres are deeply interlinked: injustice at home mirrors the broader authoritarian structures that shape public life.

Freedom of speech emerges not merely as a political right but as an existential necessity in the novel. Professor Azur's embattled intellectual space demonstrates how easily philosophical inquiry and dissent can be punished when a society fears uncertainty and suppresses dialogue. The scandal surrounding him exposes the consequences of epistemic intolerance; how societies censor not only speech but also imagination and doubt, thereby diminishing the human

capacity for growth. This erosion of academic freedom reflects the novel's broader critique of contemporary Turkey, where surveillance, ideological policing and public hysteria silence dissenting voices and undermine democratic norms.

Ultimately, Shafak's narrative argues that genuine social justice demands a commitment to pluralism and the protection of the human right to think, question and speak freely. In portraying characters who inhabit complex intersections of faith, gender and identity, the novel rejects binary worldviews and champions the dignity of ambiguity, a space where freedom becomes possible. *Three Daughters of Eve* thus challenges readers to recognize that the defence of human rights is inseparable from the defence of intellectual freedom and the pursuit of justice. Only societies that embrace multiplicity, safeguard dissent and honour individual autonomy can foster environments where human flourishing is achievable.

References

- Shafak, Elif. *Three Daughters of Eve*. Viking (Penguin), 2016.
- Mill, John Stuart. *On Liberty*. 1859.
- Said, Edward W. *Orientalism*. Pantheon, 1978.
- Spivak, Gayatri Chakravorty. "Can the Subaltern Speak?" In *Marxism and the Interpretation of Culture*, ed. Cary Nelson and Lawrence Grossberg, University of Illinois Press, 1988.
- Bhabha, Homi K. *The Location of Culture*. Routledge, 1994.
- Butler, Judith. *Gender Trouble*. Routledge, 1990.
- Nussbaum, Martha C. *Women and Human Development: The Capabilities Approach*. Cambridge University Press, 2000.
- Sen, Amartya. *Development as Freedom*. Oxford University Press, 1999.
- Universal Declaration of Human Rights, United Nations, 1948.
- Ahmed, Leila. *Women and Gender in Islam: Historical Roots of a Modern Debate*. Yale University Press, 1992.

Brahmaputra as the Silent Observer of Assam's Legacy: A Study through Literature and Lyrics

Jimi Bora

Independent Scholar, M.A. (English)
Tezpur University
mainbora1921@gmail.com

Abstract

The River Brahmaputra, also known as the Red River, is considered to be the only male river in India. It is not only a geographical artery of Assam, but a non-living central character in media, and literary works. It embodies complex characteristics that encompass both a source of sustenance as well as a force of destruction. The aim of this paper is to conduct an intertextual study that highlights the multifaceted representation of the river in various contexts, and platforms. Integrating folk-modern songs of personalities like Dr. Bhupen Hazarika, and Mitali Choudhury with literary texts of writers like Mitra Phukan, the paper would revolve around the socio-historical aspects of Assam, and shaping the river in becoming a central character who silently observes the growth and development of the state across time, and simultaneously testifying the trauma of the inhabitants, the struggles associated to attained independence, and the insurgencies that collectively shaped the memory. On one hand, the selected songs would help in establishing the resilient identity of the river, and on the other, the chosen literary texts would highlight how the river stands as a form and sole witness to various conflicts and decay-in all forms. By juxtaposing all these ideas, the paper, thus, challenges the portrayal of Brahmaputra as a mere geographical setting, and argues him to be the historical archive of the state. Further, it would highlight a deeper ecological understanding of the region, and the river's enduring legacy across times.

Keywords: Assam, Brahmaputra, memory, personification, witness.

Introduction

The river Brahmaputra or Burha Luit (in the language of Dr. Bhupen Hazarika) is the prominent geographical feature of the state, and arguably the most significant motif in the writings of Assam. While other Indian river attains the female deities' names, the Brahmaputra claims to be the singular male river because he is the son of Brahma, according to ancient works

like *Kalika Purana*. Originating towards the east of Manas Sarovar Lake in the Himalayas, in an ice glacier called Tamchuk Khambab, his dramatic flow is reckoned among the world's most majestic rivers. However, he endows a physical duality at one side, he is a life bearer, and on the other, he is an agent of relentless destroyer-ultimately shaping his character into a volatile central character in the regional consciousness. Over time immemorial,

the river has been witness to the ups and downs of Assam, the rise and fall of Ahom Kingdom, the turbulent period during the colonial era, and the insurgencies- which have shaped the state of Assam, into what it now. Therefore, one cannot claim the Brahmaputra as a mere geographical setting found in literary works, but a living entity, who bears the weight of trauma, memory, struggles, and resilience. However, his role as an archive is silent, and immovable.

This paper proposes for an intertextual analysis to dig deeper into the socio- historical and political weight borne by the river, trespassing beyond its conventional reading as a mere ecological symbol. To understand his deep resonance, the paper juxtaposes his representations across various platforms, in this paper media and literary texts, to highlight how he left his impact on the psyche of Assamese people.

Dr. Bhupen Hazarika, an awardee of all the significant prizes like *Bharat Ratna* in 2019, *Padma Vibhushan* in 2012, *Padma Bhushan* in 2001, *Padma Shri* in 1977, *Dadasaheb Phalke Award* in 1992, *Sangeet Natak Akademi Fellowship* in 2008, *Asom Ratna* in 2009, and *Friends of Liberation War Honour* in 2011, immensely helped in foregrounding the river. Dr. Hazarika made this possible by adding philosophical depth to the river in his songs like “Bistirna Parare” (On the vast shores) Similarly, the song of Mitali

Choudhury, “Burha Luitor Bixal Bahu” (The mighty arms of the old Luit) emphasizes the relevance. These two songs, among others, serve as a central force that unifies the river’s capacity.

Therefore, by converging the lyrical appeals to the meticulous representations in the literary works, the study aims to demonstrate how various platforms portray the same anxiety.

Research Questions

- How do the lyrics of Dr. Hazarika and Mitali Choudhury construct the political and philosophical identity of the Brahmaputra?
- In what perspectives do the novel of Mitra Phukan employ the Brahmaputra to represent the unaddressed issues of the region?
- To what extent does this intertextual study, either reinforce or subvert and help in understanding the traditionally perceived role of the Brahmaputra as *Mahabahu*?

Research Objectives

- To conduct a close auditory analysis of the chosen songs to decipher the philosophically layered meanings.
- To analyze the chosen literary works to highlight the descriptions of the river.
- To establish a theoretical framework that helps in comparing the river’s descriptions in the songs to that of literary texts.

Literature Review

A thorough literature review suggests that existing scholarship around the River Brahmaputra offers various perspectives into geographical setting, profound economic resource, and cultural entity. Primarily, the River Brahmaputra is treated as a part of the physical geography of Assam. *The Unquiet River: A Biography of the Brahmaputra* by Arupjyoti Saikia offers insight into deeper geological journey of the river, along with descriptions of the river as a natural agent. Similarly, *Tsanpo-Brahmaputra: A Perception Study from Riparian Perspectives* delves into the river's geomorphic process in quantifiable manners. However, in *The Brahmaputra: Shaping the History of Assam* as well as *The Brahmaputra: A Socio- Political Conundrum* the river has been analyzed in terms of socio- cultural development. Since the ancient days to the contemporary scenario, marked by migration and transboundary hydro politics, the river Brahmaputra is one of the determinants. Further, *River Narratives in the Context of Northeast India* and *Brahmaputra Chronicles* personifies the river as an archive of region's myths, and folktales.

Besides, to understand the river Brahmaputra's role as a 'silent witness,' one must acknowledge the marginalized experiences faced by women during 19th century. During this time frame, Assamese women attempted to navigate the complex landscape of colonial

transitions as well as the traditional patriarchal structures. While the existing scholarships put forth the critical views from this era related to the rise and fall of kingdoms, the river's role in witnessing and storing the endurance of women, remains unexplored.

Therefore, this paper aims to bridge the underlying gaps by establishing an intertextual framework, and thus developing the underdeveloped area. Highlighting its function as a non-human witness, who carries the silent burdens of the region, the paper explores the shifting role of the river from a general geographical setting to one with specific identity. Moreover, the paper aims to construct a unified dialogue between two aspects, i.e. artistic platform, and literary platform to enrich the study as the song *Burha Luit tumi, Burha Luit buwa kio?* (Old Luit, why do you flow silently?)

In short, the paper's uniqueness lies in its juxtaposing of lyrics of renowned artists, and narratives of famous writers from Assam. By bringing these two dimensions into a dialogical conversation, the paper aims to bring forth some new ideas.

Methodology

The paper employs a qualitative research design by integrating literary analysis of the selected texts, and deciphering the meanings in the selected songs, in an attempt at intertextuality.

Expected Outcomes

- A confirmation that proves the role of the Brahmaputra as a silent witness of the region's conditions.
- To bring forth the friction found in literary texts and musical genre.
- The river Brahmaputra as a central protagonist of the region.
- An understanding of the contribution towards the critical analysis of the writings from North-east India.
- A space to redefine natural symbols used in literary works.

Discussion

The existing studies have often acknowledged the river Brahmaputra for its unique agency in terms of geography, socio-cultural, and historical aspects. However, the representations of the river are still limited to recurring and profound physical setting. This, in turn, limits the active role of the river since time immemorial. Unlike transient human lives, fleeting political regimes, and social structures that fade with time, a river's geological longevity, on the other, guarantees a continuous memory. Understanding this philosophical framework helps in recognizing or elevating the status of the Brahmaputra from a mere setting to an active participant in witnessing the region's growth, and other turmoil, and thus secures it to attain the position of a non-human protagonist of the region's

collective memory. Consequently, the lyrics of Dr. Bhupen Hazarika, and Mitali Choudhury alongside the literary works like *The Collector's Wife*, and *Undertow* utilize the river as a central protagonist whose perspective, basically rooted in endurance, offers a historical depth of the region that is often marked by flux and resilience.

Reimagining the Brahmaputra in Artistic Representation

The artistic representations of the river in the lyrics of Dr. Bhupen Hazarika, among others, help in elevating the river from a mere geographical setting to an active observer of the region. Various songs, throughout time, have placed the river in various contexts. Songs like *Namami Brahmaputra* offers insight into its role in Assam's socio- historical concerns; *Mahabahu* highlights the majestic journey of the river; *Kohuwa Bon Mur Oxanto Mon* reflects on the restless human heart compared to the reeds grown on the riverside. However, Dr. Hazarika, and Mitali Choudhury addresses the river as *Burha Luit* (Old Luit) to reassert the river's prominent role in archiving the trajectory of Assam.

*“Bistirna Paarore oxonkhyo jonore,
Hahakar xuni, nixobde, nirobe,
Burha Luit tumi, Burha Luit buwaa
kio?”*

(Its literal translation: Hearing the cries of the countless people on your

vast shores, in silent, in peace, Old Luit, why do you flow?)

An analysis of the first few lines of this song shows how the river Brahmaputra was projected as a person who withstands the socio-political situation of the region, and thereby Dr. Hazarika asks various philosophically deep questions to the river. He establishes this song in a dialogical manner by directly addressing the river, and showing a close bond between the singer and the river, highlighted by the Assamese words he chose to address. In one part of the song, the singer directly questions the river on being silent and flowing shamelessly and lazily, *Nirlojyo bhabe buwa kio?* (Why do you flow shamelessly) despite witnessing the degradation of the region, in all forms. He also highlighted the fact that the Assamese society is concerned only with itself, and collectively, they possess no personality to stand firm, which is true, to a certain extent.

Another profound song is *Burha Luitor Bixal Bahu* (which literally translates as: Old Luit has strong arms) by Mitali Choudhury. The analysis of this song serves as a way that paves the elevation of the river from just a mere natural element to that of a profound cultural figure that unites its two banks, and hence people. This mighty armed protagonist is a powerful figure operating in the region and holds the responsibility to protect the diverse communities along with their cultures. Thus, it transcends mere musical

tribute, and opens new avenues towards reification of regional identity. By addressing the river as a 'mighty-armed protagonist,' the lyrics help in establishing its narrative identity as a protector.

Therefore, a close analysis of these two songs by two different artists serves as a platform. The two songs address the Brahmaputra as a *Burha Luit* repeatedly- to emphasize the fact that the river is serving as a testimony of struggles throughout time immemorial.

Reimagining the Brahmaputra in Literary representations

Set against the background of political insurgency in the post-colonial era, Mitra Phukan's 2005 novel, *The Collector's Wife*, positions the river Brahmaputra (named 'Red River' in the novel) not in a praiseworthy tone, as the singers did, but as a silent observer of the violence, followed by decay- in all forms. Rather than being a benevolent guardian and conservator of his people, the river remains chillingly silent, indifferent to the resolution of human suffering, and extremely busy in collecting the trajectory of human sufferings, and the never-ending trauma. However, a critical study also suggests that its turbulent monsoons are not merely ecological events, but metaphorical outbursts of long-suppressed memory. This, in turn, subverts the unifying force found in Mitali Choudhury's lyrics, which is evident in the novel where Phukan signifies the

river as uncontrollable, ambiguous, and a potential threat:

“...the Red River, or the Luit as it was known here, snaked its way past Parbatpuri in deceptively lazy loops.” (Phukan 19) The quote highlights the deceptive character possessed by the river. Choosing the word ‘Red River’ instead of the Brahmaputra or Luit suggests at the violence, and associated bloodshed, which to place during that particular period of socio-political upheaval. The use of two words might suggest two different functions: if ‘Red River’ stands for violence and bloodshed, then name ‘Luit’ stands for intimate or local archival. Thereby, by using two names, Phukan tries to highlight how the local or familiar natural entity is now reacting to the sociopolitical conflicts.

The descriptions of the river are abundant throughout the narrative, depicting its power unleashed as the narrative progresses: “Fed by the constant deluge and the melting snows in the mountains where it originated, the Red River grew suddenly vast. It spread its waters over great distances on both sides.” (Phukan 173) However, the river’s profound, and sentient presence is felt towards Chapter 24 from *The Collector’s Wife*. The description sets the tone to justify the enduring characteristic possessed by him.

“But the main aspect of the landscape here, dominating the sky as well as mountains, was the river itself.

The Red River in spate, wearing its full monsoon regalia. It was indeed red here. Red with the topsoil washed down from the high mountain plateau above. Red with the tumultuous volume of water that rushed through this cleft mountain two hill ranges.

Red with fury being thus confined. red with the violence that raged on its banks.” (342)

Endowing the river with human attributes (regalia) and emotions (fury), the writer successfully portrays the region’s tension through the utilization of the character of Brahmaputra. The description also highlights how the relationship of human and non-human affects each other. Although the region of Northeast India, or especially Assam, is full of natural elements, the Brahmaputra is the protagonist and hence endowed with more power in the hierarchical position within a particular narrative. This quote, however, subverts Mitali Choudhury’s version of the river. To her, the Brahmaputra is a unifying force, and the above given quote shows the same river in an uncontrollable entity.

“The river, already dark with the soil of distant mountains that had crumbled into its relentless waters, was now red with the unending violence on its banks.” (345) which helps in articulating how the river holds both geographical time period as well as the political trauma experienced by the inhabitants. In the initial phrase, the red

colour is related to the geographical composition, and towards the end, the description hints at the river's rage. However, towards the end of novel, Phukan tries to solidify the status of the river Brahmaputra as a non-human central character as well as an archival of the region's history: "The river red as before, rushed past, entirely indifferent to the enormity of what it had wrought." (345)

Besides Phukan, Jahnvi Barua and Arupa Kumar Patangia also offers different perspective of the river Brahmaputra. To say, the holding power of the river is so strong, and yet always carries a threatening force to destabilize the surface. The river operates silently, within, and therefore he is so strong and bears the weight of trauma and sufferings alone. He is a stock of the region's history, and the contents are buried within. The descriptions of the seasonal floods act as a literal as well as metaphorical outburst, that symbolizes the ruptures caused by suppression of unbearable painful memories.

The dialogue between the Artistry and Literature

One of the crucial points to bring forth here is the intersection of musical lyrics and literary narrative that profoundly reveals the underlying tension in conceptualizing the river Brahmaputra. While Dr. Bhupen Hazarika posed a direct question: "Why do you flow on silently?" Phukan, through her work, answers that the

silence and laziness are nothing, but a cultural mask. Again, Choudhury's lyrics *Burha Luitor Bixa Bahu* discusses the river as a unifying force, Phukan's use of the river as a snake suggests an ambiguous force who holds the threatening power to unleash at any moment.

Dr. Hazarika repeatedly questions and urges the river to speak, Mitra Phukan, on the other hand, uses this silent bearing as a powerful tool of cultural repository. Throughout the novel, the river's presence is immensely felt and the protagonist, Rukmini Bezbaruah, often tries to make parallel between her situation and that of the society to the changing nature of the river. This constant change that points towards the instability shows the socio-political upheavals of the region as well the human's fragile lives. The degradation of the ecological balance ultimately highlights the decay of governance, accompanied by bureaucratic corruption, and a distant gap between the state and its citizens. Therefore, this dialogue between art and literature highlights the critical point of convergence: Brahmaputra's role as a non-human observer of Assam's legacy. It also brings forth the shift from geographical idealism to ecological realism.

The description of the constant fluctuations operated through the river

in Phukan's narrative parallels to the protagonist, Rukmini Bezbaruah's fragile existence which embodies the critique of corruption and failure of governance. While the lyrics lay the philosophical foundation for the river as *Mahabahu* the literature is playing its crucial role by subverting this idea. Ultimately, the dialogue immensely provides an intertextual conversation that beautifully demonstrates the Brahmaputra as an active, albeit silent, non-human protagonist of the region.

Conclusion

To conclude, it can be summarized that the study was carried out to bridge the gap between the literary world and that of musical idealism. An ideal depiction of the river Brahmaputra is shown in the song, *Burha Luitor Bixal Bahu* and that of silent bearer of everything in *Bistirna Paarore*. However, the treatment of the river is somewhat different in the literary descriptions of Mitra Phukan. It portrays how the human violence and trauma remains inseparable from the river itself, and thereby he acts as a powerful character that remains silent despite experiencing every sort of struggles.

The paper, thus, suggests that the Brahmaputra is the most powerful non-human protagonist of multifaceted works from the region, and thereby establishes a new discourse to elevate the portrayal of the river Brahmaputra from a geographical site to a powerful

agent, or force, or a non – human character.

Works Cited

Primary Sources

- Choudhury, Mitali. *Burha Luitor Bixal Bahu*. 1995.
 Hazarika, Bhupen. *Bistirna Paarore*. HMV, 1970.
 Phukan, Mitra. *The Collector's Wife*. Zubaan, 2005.

Secondary Sources

- Bhattacharyya, Anima. "The River as Archive: Memory and Ecopolitics in Northeast Indian Fiction." *Journal of Cultural Studies and Ecology*, Vol. 18, No. 2, 2021, pp. 45-62.
- Biswas, Soumyajita. "Brahmaputra Chronicles: Unveiling A Vibrant Civilization." *IOSR Journal of Humanities and Social Sciences*, Vol.29, No.7, 2024, pp.56-61.
- Deka, Ranjit. "Reading Bhupen Hazarika's Lyrics: The Mahabahu Metaphor and Political Aspiration." *Indian Journal of Literary Research*, Vol. 5, No. 1, 2019, pp. 88-105.
- Gogoi, Pronami. "Trauma and Resilience: Narrating Conflict in Contemporary Assamese Literature." *The Routledge Companion to Literature of the Indian Northeast*, edited by Tamoshi Devi, Routledge, 2022, pp. 150-165.
- Sarma, Jyotirmoy. *Identity and Erosion: The Making of the Assamese Self*. Spectrum Publications, 2017.
- Nath, Ripunjay. "The Brahmaputra: Shaping the History of Assam." *International Journal of Research and Analytical Reviews*, Vol. 6, No.2, 2019.
- Saikia, Arupjyoti. *The Unquiet River: A Biography of the Brahmaputra*. 2019.
- Trivedi, Dr. Love & Lakshmi Priya, G. "The Brahmaputra: A Socio- Political Conundrum." 2022. DOI: 10.48550/arXiv.2209.02065

The Divine Dance of Science: Lord Shiva's Role in Understanding the Laws of Nature in Mythological Literature

Archana Nilesh Shelke

Assistant Professor

Dr. Panjabrao Deshmukh Arts & Commerce (Eve.) College,
Nagpur (M.S.),
archanashelke11@gmail.com

Abstract

Lord Shiva, revered mythological figure in literature, is frequently linked to strong metaphysical symbolism and a deep understanding of the mechanisms of the cosmos. The endless rhythm of creation, preservation and destruction is thought to be embodied by his famous dance, the Tandava. This study explored how Lord Shiva is portrayed in Hindu mythology as a cosmic scientist who sheds light on the principles of nature. It explores how profound cosmological, scientific and natural concepts are reflected in his deeds and qualities as they are portrayed in holy books like the Shiva Purana, Mahabharata and Ramayana. Shiva's divine dance incorporates the fundamental forces of nature and the cyclical nature of the cosmos, affording a symbolic comprehension of scientific notions such as energy, time, space, and the change of matter.

Hindu mythology provides deep insights into the relationship between divinity and nature through its intricate web of gods, goddesses, and cosmic stories. The proposed study examines how Lord Shiva, as portrayed in Hindu mythology, can be used to understand the rules of nature, especially through the metaphor of his cosmic dance (Tandava). This study illustrates how Shiva's dance functions as a metaphorical framework for scientific concepts like entropy, quantum mechanics, and the dynamic equilibrium of the cosmos by examining ancient texts, iconography, and philosophical interpretations. The study also emphasizes how mythical stories bridges the gap between science and spirituality by providing a comprehensive view of the cosmos.

Keywords: Cosmic Dance (Tandava), Cosmic Scientist, Laws of Nature, Entropy, Quantum Mechanics, Dynamic Equilibrium, Nataraja, Cyclical Universe, Iconography

Introduction

With its complex network of gods, goddesses, and cosmic tales, Hindu mythology offers profound insights into the interplay between nature and divinity. Lord Shiva, the cosmic dancer and destroyer, has a unique place in the pantheon of deities since he symbolizes both creation and destruction,

encapsulating the cyclical aspect of the universe. This essay examines how Lord Shiva, as he is represented in Hindu mythology, might be utilized to comprehend the laws of nature, especially by using the Tandava, his cosmic dance, as a metaphor. This study demonstrates how Shiva's dance serves as a metaphorical framework for scientific ideas like entropy, quantum

mechanics, and the dynamic equilibrium of the world by examining ancient texts, iconography, and philosophical interpretations.

By providing a comprehensive view of the universe, the study also highlights how stories from legends can help close the gap between science and spirituality.

Deep philosophical insights into the nature of the cosmos and existence can be found in Hindu mythology, which offer a complex tapestry of divine creatures whose traits and behaviours reflect the fundamental laws of nature. One of the most important of these is Lord Shiva, who represents the powers of rebirth and destruction and shapes the universe's cyclical cycle. Since Lord Shiva is the god of creation, preservation, and destruction, his acts are intricately linked to the natural order. The Tandava, his cosmic dance, is a symbolic depiction of these processes.

Lord Shiva in Hindu Mythology: A Cosmic Scientist

As the universe's destroyer and regenerator, Lord Shiva is regarded as a member of the Trimurti, the Hindu trinity that also includes Brahma and Vishnu. One of the most memorable images in Hindu literature, philosophy, and art is his portrayal of Nataraja, the cosmic dancer. His dance, the Tandava, represents the universe's cyclical nature, in which devastation makes room for new creation. There appears to be a

close connection between natural principles and mythological iconography, as this dichotomy of destruction and rebirth reflects scientific ideas like entropy and energy conservation.

The Tandava, a dance performed by Lord Shiva, is one of the most potent images in Hindu mythology. It captures the endless cycles of creation, devastation, and renewal that define the universe's nature. The dance is presented as a forceful and dynamic movement that represents the universe's cyclical powers. Shiva's dance, which represents the endless rhythm of life, is portrayed in the Shiva Purana as both creative and destructive. Although the Tandava is frequently portrayed as a dance of destruction, it also has the capacity to create. Shiva's dance mimics the natural cycles of life, death, and rebirth by destroying the old and creating room for the new. In this way, Shiva's dance is both a literal and symbolic representation of the cosmic processes of entropy and the regeneration of order from chaos.

Shiva's Cosmic Dance and Scientific Concepts

Shiva's dance is set within a ring of cosmic fire, *prabha mandala*, which represents time (which destroys everything) and which is shown as a circle to symbolize the Hindu belief that time is cyclical and without end.

Within the cosmos represented by the ring of fire, the form of Nataraja is seen as comprised of five concepts:

Srishiti, creation, evolution

Sthiti, preservation, support

Samhara, destruction, evolution

Tirobhava, illusion

Anugraha, release, emancipation.

The Tandava is a powerful dance performed by Lord Shiva. Unlike graceful dances, like the Bharatnatyam, which is soft and graceful, the Tandava dance embodies the fierce nature of Lord Shiva with powerful, energetic, and unrestricted movements.

The dance is usually represented by the Nataraja form as represented in the above image. Each aspect of the form holds its unique meaning.

- The raised foot-symbolizes his triumph over ignorance and illusion.
- The other foot-symbolizes being grounded on Earth.
- The raised foot-signifies liberation.
- The lowered foot-signifies a compassionate embrace of the world.

Lord Shiva is the symbol of the cosmic cycle because he produces, preserves, and finally destroys everything with his cosmic energy and strong dance. Shiva's dance provides deep insights into a number of important

scientific ideas, including the never-ending cycle of birth and death, expansion and contraction, chaos and order. We can see his gestures as symbolic representations of fundamental principles that underpin the rules of nature and physics when viewed through a metaphorical lens.

Entropy and the Cycle of Creation and Destruction

A key idea in thermodynamics, entropy is the measurement of disorder in a system. According to the second rule of thermodynamics, entropy tends to rise with time in any isolated system, indicating a shift towards disorder. This entropy concept is embodied in Shiva's Tandava, which is simultaneously creative and destructive. While creation emerges from the ashes of destruction, signifying the possibility of fresh order emerging from chaos, destruction causes form to dissolve, signifying the growth in entropy.

The cyclical nature of Shiva's dance mirrors the universe's inevitable progression toward higher entropy, where energy dissipates over time. However, Shiva also brings forth new beginnings through his dance, illustrating the constant interplay between destruction and creation-an idea that aligns with the cyclic nature of entropy.

This cyclical view aligns with the scientific understanding of entropy as a driver of change, where chaos and order are interdependent.

Quantum Mechanics and the Uncertainty Principle

Shiva's dance can also be interpreted by the lens of quantum mechanics, particularly by the principle of uncertainty. This couple cannot be measured at the same time with absolute accuracy. In quantum theory, particles exist simultaneously under several conditions, creating dynamic system of probability. This chaotic but structured movement of Shiva shows the dance of the universe itself, which functions at a quantum level, is filled with constantly evolving potential conditions and possibilities.

The Theory of Relativity and the Nature of Time

Shiva's dance is also a theory of relativity, particularly the rationale of the treatment of time & space. Time and space are connected by Einstein's theory and can be distorted by the presence of giant objects that influence the way universe events develop. The continuous rhythm of creation and destruction allows Shivas Tandaba to be seen as a dynamic representation of how time and space interact and change as a response to the game's cosmic forces. Shivas dance is not a symbol of the course of time. It also shows the nonlinear nature of time in the universe. Shiva's dance includes moments of creation and destruction, showing periodic and fluid time in the sense of the universe.

Dynamic Equilibrium and the Balance of Forces

Shiva's dance represents the balance between opposing forces, gravity and entropy, the creation and destruction of order and chaos. This balance is reminiscent of the sensitive balance dominated by the universe, from the forces that link atoms to the gravity that forms galaxies.

Iconography of Nataraja: A Visual Representation of Cosmic Laws The Nataraja icon is rich with symbolism that aligns with scientific principles:

- The **flame** in Shiva's hand represents the transformative power of energy.
- The **drum** symbolizes the primordial sound (Nada) from which the universe emanates, akin to the Big Bang theory.
- The trampled **dwarf** (Apasmara) signifies the triumph of knowledge over ignorance, reflecting humanity's quest to understand the laws of nature.
- The **circle of fire** around Shiva represents the universe's boundaries and the cyclical nature of time.

Philosophical Interpretations: Bridging Spirituality and Science

Hindu philosophy, especially Advaitavedanta, emphasizes the unity of all beings in which the material and spiritual realms are connected. Shiva's

dance embodies this unit. This shows that the laws of nature are not separated from God, but are representations of a higher cosmic order. This perspective is seen in modern scientific efforts to uncover all homogeneous theories and to bridge the gap between quantum mechanics and general theories of relativity.

Relevance in Contemporary Science and Thought

In his book *Tao of Physics*, for example, Fritjof Capra draws similarities between Shiva's Dance and The Dance of Subatomic Particles, highlighting the convergence of eastern spirituality & Western science. This interdisciplinary approach highlights the timeless relevance of mythical narratives in promoting a holistic understanding of the universe. This powerful weapon reflects the structure of creation, conservation and resolution. Each aspect is needed so that existence can exist in a state of dynamic balance. Gravity, electromagnetic, and strong and weak nuclear forces interact at the most basic levels, regulating all phenomena, from star formation to subatomic particles' behavior.

The Third Eye and Concepts of Focused Power in Physics

In physics, the third eye can be relatively related to the concept of concentrated energy rays such as lasers. Laser beams are focused alleys that allow you to navigate through materials. Shiva's third eye embodies the targets and induced energies that can penetrate

the fantasy layer to reveal the underlying facts. In this connection, the third eye is not just a physical feature, but a symbol of emotion and spiritual awakening. Various spiritual paths continue to the opening of the third eye for full understanding and recognition of hidden truths. The ability to concentrate energy combines the concept of the third eye with modern physics. His teachings and symbolism inspire countless supporters and practitioners, and promote connection with God through dance, art and spirituality. The enduring legacy of Lord Shiva and his dance invites everyone to participate in the Gods of the Universe.

Conclusion

As a universe dancer and destroyer, Lord Shiva represents a deep metaphysical understanding of the cyclical processes of the universe. His legendary dance, The Tandav, serves as a powerful metaphor for the dynamic forces of creation, preservation and destruction that dominates the universe. The study of Shiva's relationship with dance and modern scientific concepts emphasizes the timeless wisdom embedded in Hindu mythology. Shiva's myth bridges the gap between science and spirituality and provides insight into the nature of energy, time, space and material transformation. Through the lens of Shiva's cosmic dance, we have a deeper understanding of the fundamental principles of the universe and the networking of all forms of existence.

References

- Capra, F. *The Tao of Physics: An Exploration of the Parallels Between Modern Physics and Eastern Mysticism*. (1975).
- Coomaraswamy, A. K. *The Dance of Shiva: Fourteen Essays*. New Delhi: Sagar Publications. (1974).
- Coomaraswamy, A. K. *The Dance of Shiva: Fourteen Indian Essays*. (1918).
- Easwaran, E. (Trans.). *The Upanishads*. Tomales, CA: Nilgiri Press. (2007).
- Einstein, Albert. *Relativity: The Special and the General Theory*. 1920.
- Feynman, Richard P. *The Feynman Lectures on Physics*. Addison-Wesley, 1963.
- Frawley, D. *Shiva: The Lord of Yoga*. Twin Lakes, WI: Lotus Press. (2014).
- Goswami, A. *The Self-Aware Universe: How Consciousness Creates the Material World*. New York, NY: Tarcher Perigee. (1995).
- Hawking, Stephen. *A Brief History of Time*. (1988).
- Kramrisch, S. *The Presence of Śiva*. Princeton, NJ: Princeton University Press. (1981).
- Nair, C.S.S. *Shiva Purana*, tr., 2002. Narayan R. K. *Ramayana*. tr., 2006. Rajagopalachari C. *Mahabharata*, tr., 1951.
- Sarma, D. S. *The Upanishads: An Introduction*. (2000).
- Vanamali. *Shiva: Stories and Teachings from the Shiva Mahapurana*. Rochester, VT: Inner Traditions, (2010).
- Zimmer, H. *Myths and Symbols in Indian Art and Civilization*. (1946).

Harriet Jacobs' *Incidents in the Life of a Slave Girl*: A Post-Colonial Analysis of Slavery, Resistance and Survival

Dr. Aliya Halim

Assistant Professor, Department of English, The Neotia University,
39 A, Old Ballygunge, 2nd Lane, Kolkata - 700019, WB
aliya.chowdhury@gmail.com

Abstract

During the Trans-Atlantic slave trade, millions of African people were brought forcibly to America. They were stripped of their identity, culture and freedom. These enslaved people found ways to resist, survive and document their experiences. In the eighteenth and nineteenth centuries a literary tradition of writing autobiographies and memoirs emerged in United States by the enslaved black people. These slave narratives provide a powerful testament to the lives, struggles and resilience of the Black people who endured the evil custom that harmed humanity. Biographies, memoirs, life stories of Blacks were later published as models to overcome past adversities. The autobiographies served as counter-narrative to the dominant discourse on slavery. This paper analyses the *Incidents in the Life of a Slave Girl* by Harriet Jacobs. Jacobs' autobiography provides a rare perspective on the intersection of slavery, resistance and survival.

Keywords: Narrative, Slavery, Resistance, Survival

The history of human bondage and slavery that the European colonizers introduced in Africa and America was so inhuman that it finds no comparison in World History. The Americans introduced such precision to this inhuman torture that presented it to be simply unique in the evolutionary history of man-kind. When the Portuguese began trading in Africa, they found that the African prisoners of war, their wives and children could be easily sold as slaves.¹ The first Africans that landed on the American soil turned into indentured servants.² The boom in plantation industry of the Southern States of America ushered a huge

demand for labour and with this the institution of chattel slavery began.³ The Blacks now became lifetime properties of their white masters. They were completely bound to depend on their master's will. These African American⁴ slaves henceforth were divested of their culture, language and beliefs.

Orlando Patterson (1982) has described the hell-like torture of the Middle Passage⁵ and the hellish treatment of the Blacks as "social death." The system of slavery prevented African Americans from having any identity. Patterson remarks that a slave becomes a "social non-person" who

could neither have a family nor a community nor a past or future and any personal honour.

The slaves developed a feeling of complete alienation created out of slavery. The American white masters thought that the conditions they created for the slaves were most natural and proper for the “Black Aborigines.” All probable steps were taken to provide an intellectual and moral cover to slavery’s naked politics of exploitation. According to the advocates of slavery, the darkness of skin symbolized “an absence of light within”, a void which rendered the Black people as an “unknowable alien” and a “threatening other.” For the white masters this intellectual, spiritual and moral otherness could be managed only by the institution of slavery which in their view was the only acceptable alternative.

After United States won the War of Independence, the newly formed U.S. Constitution included various criteria to protect slavery. The presence of slaves increased the representation of a state in the Congress. This led to an increase in power of the Southern states where plantation economy had enormously gathered a huge number of slaves. In contrast, in the industrial North, slavery was growing into a costly investment. Therefore, because of socio economic necessity and the rise of anti-slavery advocates known as Abolitionists, slavery began to be abolished in the North and North-Western States.

However, the South did not abolish slavery even after the U.S. Constitution outlawed the African slave trade in 1807. One of the reasons was the growth of the British textile industry that required increased production of cotton fibre. The planters and land owners found that slaveholding was the key to unlock the vast wealth. The system of slavery and owning slaves was integral to the Southern part.

At this crucial juncture, a Black preacher of Southampton County in Virginia named Nat Turner⁶ led a group of Black slaves in a bloody march towards Jerusalem, capturing its arsenal and ammunition supply and killing sixty whites. Later they were captured by the federal troops. However, this incident traumatized the slave-holding Southern states so much that they placed tighter restrictions on their slaves. The horrid treatment of the slaves by their white master class brought out the talent of the Black writers, orators, poets, women right activists alike to lay bare the hypocrisy underlying the white democratic mentality. Some of the well-known names include James Albert Ukawsaw Gronniosaw (1705-1775), Jupiter Hammon (1711-1806), Benjamin Banneker (1731-1806), Olaudah Equiano (1745-1797), Sojourner Truth (1797-1883), George Moses Horton (1797-1883), Maria W. Stewart (1803- 1879), Henry Highland Garnet (1815-1882), William Wells Brown (1816-1884), Frederick

Douglass (1818-1895), Francis Ellen Watkins Harper (1825-1911) and many more. One of them was Harriet Jacobs whose *Incidents in the Life of a Slave Girl* is a seminal work on slave narratives.

Harriet Jacobs (1813-1897) was a fugitive slave. She was born under the institution of slavery but she acquired literary skills which was rare among slaves. *Incidents in the Life of a Slave Girl* is her autobiography chronicling her life events, the harmful effects of the evils of slavery, sexual abuse and exploitation of female slaves, the painful anguish of slave mothers parting from their children and the harrowing details of her own escape. She wrote under the penname Linda Brent who is both the narrator and the protagonist. The book after several rejections was finally published in the year 1861 and was edited by L. Maria Child. It is a slave narrative documenting Jacobs' life as a slave and her struggle to gain freedom for herself and her children. Her autobiographical narrative brings out her resistance against the exploitation and abuse of her white master and is an instance of her effort to shape opinion on the "peculiar institution" of slavery. She writes in her preface, "I do earnestly desire to arouse the women of the North to a realizing sense of the condition of two millions of women at the South, still in bondage, suffering what I suffered and most of them far worse." Her answer to the question to

what slavery really is: "Only by experience can anyone realize how deep and dark and foul is that pit of abominations." Henry Louis Gates' theory of "authentication" explains how Jacob uses prefaces, testimonials and linear autobiographical structures to validate her experiences within a sceptical white publishing world. (2007)

Jacobs' autobiography *Incidents in the Life of a Slave Girl* consists of forty chapters and is written in the first-person narrative. She has used fictitious names of persons and places. The editor L. Marie Child in the Introduction comments that, "this peculiar phase of slavery has generally been kept veiled; but the public ought to be made acquainted with its monstrous features" and she states that she is doing it for "the sake of my sisters in bondage" and with the hope of "arousing conscientious and reflecting women at the North to a sense of their duty, in the exertion of moral influence on the question of slavery on all possible occasions" and that "every man who reads this narrative will swear solemnly before God that so far he has the power to prevent it, no fugitive from slavery shall ever be sent back to suffer." She describes slavery as a "loathsome den of corruption and cruelty." This testimonial written by a white editor was considered essential for the work to get published as it testified its authenticity and credibility. The autobiography though a personal

record, documents Jacobs' quest for freedom, the pain, the suffering and degradation she underwent due to slavery, her self-expression and resistance and the bond of motherhood, family loyalty and abandonment. It also serves as an important testament of the brutalities of slavery, the impact of the Fugitive Slave Law⁷ and different socio-political issues of her time. William L. Andrews (1993) terms the slave chronicles as "literatures of emancipation" crafted not only to document the suffering but to intervene politically in abolitionist debates. In this case Jacob writes back against systems that attempt to silence her. Her autobiography becomes a process of reclaiming personhood in a context designed to erase it.

The autobiography opens with Jacobs' father, a carpenter who was permitted to work and maintain his family in lieu of paying his owner a huge sum of money every year. Her father's strongest desire was to acquire his own children and free them from slavery but he could never fulfil his wish. She informs that the slaves had to make money to purchase their own freedom. Jacobs mentions that a slave is considered "a piece of merchandise", "a valuable piece of property" by the white master class. After the demise of the master or the mistress the slaves were distributed among the relatives or sent for "auction." Her grandmother, Aunt

Martha's children were sent to the "auction block" (Jacobs).

When Jacobs' father died, she was stopped from visiting her father's house. Instead, she was directed to get flowers for decorating her mistress's house for the evening party. She writes, "I spent the day gathering flowers and weaving them into festoons, while the dead body of my father was lying within a mile of me. What cared my owners for that? He was merely a piece of property. Moreover, they thought that he had spoiled his children by teaching them to feel that they were human beings. This was a blasphemous doctrine for a slave to teach..." (Jacobs). Jacobs opines that, "we who are slave-children, without father or mother, could not expect to be happy" (Jacobs). As a slave girl "she is not allowed to have any pride of character" because it is regarded as criminal offence for slaves to remain morally good (Jacobs).

Jacobs critiques the system of law by bringing forward that, "no promise or writing given to a slave is legally binding, for, according to Southern laws, a slave, being property, can hold no property." She illustrates different painful incidents that she experienced and witnessed in her life. The slaves are devoid of any protection from law as she declares that, "there is no shadow of law to protect her from insult, from violence or even from death... the degradation, the wrongs, the vices, that grow out of slavery are more than I can describe.

They are greater than you would willingly believe” (Jacobs). She narrates her falling in love with a carpenter in the neighbourhood but she was unable to marry him because “when I reflected that I was a slave and that the laws gave no sanction to the marriage of such.” Even the “husband of a slave has no power to protect” his wife because “slaves had no right to any family ties of their own” (Jacobs).

Jacobs describes the institution of slavery as an “act of injustice”, “a cruel bondage.” She discusses that when everyone is busy celebrating the New Years Day on first of January, the slaves are sold and hired on that day. If a slave is not ready to go with his new owner, he is either whipped or put in lockup. In case any slave is caught trying to escape then “the whip is used till the blood flows at his feet and his stiffened limbs are put in chains, to be dragged in the field for days and days!” A slave mother experiences huge sorrow and loss on the New Year Day. All her children will be separated from her and traded to far off places not to be united again. Jacobs remarks that it is a painful situation that every slave mother goes through. Their wish is to die before the day begins. She says that, “she may be an ignorant creature, degraded by the system that has brutalized her from childhood, but she has a mother’s instincts and is capable of feeling a mother’s agonies.” She recounts that, “instances of this kind

are of daily, yea, of hourly occurrence” (Jacobs).

Jacobs asserts that, “no pen can give an adequate description of the all-pervading corruption produced by slavery.” She reveals that the white daughters of the owner are attended by the black slave girls whom their father has corrupted. They very well know that these women slaves are subject to their father’s authority and so similarly they too exercise similar authority on the men slaves. She testifies from her own experiences and observations that slavery is “a curse to the whites as well as to the blacks. It makes the white fathers cruel and sensual; the sons violent and licentious, it contaminates the daughters and makes the wives wretched. And as for the coloured race, it needs an abler pen than mine to describe the extremity of their sufferings, the depth of their degradation.” She concludes that, the institution of slavery brings about a “widespread moral ruin occasioned by this wicked system” (Jacobs).

Jacobs discusses her traumatic sexual history in order to politicize it and also insist that a forbidden topic like sexual abuse of slave women should be brought to light in discussions on slavery. Her autobiography is one of the earliest narratives to openly address the sexual vulnerability of Black women under slavery, making it a foundational text in Black Feminist literary history. She says that every moment Dr. Flint

made her feel traumatised in a way that she should conform to all his commands because she “was nothing but a slave, whose will must and should surrender to his.” The power of her resistance is seen in her comments, “the war of my life had begun, though one of God’s most powerless creatures, I resolved never to be conquered” (Jacobs). She reveals that her “soul revolted against the mean tyranny” meted out on her by Dr. Flint (Jacobs).

When she escapes, she hides in the swamp and for her “those large, venomous snakes were less dreadful... than the white men in that community called civilized” (Jacobs). At her grandmother’s house, she remained in the hideout for seven years in a cramped position where there was no gleam of light for days. She preferred this state of living rather than be a slave to someone. This space where Jacobs confined herself acts as a metaphor in Black critical thought. In the beginning the space of the garret was oppressive because of its darkness, lack of movement and loss of speech. Later on, she bore holes in the garret that allowed her to see the happenings taking place outside. McKittrick (2006) explains that, Jacobs creates an alternate way of seeing and reimagining freedom while protecting her from hyper-visibility that the Blacks, particularly the Black women are subjected to. She shows how gendered-racial-sexual domination is spatially organized. For Jacobs, the

garret acts as a space of concealment and confinement as well as a space for resistance and freedom. It becomes her meaningful response to slavery.

Jacobs in her autobiography *The Incidents in the Life of a Slave Girl* brings out “how slavery perverted all the natural feelings of the human heart” (Jacobs). Her text functions as a subversive autobiographical act by foregrounding the brutal realities of sexual exploitation, family separation and systemic violence. Her real-life experiences are a powerful source of information on the system of slavery. She calls slavery “a patriarchal institution” (Jacobs). Her memoir gives a vivid picture of the abominable system of slavery. It accounts her struggles and the method she adopted to fight back the system and to escape from it.

Her work depicts the cultural and racial inequalities, deprivation, subjugation, economic subordination, rootlessness and cultural isolation that the Black people underwent. Spivak points out that, an epistemic violence is carried out on colonial people, devaluing their history, culture, language and ways of seeing. (1993). The Blacks were forced to remain subservient and subordinate and treated as the “Other”. Jacobs’ autobiography portrays the hypocrisy, corruption and exploitation of the Blacks. The torment they underwent is beyond the factors of race, sexuality, nationality and ethnic variations. Jacob’s work informs the

world about the inhuman torture committed by the colonial rulers and the fight of the Africans against the colonizers. Her detailed recounting of abuse, captivity and psychological torment transforms her autobiography into a testimonial narrative, offering communal memory for collective trauma. She claims agency by naming atrocities that were often socially suppressed. Her narrative therefore becomes an act of political and rhetorical resistance, expanding the boundaries of nineteenth century women's literature.

End Notes

1. Bonded labourers for life.
2. These individuals had to toil hard for the masters who purchased them but they had the freedom to work outside in their free time and earn money to buy back their own freedom.
3. These people could never buy their freedom and remained in perpetual bondage generation after generation.
4. The term 'African American' has its roots in the late 20th century. It replaced the earlier terms 'Negro', 'Coloured' and 'Black.' This was because of the increased pride in the African heritage, for self-identification and autonomy.
5. The journey from Africa to America by sea and the torture that

started on-board to initiate them into the ways of slavery.

6. Nat Turner (1800-1831) was an enslaved African American revolutionary leader who led several slave rebellions. He was captured, tried and convicted for treason and insurrection and later executed.
7. The Fugitive Slave Law of 1850 laid down the return of enslaved persons who had fled from slavery to their owners. This law allowed slave holders to pursue and capture their slaves who had run-away to the Free States.

Works Cited

- Andrews, William L. *African American Autobiography: A Collection of Critical Essays*. Prentice Hall, 1993.
- Andrews, William L., *Foster Francis Smith & Harris Trudier*. *The Oxford Companion to African American Literature*. New York: Oxford University Press, 1997.
- Ashcroft Bill, Gareth Griffiths & Helen Tiffin. *The Empire Writes Back: Theory and Practice in Post Colonial Literatures*. London & New York: Routledge, 2002.
- Baker, Houston A., Redmond Patricia. *Afro-American Literary Study in the 1990s*. University of Chicago Press, 1989.
- Bhabha, Homi K. *The Location of Culture*. Routledge, 1994.
- Braxton, Jeanne M. *Black Women Writing Autobiography: A Tradition within a Tradition*. Philadelphia: Temple University Press, 1989.
- Fanon, Franz. *Black Skin, White Masks*. New York: Grove Press, 2008.

- Garraty, John A. *The American Nation: A History of the United States since 1865 to 1877*. New York: Harper & Row Publishers, 1966.
- Gates, Henry Louis, Jr. Mc Kay, Nellie Y. *Norton Anthology of African American Literature*. New York: W.W. Norton & Company, 1997.
- Gates, Henry Louis & Jarrett, Gene Andrew. *The New African American: Readings on Race, Representation & African American Culture 1892-1938*. Oxfordshire: Princeton University Press, 2007.
- Horton, James Oliver & Horton, Lois E. *Hard Road to Freedom: The Story of African Americans*. Rutgers University Press, 2001.
- Jackson, Blyden. *A History of Afro-American Literature. Vol.1: The Long Beginning, 1746-1895*. Louisiana State University Press, 1989.
- Jacobs, Harriet A. *Incidents in the Life of a Slave Girl*, Written by Herself. Boston, 1861. <http://www.gutenberg.org/ebooks/11030>.
- Killens, John Oliver & Ward, Jerry W. Jr. *Black Southern Voices: An Anthology of Fiction, Poetry, Drama, Non-fiction & Critical Essays*. New York: Meridian, 1992.
- McKittrick, Katherine. *Demonic Grounds: Black Women and the Cartographies of Struggle*. University of Minnesota Press, 2006.
- Moore Gilbert, Stanton Maley, Addison Wesley (ed.). *Postcolonial Criticism*. New York: Longman Limited, 1997.
- Morison, Samuel Eliot. *The Oxford History of the American People*. Oxford University Press, 1965.
- Patterson, Orlando. *Slavery and Social Death: A Comparative Study*. Cambridge: Harvard University Press, 1982.
- Said, Edward W. "Resistance and Opposition" in *Culture and Imperialism*. London: Chatto and Windus, 1993.
- Spivak, Gayatri C. "Can the Subaltern Speak?" in *Colonial Discourse and Post-Colonial Theory: A Reader*. Patrick Williams and Laura Chrisman (ed.). Hemel Hempstead: Harvester, 1993.

Revolt Against Patriarchal Subjugation: Women's Resistance in the Works of Banu Mushtaq and Rohinton Mistry

Dr. Abdul Shamim

Dept of English, Renuka College, Besa, Nagpur.
abdulshamim3@gmail.com

Abstract

The present research paper examines how women characters in the works of Banu Mushtaq and Rohinton Mistry revolt against patriarchal subjugation and assert their agency within oppressive social structures. Situated in the socio-cultural contexts of minority communities in India-Muslim and Parsi respectively-the selected fictional narratives expose multiple forms of domination: patriarchal control, sexual and social exploitation, and enforced economic dependency. Through the struggles of characters such as Dina Dalal in *A Fine Balance* and Mehrun, Aashraf, and other women in Mushtaq's *Heart Lamp*, the study reveals how women confront institutionalized gender norms that restrict their mobility, autonomy, and decision-making. Drawing from feminist perspectives articulated by thinkers such as Sarah Grimké, Mary Wollstonecraft, and Virginia Woolf, the paper analyses how these women resist the hegemonic structures of family, community, custom, and religion. Mushtaq's association with the *Bandaya Sahitya* (Rebel Literature) movement and Mistry's socially conscious narratives provide powerful literary platforms for portraying women who challenge oppression-subtly or assertively-while reclaiming dignity, justice, and independence. The study ultimately highlights that despite the constraints of tradition, religion, and community, the voices of these women emerge as symbols of resilience and revolt, urging a re-evaluation of gender roles in contemporary Indian society.

Keywords: Patriarchy, justice, domination, gender, rights and revolt

Introduction

Society consists of men and women. The society should run smoothly so certain rules are formed and it is expected that they should be followed by each gender. When we analyse those rules we come to know that they are made to give advantage to the male and dominate the women. These customs and traditions are made by the male members of the society to

take undue advantage of the women. They don't consider women as equal but subordinate to them. They are oppressed and exploited in a systematic manner in which they are given the impressions that they are incapable of taking the decisions of the lives and they are weak so they need to be protected. The agency of patriarchy works at different level in the society. Sarah Grimke in "*Letters on the Equality of the Sexes*" observes"

Man has subjugated woman to his will, used her as a means to promote his selfish gratification, to minister to his sensual pleasures, to be instrumental in promoting his comfort; but never has he desired to elevate her to that rank she was created to fill. He has done all he could do to debase and enslave her mind” (11).

The late eighteenth century saw the agitation of women for their rights particularly the writings of Mary Wollstonecraft, Virginia Woolf. Their works strive to awaken women for their rights. In the 21st century there are women writers like – Kamala Markandaya, Nayantara Sahgal, Shashi Deshpande and Anita Desai are few writers who have delineated women characters who rebel against the subjugation of men. In the present research paper, the researcher has selected the fictional works of Banu Mushtaq and Rohinton Mistry who are acclaimed writers have won several prestigious awards. They are the writers of Indian origin. Rohinton Mistry has migrated to Canada whereas Banu Mushtaq lives in India and writes in Indian regional language of South India. They both belong to the minority religions –Muslim and Parsi religions respectively in India. They represent their religions in their fictional works. They reflect the positive and negative aspects of their community. Banu Mushtaq is the international Booker Prize Winner of 2025 for her fictional

work *Heart Lamp* that was originally written in Kannada and later translated into English by Deepa Bhashti. It is a collection of 12 short stories set in south India. The characters are South Indian Muslims and the protagonists are women in all her stories. The customs, traditions and rituals are portrayed faithfully in her works. She is a lawyer, activist and is associated with *Bandaya Sahitya* (Rebel Literature) movement which is reflected in her writing.

Patriarchal Control: Dina Dalal is a female protagonist in the novel *A Fine Balance* (AFB). She belongs to a traditional Parsi family. When her father dies, Nusswan, –her elder brother, becomes the head of the family. He tries to dominate her from her childhood. The maid of the family has been removed and the household chores lie on the young shoulders of Dina who finds it difficult to cope with her studies, and therefore she does not get good marks in her exams. Yadav opines that “He (Nusswan) considers Dina’s desire for independence as a sign of rebellion against his authority” (124). He makes it an excuse to stop her studies and plunges her into the drudgery of the house. She shows her rebellious nature right from the beginning in the novel when she gets her haircut which is against her brother’s -male chauvinism. So, she has been beaten black and blue because of this fault of hers because she has tried to break the hegemony of patriarchy.

Heart Lamp is Banu Mustaq's anthology of 12 short stories and it is also the name of one of her stories. *Heart Lamp* is the story of Mehrun who has been married to Inayat and has returned to her paternal home because her husband has been in an illicit relationship with the nurse and has started staying with her in another town. She complains that she wanted to continue her higher education but it was not allowed to her. Her elder brothers decided the date of her marriage without taking her consent. She pleads with them to be permitted to appear in her B.Com –second year exam before the ceremony. They got her married when she entreated her husband to appear in the exam, "A week or so after the wedding, she had hesitantly talked to her husband about it. He had laughed, called her 'love', 'darling, 'my heart. 'If you are not here,' he had said, 'won't I stop breathing? Mehrun had believed that if she was not with him, maybe he might. She was happy. She had followed his every wish" (Heart Lamp 108). The father, brothers and husband –the representative of patriarchy totally controls her and do not allow her to pursue her education.

Dina shows her resistance right from her childhood: she cuts her hair short. When Nusswan sees her short hair, he frets and fumes. He tries to show his authority and punishes her by forcing her to tie back her short hair with the tape when she attends her

school. She still does not surrender her free will and desire to leave her life on her own terms and conditions. She comes up with the idea when she reaches school, she removes the tape and slips the hair into her bag only she puts it on while returning to home.

When Dina Dalal reaches the age of marriage, the proposals have been brought by Nusswan of his friends who have been financially sound and he wants that she should get married with one of his friends. She has been firm in her decision to get married with Rustom - a boy of her choice. He is a mere chemist but unfortunately their happy married life is very short. He meets with an accident and succumbs on the spot.

The three elder brothers of Mehrun don't allow her to stay at their place and the day she comes from her husband's house, she is made to return her husband's house. The patriarchal members give a lecture on the honour of the family and remark "But if you had any concern for this family's honour then you would have done that instead of coming here. The house that your dholi goes to should be the house from which your dhola comes out. That is the life of a decent woman" (Heart Lamp 103).

In another story *Black Cobras* by Banu Mustaq –Aashraf who is the leading female character has been deserted by her husband after the birth of their third daughter, Munni. She is

very weak and needs medicine, but she does not have money for it. So, Aashraf has started working in other people's houses as a domestic help. Yet she finds it difficult to cope with the household expenses. Aashraf meets her husband Yakub personally and persuades him not to desert her and their poor children. Yakub gets angry and throws a ten-rupee note at her as if throwing alms at a beggar, and rebukes her with laughter. He wants a son who can carry on his lineage. Yakub even gets married again to another woman. When Aashraf complains about this to the Mutawalli :

The mutawalli coughed, spat forth loudly. "What forbidden thing has he done now? He has done another nikaah, that's all, isn't it? He didn't elope with anyone, did he? Let him do it. Do you know that there is a Sharia law that says he can get married to four women? Why are you getting jealous of that? These women are like this only. They know only to be jealous, he said, looking at Amina from the corner of his eyes. (*Heart Lamp* 51)

Sexual and Social Exploitation:

In *Heart Lamp*, Inayat enjoys his marital life with Mehrun and she bears him five children in a period of seventeen years of their married life. She takes care of his joint family and she does not get time to take care of herself; "her face had become wrinkled and the veins on her hands stood out, and there was a thin shadow under her eyes, her heels had cracked, and dirt had settled

permanently under her chipped, uneven nails, her hair had thinned - and she had noticed none of this"(*Heart Lamp* 108). When he does not get sexual satisfaction from Mehrun, he gets seduced by the nurse. As Mehrun raises objections he retorts that she has become old, "he criticised Mehrun for her loose stomach, and her sagging breasts" (*Heart Lamp* 108). It is quite noticeable here that how a male controls the body of the woman and uses it to his sexual gratification. When he doesn't get gratification, he moves to another woman. But Mehrun does not remain silent, she writes several letters to her parents and intimates her parents about her husband's illicit relation with the nurse. She decides to leave him and stays with his parents.

In *Black Cobras* by Banu Mushtaq, Aashraf the protagonist of the story revolts against her husband – Yakub – an auto driver who deserts her and her three little children. His complaint was that she has not given birth to a boy who could continue his lineage. He even got married with another woman and starts living with her. Aashraf complains to the muttawali – trustee of the mosque committee to give justice to her children. She gives petition to the muttawali that she wants that she should be given expenses for her children.

Economic Dependency: Dina Dalal after the death of her husband, does not return to her brother's house. She begins her work of supplying stitched clothes to an emporium. She

even hires two tailors –Ishvar and Omprakash and when they face the problem of shelter, she keeps them at her house and earns her living by stitching clothes. Dewnarian states “Dina Dalal seeks to escape from this subordinate position within the family and struggles to maintain her independence in an unorthodox manner” (57). She decides to lead a life of an independent woman who is financially strong therefore she stays lonely at the house of her death husband. She learns the skills of stitching and soon gets mastery and she starts stitching by taking the contract from the big emporium. Gradually, with the passage of time, her vision gets weak but it doesn't deter from her mission of leading a life of her own. So, she hires two tailors belonging to the lower caste and keeps them in her house for the work of stitching that is also a revolutionary step for a woman belonging to a traditional Indian family.

Aashraf in the story begins work as a maid in the house of Zulekha Begum and looks after her three daughters. But she falls short of money and protests against the patriarchal system of compelling the women to remain economically dependent on them. She agitates against the system and lodges complaints to the committee of the mosque to give justice and help her to get medical expenses for her infant daughter:

Aashraf was determined and ready to make justice hers, instead of having to beg for it. Munni stirred in her lap. Her breath sounded strained. There were beads of sweat on her forehead. Munni's neck was soaking wet. Aashraf wiped her child's neck and armpits with her saree. She touched her body, and, even in that state of distress, felt relieved that the fever was coming down. (Heart Lamp 54-55)

Patriarchal Judgement: Zulekha Begum who belongs to an elite family and is highly educated, has sound knowledge of Islam and Hadith- the sayings and the life of Prophet Mohammed, makes her aware about the rights of women in Islam and inspires her to fight for her rights given in Islam. They are being usurped by the male dominated society in collusion with one another. She says:

"What I am saying is correct, Aashraf. All these rights are available for women in Islam. A girl can go to school, she can go to the shops, go to work. She can have a life outside. But there is a clause too that she should not exhibit her body and her beauty"

.... Zulekha Begum began giving a passionate lecture.....If he does not, hold his collar in front of people and demand them. This mutawalli, take the slipper from your foot in your hands. Slap him with it and insist. Do not beg. Demand justice. Do you know who gets justice? Only those who demand it.

People like you will not get justice if you don't demand it. Give a petition to the masjid, gather a panchayat around and call me. I will tell your man, and that mutawalli, what the Sharia is, what justice is. Twisting the Qur'an and Hadiths the way they want in front of a helpless woman is not justice. (Heart Lamp 54)

Aashraf gets success in conducting the meeting of the mosque committee however the mutawalli at first makes excuse that her case is inadmissible that Sharia law allows that a Muslim man to keep two wives. Aashraf does not get justice for her children that is given in Islam that a male can marry to another woman but he has to bear the expenses of both the wives, he has to give justice to both. Yakub complains before the committee "That Gafoor. Idris, Nasir, all of them have two wives and are having fun, but none of their wives are causing trouble like this. They have quietly gone to their maternal homes, or else they are working as coolies or something. This bitch has not only troubled me for two years, but has now climbed the steps of the mosque even" (Heart Lamp 57).

In a fit of anger Yakub kicks Aashraf who is holding her infant Munni. They both fall. Aashraf is injured, but her baby dies because of the fall.

Tradition and Customs: In the case of Mehrun also when she protests

against her adulterous husband that she does not want to live with him; her brothers do not listen to her but leave her at her husband's without talking about his illicit relation. Mehrun takes the extreme step of killing herself by self-immolation however the attempt was thwarted by her daughter Salma who persuades her to live for her and her other children forget about their father who has brought innumerable miseries in their lives. After the burial of Munni all the women of the village revolt against the mutawalli when he returns from the graveyard the elder woman Hanifa sweeps the slush on the mutawalli and curses her. Rafiya throws stone at non-existing dog looking at him shouting dog. Naseema looking at the cock curses throwing the ill words on the mutawalli –donkey and Quazi Saheb's daughter in law remarks that he is gorilla, Jameela prays that the Mutawalli be born with pig's face on judgement day. Asifa literally spits at him in anger. Mutawalli's wife declares that she will get herself operated and stays at her parents' place for a week and orders to look after her seven children meanwhile. As the title of the story is *Black Cobras* all the women in the story appear to be emitting venom of resistance against the mutawalli.

Dina Dalal a character delineated by Rohinton Mistry in *A Fine Balance* is a revolutionary character who tries to challenge patriarchal hegemony of the society where women are considered as

subordinate to their males' counterpart. She revolts to break the shackles of the traditional Indian woman and becomes the embodiment of modern woman in the post independent India.

Conclusion

The comparative study of Banu Mushtaq and Rohinton Mistry demonstrates that both writers, though emerging from distinct cultural and linguistic backgrounds, foreground the persistent realities of women's subjugation within patriarchal systems. Their female protagonists are not passive sufferers; instead, they embody revolt in diverse ways—through emotional resistance, moral dissent, and tangible acts of self-assertion. Dina Dalal's struggle for independence despite familial control, and the defiant actions of Mehrun, Aashraf, and other women in Mushtaq's *Heart Lamp*, collectively reveal the complex interplay between gender, community, religion, and socio-economic structures.

The stories analysed illustrate that patriarchy manifests not only through overt physical oppression but also through subtler mechanisms: denial of education, economic dependency, silencing of women's voices, and misinterpretation of religious laws to cement male authority. Yet, these very structures ignite resistance. Aashraf's insistence on justice before the mosque committee, the collective uprising of village women against the mutawalli, and Dina's determination to sustain a self-reliant life challenge the

conventional expectations imposed on women.

Ultimately, both authors underscore a powerful truth—women's resistance is not a momentary act but an ongoing process of reclaiming identity, agency, and dignity. Their works advocate the necessity of social awareness and structural change, urging communities to reinterpret tradition and religion in ways that honour women's rights and humanity. Through these narratives of revolt and resilience, Mushtaq and Mistry contribute significantly to contemporary Indian feminist discourse and inspire further research into women-centred resistance in literature.

Works Cited

- Dewnarian, Nandini Bhautoo. *Contemporary Indian Writers in English -Rohinton Mistry: An Introduction*. New Delhi: Cambridge University Press, India Pvt. Ltd., 2007.
- Mistry, Rohinton. *A Fine Balance*. London: Faber and Faber, 2003.
- Mushtaq, Banu. *Heart Lamp: Selected Stories*, tr. Deepa Bhashi, Penguin Random House India, 2025.
- Sarah, Grimke. *Letters on the Equality of the Sexes and the Condition of Women*. New York: Bart, Franklin, 1970.
- Yadav, Jyoti. *Ethnic Anxiety and Cultural Adaptability: A Critical Study of Bapsi Sidhwa and Rohinton Mistry*. New Delhi: Creative Books, 2011.

Preserving the Past, Sustaining the Future: Archaeological Tourism Potential of Pauni Heritage

Neha Dubey

Assistant Professor, Department of Travel and Tourism,
RTM Nagpur University

Dr. Priyadarshi Khobragade

Associate Professor, Department of Ancient Indian History, Culture and
Archaeology, RTM Nagpur University
justneha09@gmail.com

Abstract

This work describes an action plan founded on a place-based approach to sustainable regeneration of an archaeological site, Pauni, located on the Wainganga River in Maharashtra. The strategy suggested would combine the preservation of archaeological background with non-exclusive ways of local development. The framework is based on the UNESCO theory of the Historic Urban Landscape HUL and informed by the results of the Archaeological Survey of India (ASI) at Pauni, by the provisions of the laws in India under the Ancient Monuments and Archaeological Sites and Remains (AMASR) Act of 1958. The study will present archaeological documentation and policy literature (i) outline the central heritage values of Pauni (Buddhist stupas, inscriptions, coinage, and fort landscape); (ii) indicate its assets, constraints and opportunities for governance and planning of conservation-oriented development; and (iii) create a staged 24-month action for developing it as an archaeological tourism site. The combination of legal tools, archeology, and participatory planning can be merged to deliver both heritage protection and social welfare of the local community.

Keywords: Pauni; Bhandara, archaeology; Buddhist stupas; sustainable heritage; HUL; AMASR; heritage tourism; India

Introduction

Several small historic towns are facing the twin challenge of maintaining the delicate archaeological heritage and at the same time allowing the local populations to maintain respectable livelihoods. These communities frequently represent centuries of cultural and religious heritage, but the

population there hopes to have a better economic life. The city of Pauni in Bhandara District of Maharashtra is a typical example of such a balance. The Archaeological Survey of India (ASI) has conducted excavations revealing its early historic status of Buddhist stupas, inscriptions and a variety of coinage. Although these findings shed more light on the history of the city of Pauni, they

also pose pressing questions on how to preserve its heritage and at the same time encourage modern development. The geographical and cultural context of Pauni increases its relatability even more. The town lies next to the Wainganga River and the landscape of a fort-temple incorporates natural, military, and spiritual elements. These cultural deposits provide high possibilities of heritage-based tourism. In this regard tourism is not just about inviting visitors; it is also used to use heritage as an educational, community pride, and sustainable local economies catalyst. Maharashtra Tourism has already realized the potential of Pauni but to access it, they need a holistic approach that integrates the need to maintain the archaeological sites with the developmental needs. The preservation of monuments is not enough to adequately involve sustainable revitalisation. It needs an interdisciplinary landscape-based approach that puts into account the interrelations between heritage resources, the environment and the community life. There are archaeological sites in places with living populations where farmers work, people hold festivals, construction of houses, and trade. Widely centered attention to monuments and its narrowness may jeopardize the results of conservation and the disengagement of residents. Rather, the revitalisation should encompass the local communities, accommodate their interests, and make them enjoy the economic opportunities created by the

tourism. Such an approach can help with the UNESCO Recommendation on the Historic Urban Landscape (HUL), which was adopted in 2011. It perceives heritage as a living resource which aids in modern day wellbeing and not an inanimate object. The HUL framework emphasizes proper inclusiveness of governance, social and economic realities, and the compatibility of heritage protection to the overall urban development policies. In the case of Pauni, this would mean putting together plans that would save stupas and inscriptions and enhance basic infrastructure, provide training to local guides and craftsmen and make sure that the development of tourism does not affect the ecological balance of the Wainganga River. These activities should be in operation in terms of the laws that protect the heritage in India with special references to the Ancient Monuments and Archaeological Sites and Remains (AMASR) Act of 1958. The Act also establishes 100 metres prohibited zone and a 200 metres regulated zone around identified monuments, thus defining what can be done within the surrounding. Although these encroachment restrictions protect the archaeological resources of Pauni, they also bring up the need to be creative in the way the encroachment restrictions are planned to ensure that the heritage-compatible development does not infringe upon the legal requirements. In a way, Pauni is the representation of the larger issue of historically managing the South Asian context; how to reconcile

archaeological authenticity with local developmental sustainability. Its location on the riverfront, fort-temple complex and Buddhist remains are a strong base on which cultural tourism could thrive, but only inclusive planning, community involvement, compliance in the law, and seeing heritage as a living cultural resource can make the difference. The lessons out of Pauni are hence not limited to the area only, but are also applicable to most of other small towns within the area which happen to be in a similar situation.

Research Objectives

- To outline the central heritage values of Pauni (Buddhist stupas, inscriptions, coinage, and fort landscape)
- To indicate the governance and planning challenges that may limit the opportunities of conservation-oriented development through comparison.
- To create a staged 24-month action plan that encompasses the financing strategies and a monitoring scheme.

Literature Review

The archaeological significance of Pauni is strongly based on the decades of documentation and studies. According to the Pauni Excavation Report, the town is important as a very early Buddhist settlement site since it has stupas, monastic sites and artefacts which make it a part of the cultural landscape of Vidarbha (Archaeological

Survey of India, 1991). This perception is strengthened by the complementary regional studies. Naranje (2002) notes that the Bhandara-Gondia region hosts a wide range of cultural and religious structures and monuments and Pauni is one of the most interesting early Buddhist structures since it has sculptural remains and well-maintained stupas. He also emphasizes the fact that it is necessary to place Pauni in the context of greater archaeological India, where the identity of the place has been formed through a long-term presence and religious practice. The documents on planning shed more light on the strains on the cultural landscape of the town. In development plans developed by the Town and Country Planning Department (1973, 1996), factors like land encroachment, inadequate infrastructure and the necessity of intertwining the heritage preservation and the modern city development are highlighted. Other artisanal scholarship, such as that by Nanekar (1968), shows how traditional industries, especially handloom weaving, are useful to the socio-economic life, and thus shows that heritage in Pauni not only ends in archaeology but also in craft traditions and contemporary living cultures. Meshram (1994) adds to this knowledge by finding Pauni a prominent Hinayana Buddhist center, which was connected with more widespread Buddhist networks in central India. These discoveries are closely associated with the international research on sustainable

redevelopment of historic towns, whose current trends are dealing with the intersection of heritage management and urban planning and community development. The literature falls into three main themes; landscape-based heritage management most prominently the Historic Urban Landscape-HUL-methodology, participatory heritage planning and tourism governance and regulatory compliance. They are especially applicable to Pauni where the presence of archaeological sites, a riverfront environment, and a complex of fort and temple both offer opportunities and limit them. Landscape Approaches and Historic Urban Landscape (HUL). The HUL Recommendation by UNESCO of 2011 marks a historic move to stop the focus of the preservation of monuments to the management of dynamic, lived cultural landscapes (UNESCO, 2011). Researchers argue that HUL can be used as a conceptual paradigm and an applied instrument that combines cultural-value mapping, environmental systems, and socio-economic realities with urban development agendas like SDG 11.4 (Bandarin and van Oers, 2015; Taylor, 2016). Despite the increased adoption of HUL since 2013, small towns tend to face challenges such as fractured governance, lack of adequate funds, and knowledge gaps (Ginzarly et al., 2019; Veldpaus, 2017). Research therefore recommends differentiation in implementation and gradual implementation instead of a blanket

application. Participatory and Values-Based Preservation. Another related literature has focused on the values-based heritage planning that recognizes tangible as well as the intangible as essential (Mason, 2002; Avrami et al., 2019). According to the findings of empirical research, community engagement leads to improved legitimacy, stewardship, and resolves conflict between conservation and development (Jokilehto, 2017; Wijesuriya, 2015). However, the involvement is not balanced in the case where heritage management is state-dominated and top-down (Logan, 2012). The current research highlights the importance of inclusive governance and long-term sustainability, which can only be realised by involving youth, women, and marginalised groups (Veldpaus & Pendlebury, 2019). Heritage Tourism and Community development. There is a huge debate on the relationship between heritage tourism and community well being. It has been found that tourism can positively impact the livelihoods of locals and the continuity of their culture in case benefit-sharing policies and participatory frameworks are tight (Rasoolimanesh et al., 2020). On the other hand, the inappropriate development of initiatives may lead to commodification and elite capture (Chok et al., 2007). The Indian case studies emphasize how effective community-based tourism (CBT) can be, but its implementation requires the

presence of proper institutions, branding, and market penetration (Singh, 2021). Buddhist circuit studies have also found that disjointed visitor patterns and poor interpretation limit the positive impacts of tourism unless site-level interventions are focused on accessibility and the quality of interpretation (Shinde, 2020).

Carrying Capacity and Visitor Management

An increase in the burden on archaeological landscapes has also redirected attention to adaptive carrying-capacity frameworks where visitor numbers are identified with conservation states, readiness of infrastructure, and toleration by the community (Saveriades, 2000; Albrecht, 2017). The flows are more regulated by using digital means, including QR-based entries and timed tickets (Pereira et al., 2022). It has been indicated that staggered itineraries and data-driven governance reduce the ecological burden and do not affect the local economic benefits (Peeters et al., 2018). Regulatory Environment in India. In India, heritage protection still relies on the AMASR Act (1958; amended 2010) which introduces 100-metre and 200-metre prohibited and regulated zones around the monuments being protected. Although it is essential in preserving the archaeological sites, academics realise that the Act has socio-economic effects, especially in highly populated towns (Chakrabarti, 2013).

The current policy controversies highlight the importance of context-specific by-laws, open approvals, and better definitions of the concept of setting monuments (Menon, 2017). Riverfront Environmental and Heritage Resilience. The riverine heritage towns require generative environmental plans. Blue-green infrastructure (erosion control, permeable surfaces, rain gardens, and others) promotes ecological stability besides providing ritual, cultural, and tourism applications (Kabisch et al., 2017; Das, 2020). Examples include Varanasi case studies, which show that there is tension between beautification efforts and local cultures and the nature of conservation necessities, highlighting the necessity of having balanced governance models (Singh, 2018). Pauni-Specific Insights Widely discussed issues reflect in the problems that Pauni faces. Its history, the weaving industries and their downfall, and their possible regeneration by adaptive reuse and tourism were recorded by Parlewar and Fukukawa (2006). The main constraints became the fragmentation of governance and financial constraints. Later studies also focus on the coordinated planning, product diversification, and community facilities to correspond the heritage conservation and livelihood improvement (Parlewar, 2010). These results indicate that Pauni would be serviced by an HUL-informed, participatory regeneration model.

Synthesis The literature however shows that sustainable revitalisation of Pauni would need: (a) HUL based, values based planning; (b) locally developed by-laws AMASR-conformant; (c) community-based tourism that has equal distribution of benefits; (d) visitor management, which is data-driven; (e) resilience to riverside features incorporated in upgrades to the public-realm. These features altogether can be considered evidence of a Heritage-Livelihood-Landscape model that is quite appropriate in small historic towns in South Asia.

Research Methodology

In the current study, the research paradigm is qualitative in nature by attempting the mapping of the heritage landscape of Pauni through practices of observation, secondary evidence and contextual analysis. This method focuses on the document analysis, research on archive and comparisons with already existing case studies, thus making it particularly appropriate to heritage inquiry where cultural values and historical importance cannot be quantified to be commodified. The investigation starts by reading a contextual background of the riverfront site of Pauni, fort-temple topography, archaeological elements of stupas and inscriptions. Though no explicit ethnographic fieldwork was used, observations were made on the basis of published reports, photographic archives and tourism histories to clarify

spatial and cultural relationships between monuments, natural environment and practices of the community. The main methodology is systematic analysis of secondary sources. They are ASI excavation reports outlining the early historic remains of Pauni, government documents like the AMASR Act and state tourism policies influencing heritage management, the existing scholarly literature on Buddhist archaeology and conservation. Insights gained in comparison to heritage towns such as Sanchi and Ajanta also help put Pauni in a better perspective in how it struggles to balance conservation and development. Thematic interpretation, informed by archaeological integrity, HUL-based planning and regulatory compliance, assures the synthesis of evidence which is comprehensive and based on two or more streams of evidence.

Results and Discussions

Diagnosis: Assets, Constraints, Opportunities

Heritage assets

- **Archaeology:** Stupas and associated material culture (inscriptions, coins) evidencing early historic religious and trade activity.
- **Built landscape:** Pauni Fort and ghats on the Wainganga-strong

spatial anchors for public realm and interpretation.

- **Intangibles:** Pilgrimage and annual festivals (e.g., Dhamma Mahotsav) that sustain living traditions.

Constraints (typical for small heritage towns)

- **Regulatory:** AMASR buffer restrictions necessitate meticulous design approvals for any interventions near protected assets.
- **Governance & Capacity:** Fragmented mandates between ASI, tourism, and local bodies; limited interpretation infrastructure and trained guides (commonly observed across the state).

- **Environmental:** Riverine setting implies exposure to flooding and bank erosion; visitor waste management challenges in peak festival seasons (generalized small-town risk; to be verified locally).

Opportunities

- **HUL-aligned revitalization** can marry conservation with mobility upgrades, flood-resilient landscapes, and craft/food economies.
- **Values-based tourism** (pilgrimage, Buddhist circuits, living fort–river walks) with interpretive media, training, and equitable revenue sharing.

Comparison of Pauni with Sanchi and Ajanta as a part of study

Dimension	Pauni	Sanchi	Ajanta
Heritage Significance	Emerging Buddhist site with stupa remains and sacred associations; less explored in mainstream heritage circuits.	UNESCO World Heritage Site; renowned for Buddhist stupas and monasteries, representing early Buddhist art and architecture.	UNESCO World Heritage Site; globally recognized for rock-cut caves and paintings depicting Buddhist narratives.
Tourism Development	Limited infrastructure; still outside major tourist itineraries; dependent on local/regional visitors.	Well-developed visitor facilities (museum, signage, pathways, guided tours); part of India’s central heritage tourism circuit.	Advanced facilities (visitor center, interpretation, controlled access); attracts large international and domestic tourist flows.
Visitor Management	Largely informal, community-driven; lacks formalized carrying capacity or ticketed regulation.	Managed by Archaeological Survey of India (ASI); structured entry, conservation zones, and crowd management systems.	Strict ASI and UNESCO guidelines; ticketing, time slots, and security to preserve delicate murals.
Interpretation & Education	Minimal interpretation (limited signage, basic	Strong interpretation through ASI museum,	Extensive interpretation with emphasis on art

Dimension	Pauni	Sanchi	Ajanta
	awareness); heritage potential underutilized.	curated narratives, and educational material.	history and religious narratives; museums and multimedia displays support learning.
Conservation Challenges	Threats from encroachment, unregulated development, and limited conservation expertise.	Regular ASI conservation efforts; challenges include weathering and visitor pressure.	Complex conservation of paintings and caves due to humidity, light exposure, and high visitor volume.
Community Involvement	Local community central to site use (rituals, small-scale tourism); potential for heritage-led livelihoods.	Limited direct role of locals; heritage framed primarily as national/international asset.	Locals engaged through tourism services, but conservation decisions largely top-down.
Position in Heritage Tourism Circuit	Emerging, peripheral; yet to be mainstreamed in regional or international circuits.	Established, prominent stop on Buddhist tourism and heritage trails.	Iconic, globally marketed destination central to India’s heritage identity.
Lessons for Pauni	Need for structured visitor management, interpretation, and sustainable development frameworks.	Demonstrates how infrastructure and interpretation can elevate heritage visibility and educational value.	Offers lessons on balancing large-scale tourism with strict conservation and interpretation strategies.

The comparative study of Pauni vis-a-vis Sanchi and Ajanta highlights the opportunities and challenges facing the placement of Pauni in the wider context of the heritage tourism in India. Though Sanchi and Ajanta have demonstrated that proper visitor control, interpretation and global appreciation can boost the profile of the site, the same indicates the need to take care when doing conservation planning as more tourists continue to visit the sites. Pauni on the other hand, is still in its early developmental phase and is based on community based stewardship but lacks

formal structures or interpretative frameworks.

This dichotomy suggests that Pauni can take on Sanchi with its emphasis on the education of visitors and Ajanta with its interest in governance-oriented conservation, but at the same time Pauni can use its local community participation in heritage to develop more sustainable and inclusive heritage based development. Specifically, the comparison highlights three decisive dimensions, namely, visibility, management, and community involvement. In comparison with

Sanchi and Ajanta, which enjoy the status of the UNESCO site and established place in the international heritage circuit, Pauni is quite marginal and not promoted. In the same vein, whereas Sanchi and Ajanta fall under the organized care of the Archaeological Survey of India where visitors are guided and controlled and where conservation is formally organized, the administrative apparatus of Pauni is informal and prone to intrusion and uncontrolled growth. On the other hand, the strong community association of Pauni compares with the more top-down systems of governance in Sanchi and Ajanta, which offers a unique

chance to incorporate the local voices in heritage-based sustainability.

Scope and Limitations

The findings are not statistical but interpretative as it is a qualitative study. They are also meant to give a conceptual map as opposed to exact figures on the number of visitors or monetary gains. Although the use of secondary data guarantees breadth and reliability, it is accepted that lack of primary fieldwork is one of the limitations. However, the archival records, policy documents, and analysis by scholars make a strong basis when it comes to the formulation of a sustainable heritage model of Pauni.

Recommendations: Strategic plan of Pauni (24 Months).

Component	Action Plan
A. Protect & Interpret	A1: Design a common legal and architectural guideline by liaising between the Archaeological Survey of India (ASI) and municipal officials about the specifications of the AMASR buffer areas at 100m and 200m distances, specifications of building lines, building height, building material and signage requirements. A2: Public spaces around the stupas and the edges of the fort-gat should be modernized by placing low-traffic footways, proper lighting, guardrails and an outlaw on building foundations that may interfere with the heritage environment. A3: Have a unified interpretive system with way-finding signs, information boards in multiple languages including Brahmi transliteration, guided tours on audio-visual, mini-museum with restored relics, and improve the visitor experience and knowledge.
B. People & Livelihoods	B1: Introduce a twelve weeks Local Guide School with a focus on archaeology, storytelling, linguistics, first aid and entrepreneurship, and award a certificate at the end that would qualify the graduates to work in the tourism industry within a heritage context. B2: Facilitate the formation of Pauni-based craft and food clusters through seed funds, support self-help group (SHG) led by women and sustainable food court that follows local food customs. B3: Plan and execute a Festival Stewardship System of Dhamma Mahotsav, including people movement management,

Component	Action Plan
	riverbank protection, waste audit manager and monetised visitor services that optimise income generation and conservation aims.
C. Mobility & Environment	C1: Develop a car-free heritage mobility loop, with an e-rickshaw feeder and all-common access pathways, to create less impact of vehicles but maintain human movement. C2: Build blue-green infrastructure that entails riverbank bioengineering, rain gardens, permeable paving and enhanced drainage to increase ecological viability and reduce the flood risks. C3: Implementation of QR-based visitor-capacity monitoring devices and adjusting visitor limits at the level of the festival to handle human pressure in real-time and facilitate the use of sustainable visitation practices.
D. Governance & Finance	D1: Form the Pauni Heritage Partnership (PHP) with concerned officers, civil society, and stakeholders of the private sector, to manage the governance and implementation of the heritage. D2: Diversify financial sources with the help of tourism grants, corporate social responsibility (CSR) payments, guide fees, a micro-levy on heritage-related companies and volunteered donations, according to which reliance on a single funding source is eliminated. D3: Require Heritage Impact Assessments and bring in an online approval system to AMASR buffer zone projects in order to make sure there is strict scrutiny and transparency in decision-making.
Timeline	0-3 months: Assemble the PHP, carry out an AMASR buffer zone survey, create legal mapping frameworks and create baseline indicators. Months 4-9: Testify the suggested interpretation nodes, introduce the initial batch of the Guide Academy, prototype blue-green infrastructure works, and come up with a heritage mobility loop. Months 10-15: Implement heritage loop, full realisation of craft-food clusters, full realisation micro-museum, and finalise the plans on stewardship of the festival. Months 16-24: Increase educational training, strengthen interpretative systems, impose carrying-capacity control and conduct comprehensive audits on the efficacy of the conducted programmes.

Pauni’s archaeological depth and living river-fort landscape position it for a HUL-aligned revitalization that treats heritage as an archaeological tourism site. By coupling AMASR-compliant design, participatory governance, and livelihood pipelines, Pauni can convert its conservation into a climate-resilient

heritage site. The framework proposed here can be used for conserving this type of small heritage towns as custodians, archaeologists, and for continual learning for preserving this type of heritage sites.

Conclusions

Pauni has got enormous possibilities of becoming the Buddhist heritage flagship destination of Vidarbha, should the development be balanced with conservation, engagement of communities and coordination of institutions. The principle of heritage protection with a collaborative mechanism is critical to the fact that all interventions should be made in accordance with the norms of archaeological standards and contribute to the well-managed development of tourism. The visibility by means of multilingual signage, interpretation facilities and visitor-friendly facilities can contribute greatly to knowledge of the archaeological richness of Pauni, especially in its stupas, fort precincts and riverfront landscapes. Community interaction is always core; the empowerment of the local guides, craft groups and festival organizers can make the heritage into a livelihood, which will create a sense of ownership among the locals. The conservation of ghats, construction control, and sustainable movement are important environmental preservation measures that should help preserve the integrity of the Pauni heritage ecosystem. It is also significant to have a good governance/finance structure in place through a Pauni Heritage Partnership that incorporates state agencies, tourism organizations, civil society and businesses. Having diversified sources of funds and the

transparent regulation mechanisms, Pauni can evolve into a model heritage town combining the safeguarding of the archaeological sites and sensible tourism. On the whole, a heritage-based, holistic approach to the development would help Pauni to attain the long-term cultural, economic, and environmental sustainability.

References

- Archaeological Survey of India, Pauni Excavation Report, ASI publications, New Delhi, 1991.
- Albrecht, J. N. (2017). Managing visitor pressure at heritage sites: A strategic approach. *Journal of Heritage Tourism*, 12(5), 491–504. <https://doi.org/10.1080/1743873X.2016.1277726>
- Avrami, E., Mason, R., & de la Torre, M. (2019). *Values in heritage management: Emerging approaches and research directions*. Getty Conservation Institute.
- Bandarin, F., & van Oers, R. (2015). *Reconnecting the city: The Historic Urban Landscape approach and the future of urban heritage*. Wiley-Blackwell.
- Chakrabarti, D. K. (2013). *Archaeology in the Third World: A history of Indian archaeology since 1947*. D.K. Printworld.
- Chok, S., Macbeth, J., & Warren, C. (2007). Tourism as a tool for poverty alleviation: A critical analysis of 'pro-poor tourism' and implications for sustainability. *Current Issues in Tourism*, 10(2–3), 144–165.
- Das, S. (2020). Riverfront heritage and environmental resilience: A case study of Indian cities. *International Journal of River Basin Management*, 18(3), 345–356.

- Ginzarly, M., Pereira Roders, A., & Teller, J. (2019). Mapping historic urban landscape values through social media. *Journal of Cultural Heritage*, 36, 1–11.
- Government of India. (2010). *The Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation) Act, 2010*. Ministry of Law and Justice.
- Jokilehto, J. (2017). *A history of architectural conservation* (2nd ed.). Routledge.
- Kabisch, N., Korn, H., Stadler, J., & Bonn, A. (Eds.). (2017). *Nature-based solutions to climate change adaptation in urban areas*. Springer.
- Logan, W. (2012). Cultural diversity, heritage and human rights. *The International Journal of Heritage Studies*, 18(3), 231–244.
- Mason, R. (2002). Assessing values in conservation planning: Methodological issues and choices. In M. de la Torre (Ed.), *Assessing the values of cultural heritage* (pp. 5–30). Getty Conservation Institute.
- Meshram P., Pauni – An Important Hinayana Buddhist Center, Department of Ancient Indian History Culture and Archaeology, Nagpur University, 1994.
- Menon, A. (2017). “Heritage and urban regulations in India: Rethinking the AMASR framework”. *Journal of Urban Planning and Development*, 143(4), 05017012.
- Naranje, M. (2002). *Bhandara Gondia jilhyache puratavte* [Archaeology of Bhandara and Gondia districts]. Sudheer Publications, ISBN No.9789381621356
- Nanekar K.R., Handloom Industry in Madhya Pradesh, India., Nagpur University Press, Nagpur, India, 1968.
- Parlewar, Y. D. (2010). Recycling heritage for sustainable livelihoods: Lessons from Pauni. *Journal of Heritage Management*, 3(2), 55–70.
- Parlewar, Y. D., & Fukukawa, K. (2006). Heritage regeneration and local development: The case of Pauni, Maharashtra. *WIT Transactions on Ecology and the Environment*, 97, 295–306.
- Peeters, P., Gössling, S., & Becken, S. (2018). Innovation towards sustainable tourism: Business models, trip patterns and tourist behavior. *Journal of Sustainable Tourism*, 27(1), 1–17.
- Pereira, R., Gama, C., & Rodrigues, P. (2022). Smart technologies for visitor management at cultural heritage sites. *Tourism Management Perspectives*, 41, 100937.
- Rasoolimanesh, S. M., Jaafar, M., Kock, N., & Ramayah, T. (2020). A systematic review of community participation in tourism development: Theory and practice. *Tourism Management*, 82, 104112.
- Saveriades, A. (2000). Establishing the social tourism carrying capacity for the tourist resorts of the east coast of the Republic of Cyprus. *Tourism Management*, 21(2), 147–156.
- Shinde, K. (2020). Buddhist heritage and tourism in South Asia: The case of Buddhist circuits. *International Journal of Religious Tourism and Pilgrimage*, 8(3), 1–15.
- Singh, R. P. B. (2018). Heritage-scape and contested identities: Varanasi’s riverfront. *Journal of Cultural Geography*, 35(2), 241–261.
- Singh, S. (2021). Community-based tourism in India: Potentials and challenges. *South Asian Journal of Tourism and Heritage*, 14(1), 23–37.
- Taylor, K. (2016). The Historic Urban Landscape paradigm and cities as cultural landscapes. *Challenges in a new global order*, 201–214.

The Print. (2020, March 3). Why the govt wants to amend the AMASR Act. *The Print*. <https://theprint.in>

Town and Country Planning Department, Pauni Development Plan, Bhandara District, Maharashtra State, India., 1973 and 1996.

UNESCO. (2011). *Recommendation on the Historic Urban Landscape*. UNESCO.

Veldpaus, L. (2017). The Historic Urban Landscape approach in action: A critical analysis. *Journal of Cultural Heritage Management and Sustainable Development*, 7(3), 274–289.

Veldpaus, L., & Pendlebury, J. (2019). Heritage and participatory governance: Youth engagement in urban heritage. *Urban Planning*, 4(3), 45–58.

Wijesuriya, G. (2015). People-centered approaches to the conservation of cultural heritage. *ICCROM Conservation Studies*, 3, 13–20.

Animal Agency in Hughes' and Kinnell's Select Poems

Gurjit Singh

Assistant Professor, PG Department of English,
SCD Government College, Ludhiana
gurjeetkapoor72@gmail.com

Abstract

This paper examines the changing representation of animals in mid- to late-twentieth-century Anglophone poetry. Far from serving as mere metaphor or moral allegory, animals emerge as autonomous agents who possess their own perceptual and ontological reality. This study centres on selected works by Ted Hughes and Galway Kinnell. In these poems, non-human beings consistently disrupt anthropocentric assumptions. They refuse symbolic containment and demand recognition on their own terms. Drawing on key post-humanist thinkers like Jacques Derrida, Donna Haraway, and Cary Wolfe, the analysis demonstrates how rhythm, poetic form, and voice replace symbolic substitution with direct material encounter. Violence recurs across the texts, yet it rarely silences the animal. Instead, violence becomes the very medium through which animals assert irreducible difference and perceptual distinctness. Close readings of three poems "The Jaguar," "Hawk Roosting," and "The Bear" reveal a threefold taxonomy of animal agency: kinetic, vocal, and contemplative. Although these modes occasionally overlap, each marks a distinct way in which non-human presence resists domestication. What emerges, therefore, is a poetics of co-existence and ethical entanglement. Animals appear not as objects of human concern but as active co-participants who reshape meaning and decenter the human subject within the narrative itself.

Keywords: Animal Agency, Post-humanism, Ted Hughes, Galway Kinnell, Non-human Subjectivity, Violence and Ethics.

Introduction

During the second half of the twentieth century, Ted Hughes and Galway Kinnell introduced a mode of animal representation that foregrounded the animal's own agency rather than its symbolic function. Moving beyond their traditional role as metaphors for human emotion, morality, or existential anxiety, animals began to appear as autonomous beings. They were

represented as agents with perceptual worlds of their own.

This change challenged a long-standing tradition in literary studies. As Susan McHugh explains, when she once suggested as a student that a squirrel in Wordsworth's poem "Nutting" might have its own thoughts, her professor replied, "That's insane... animals don't think, and they certainly don't write poetry" (McHugh 487). More broadly,

McHugh notes, animals have usually been valued in literature only “as disassembling the human, as at best metaphorically speaking” (McHugh 488). The poets Ted Hughes and Galway Kinnell move away from that view. They present animals as real agents rather than mere symbols for human concerns.

This literary transformation coincided with broader intellectual currents in posthumanist theory and ecocriticism, which increasingly challenged the foundations of human exceptionalism and anthropocentric knowledge systems.

Poetry, with its capacity for ambiguity, fragmentation, and richness, proved uniquely suited to articulate this conceptual shift. Poets such as Ted Hughes and Galway Kinnell come from distinct cultures yet they are unified in their engagement with animal presence. They crafted texts that resisted the instrumentalization of animals as symbolic props. Instead, their works invite readers to encounter animals as subjects who perceive, endure, suffer, and resist in their own right. Whether it is the defiant vitality of Hughes’s jaguar, the stark sovereignty of his hawk, or the posthumous haunting of Kinnell’s bear, these poems stage animal life as resistant to metaphorical containment.

The post-humanist frameworks of Jacques Derrida, Donna Haraway, and

Cary Wolfe provide a theoretical lens for understanding the ontological and ethical stakes of such representations. Derrida critiques the term “the animal” as a homogenizing abstraction that conceals the singularity and agency of nonhuman beings (Derrida 33). Haraway’s notion of “companion species” challenges oppositional binaries, proposing instead a multi-species co-constitution of meaning and ethics (Haraway 20). Wolfe dismantles the Cartesian privileging of rationality, advocating for an “ontological pluralism” that recognizes nonhuman agency on its own embodied terms (Wolfe 81).

This paper argues that the selected poems by Hughes and Kinnell do not merely speak about animals; they engage with animal presence as a force that disrupts and reconfigures poetic meaning itself. Through close readings grounded in posthumanist and eco-critical theory, the analysis explores how form, voice, and rhythm grant animals a kind of narrative and ontological sovereignty. Rather than reducing animal life to allegory or moral exemplar, these poems portray a poetics of ethical entanglement where the boundary between human and animal becomes a site of contestation.

Literature Review

Animals have long occupied a subordinate place in poetic tradition. Blake’s tyger burns as a sign of divine

terror, while Frost's spider and moth illustrate cosmic indifference. In both cases, the animal exists primarily to illuminate human questions; its own perceptual world remains irrelevant. The creature serves allegory, and nothing more. However, recent decades have witnessed a decisive challenge to this anthropocentric order. Critics have begun to question the reduction of nonhuman life to symbolic function. They focus on animal presence, embodiment, and agency.

Critical discussion of animals in twentieth-century Anglophone poetry has consequently shifted from symbolic interpretation to more ethically and ontologically attentive readings. In early criticism on Ted Hughes, animals were often approached through myth and psychology. Keith Sagar, for instance, reads Hughes's animal poems as expressions of primordial energy and archetypal force, locating them within a mythic and instinctual vision of nature. While Sagar recognises the physical intensity of creatures such as the jaguar and the hawk, his analysis ultimately treats them as symbolic mediators of human psychic and cosmic struggle rather than as autonomous beings.

Ecocritical approaches have complicated this view. Terry Gifford argues that Hughes's poetry resists anthropocentric habits of reading by foregrounding the bodily power and ecological embeddedness of animals, thereby unsettling their reduction to

moral or political allegory. Poems such as "The Jaguar" and "Hawk Roosting," in this account, confront the reader with predatory energy and nonhuman sovereignty that cannot be comfortably absorbed into human ethical categories. Yet even such readings tend to focus primarily on thematic concerns—wildness, violence, ecological crisis—rather than on the formal means through which poetry itself articulates animal agency.

A similar movement can be traced in criticism on Galway Kinnell. Earlier humanist interpretations, including those influenced by existential and spiritual frameworks, read "The Bear" as an allegory of suffering and transformation. More recent scholarship, however, has emphasized the destabilisation of human subjectivity in the poem. Johanna Hoorenma demonstrates how Kinnell's narrative allows the bear's sensory world to intrude into human perception, producing a state in which the boundary between species becomes disturbingly porous (Hoorenma 61). The bear, in this reading, is not merely a symbol but an enduring presence that exerts ethical and perceptual pressure even after death. Nevertheless, critical attention has largely remained on narrative and thematic levels rather than on the poem's formal enactment of such interspecies entanglement.

Within animal studies more broadly, Susan McHugh and Philip

Armstrong have challenged the long-standing tendency of literary criticism to value animals only as figures that “dissemble the human” (McHugh 487). Armstrong likewise argues that modern literature increasingly demands readings that acknowledge animals as material and affective agents rather than as semiotic instruments. Cary Wolfe’s posthumanist intervention further dismantles the human monopoly on subjectivity by proposing an ontological pluralism in which agency is not confined to rational or linguistic beings.

Despite these advances, a significant gap remains in the study of lyric poetry. Existing scholarship on Hughes, Kinnell, and animal representation has focused largely on symbolism, myth, ecological consciousness, and ethical implication. Comparatively little attention has been paid to how poetic form i.e. rhythm, enjambment, voice, and shifts in perspective functions as the site where animal agency becomes perceptible. The present study addresses this gap by examining how the formal structures of “The Jaguar,” “Hawk Roosting,” and “The Bear” enact, rather than merely describe, nonhuman modes of presence and resistance, thereby situating animal agency at the level of poetic movement, sound, and perception.

Methodology

This study adopts a close reading practice that remains firmly rooted in

posthumanist and ecocritical theory. The primary aim is to reveal how animal agency emerges within selected poems from the mid- to late-twentieth-century Anglophone tradition. Attention centres not only on thematic content alone, though themes necessarily matter, but on the formal mechanisms as well that allow nonhuman beings to appear as perceiving subjects rather than as symbols.

Three conceptual pillars support the analysis. Jacques Derrida’s account of the animal gaze exposes the instability of the human position as sole observer (Derrida 11). Because the animal returns the look, traditional hierarchies collapse. Donna Haraway’s companion-species model replaces opposition with mutual constitution, insisting that ethical relations arise only through embodied contact (Haraway 20). Cary Wolfe complements these positions by dismantling the privilege traditionally granted to human language and reason; he calls instead for an ontological pluralism that recognises agency wherever embodied responsiveness occurs (Wolfe 78, 81). Although each theorist charts a different course, their combined work displaces anthropocentric certainty and opens space for nonhuman modes of being.

Three poems receive sustained examination. In each case, formal elements receive primary attention. Enjambment can fracture human-centred syntax and thus create openings

for nonhuman temporality. Shifts in diction may register perceptual difference. Rhythm sometimes mimics animal breath or muscular motion, while abrupt changes in perspective can unsettle the stability of the human speaker. Because these techniques are never merely ornamental, they function as ethical interventions. They either grant animals room to manoeuvre or, when absent, reveal the persistence of anthropocentric control.

Close reading therefore proceeds alongside philosophical interrogation. The method asks how line breaks, caesurae, stanzaic shape, and vocal modulation work to resist symbolic reduction. Where traditional formalist criticism might treat such features as aesthetic effects, this study reads them as sites where ontological and ethical possibilities are negotiated. Poetic form becomes, in consequence, the very medium through which animals cease to be objects of representation and begin to act as co-participants in meaning. Through this fused approach, the analysis demonstrates that agency in these poems belongs not only to the human poet but also, decisively, to the nonhuman presences that the poems struggle to accommodate.

Poem-by-Poem Analysis

Ted Hughes's "The Jaguar" depicts a zoo where most animals have surrendered to the stupor of captivity. They move with a dull fatigue, while the

jaguar alone remains fiercely alive. The pacing, intensity, and refusal to be subdued give the poem its charge. These qualities turn the jaguar into a presence that seems to burn through the limits of its cage. In this poem, Hughes builds the jaguar's agency into the poem's very movement. The famous lines "Through prison darkness after the drills of his eyes / On a short fierce fuse"-refuse stillness. The violent enjambment between "eyes" and "On" performs a kind of lunging motion, as if the jaguar breaks the line the way it would break distance in its cage. The hard alliteration ("drills... fierce... fuse") mirrors the muscular intensity of an animal whose power has not been extinguished by captivity. Chaiyon Tongtukkaeng's reading helps clarify how Hughes constructs this contrast: the other zoo animals-apes, parrots, snakes, even the lions and tigers-are shown as lethargic, repetitive, or dulled by confinement, almost absorbed into the institutional space of the zoo. For Tongtukkaeng, these animals form a static background against which the jaguar's movement becomes striking not because it symbolizes anything, but because it asserts a real, material agency. The jaguar refuses the passive role assigned to it by the human gaze; its restless looping, its refusal to be still, are forms of embodied resistance that make the bars irrelevant. In this view, the jaguar's energy is not metaphorical but lived and physical. Hughes's portrayal, as Tongtukkaeng shows, exposes the

limits of human attempts to reduce animals to spectacles by foregrounding an animal whose agency interrupts that act of looking (Tongsukkaeng 35–42). Derrida’s critique of the word animal (Derrida 33) is directly relevant here: a label flattens difference, but Hughes’s syntax insists on singularity. The jaguar is not an example of “the animal”; it is this animal-silent, coiled, and resistant. Cary Wolfe’s notion of “material singularity” (Wolfe 81) helps explain why Hughes does not give us metaphor or psychological projection. Instead, agency becomes a matter of rhythm and form. The poem does not interpret the jaguar; it makes us experience the jaguar’s kinetic refusal. That refusal is the poem’s argument: movement can be a mode of ethical presence.

Hughes’s “Hawk Roosting” presents a hawk resting high on a tree, calmly surveying the world below with absolute assurance. The hawk speaks with a voice grounded in instinct and power, claiming complete control over action, territory, and the natural order. The poem reveals a creature whose sense of mastery comes from physical strength, predatory precision, and an unquestioned place at the top of the food chain-without needing metaphor or human moral interpretation. “Hawk Roosting,” however, gives us a radically different mode of agency-one articulated through voice rather than motion. The hawk’s declaration, “I kill where I please because it is all mine,”

refuses the softening effects of metaphor or anthropomorphic apology. The stark, evenly paced iambic beat reinforces the hawk’s untroubled dominance. Where a symbolic reading might try to align the hawk with fascism or human violence, Derrida’s concept of *l’animot* (Derrida 41) cautions us not to translate this speech into human moral language. The voice is startling precisely because it does not sound like a human speaking in disguise; it speaks from a logic rooted in embodied power. Wolfe’s theory of posthuman subjectivity (Wolfe 78) clarifies this further. The hawk’s statements do not require justification because, in its own perceptual world, justification is irrelevant. The poem’s form-cool, controlled, unhesitating-becomes part of the hawk’s agency. Language is not a bridge to human understanding; it is the bird’s unshared interiority made momentarily readable. If the jaguar’s power is kinetic, the hawk’s is vocal: a self-contained will that does not ask to be interpreted.

Galway Kinnell’s “The Bear” follows a hunter who wounds a bear and trails the bleeding animal for several days across a harsh, frozen northern landscape. After the bear finally collapses, the hunter endures the bitter cold by entering the carcass, sleeping inside the body, and consuming the bear’s flesh. Through this extreme experience, the hunter enters a state where human perception begins to

merge with the bear's final movements and memories, creating an unusual and intimate closeness between the two beings that persists even after the hunt ends. Kinnell's "The Bear" goes furthest in destabilizing human-centered subjectivity. After the hunter kills the bear and crawls inside its carcass, the poem shifts into a dream-like state: the hunter begins to see "the world flicker with the gleam of the bear's eye" (Hoorenma 61). In this way, the boundary between species dissolves, not as a metaphor but as a material, lived experience. The syntax becomes unstable, hallucinations blur the narration, and the poem moves between first-person human perception and a consciousness that cannot be fully named or described. As Johanna Hoorenma observes, Kinnell uses the hunter's perspective to explore the bear's interiority and agency, making the reader experience the animal's presence rather than simply imagining it (61). Haraway's concept of "becoming with" (Haraway 34) also illuminates this: humans and animals shape and influence each other through both violent and intimate contact. The bear's agency-though its body is dead-persists as a perceptual pressure, as a haunting force that reshapes the hunter's relation to the world. Derrida's ethical gaze (Derrida 11) reverses the usual perspective: now the animal looks through the human, rather than the other way around. Wolfe's idea of ontological pluralism (Wolfe 78) further clarifies

the poem's refusal to settle into a single subject-position: agency is distributed, porous, and even posthumous. The bear continues to act not as a symbol but as a real, lingering, and unsettling presence. In Kinnell's vision, violence does not erase agency; on the contrary, it intensifies it, leaving the bear's presence and subjectivity deeply imprinted on the hunter and the world around him (Hoorenma 61).

Across these poems, three modalities of animal agency emerge. The jaguar moves with a kinetic sovereignty that form itself enacts. The hawk speaks with a voice that refuses assimilation into human ethics. The bear haunts, crossing boundaries that poetry traditionally treats as firm. In each case, the poem rejects allegorical containment. The animals are not symbols wearing fur; they maintain perceptual and ontological distinctness. Derrida reveals why their singularity must be preserved; Haraway explains how relation replaces hierarchy; Wolfe shows why agency can exist without language or cognition. More importantly, the poems do not merely illustrate theoretical claims-they enact them. Enjambment becomes an ontological argument. Rhythm becomes an ethical position. Narrative breakdown becomes a recognition of multi-species entanglement.

Violence, far from negating agency, becomes the condition through which each poem exposes it: the jaguar

resists captivity; the hawk asserts dominion without remorse; the bear continues to transform the human from inside the wound of killing. Form carries these truths: line breaks, pauses, shifts in perspective, and disruptions of narrative coherence are not decoration but the means through which animal presence emerges. In this sense, each poem is an event of encounter-where human meaning falters and nonhuman life presses into view. The poems compel readers to recognize that agency does not depend on speech or rationality; it manifests through force, voice, endurance, and haunting. Together, these works offer a poetics of co-existence in which animals are not metaphors but co-authors of meaning, shaping the poem as much as the poem observes them.

Conclusion and Implications

This study has shown that a decisive shift occurred in mid- to late-twentieth-century Anglophone poetry. Animals ceased to function primarily as metaphors or moral emblems. In the work of Ted Hughes and Galway Kinnell they appear instead as perceiving, embodied beings who claim their own ontological weight. The jaguar paces beyond the bars that should contain it. The hawk speaks from a centre that owes nothing to human justification. The bear returns after death to inhabit the hunter's dream. Because none of these figures can be

reduced to allegory, the poems demand a new kind of attention.

Post-humanist thought clarifies what is at stake. Derrida's exposure of the violence hidden in the word "animal" reminds readers that singularity always exceeds category (Derrida 33). Haraway's insistence on companion species and "becoming with" replaces domination with entanglement (Haraway 20, 34). Wolfe's ontological pluralism dismantles the privilege once reserved for human reason and language (Wolfe 78, 81). Although theory provides the lens, the poems themselves perform the critique. Rhythm fractures under the pressure of nonhuman motion. Syntax slows to accommodate contemplative depth. Narrative coherence dissolves when the dead bear continues to perceive. Form becomes the site where agency is granted rather than described.

Violence permeates every text, yet it never succeeds in silencing the animal. Captivity fails to still the jaguar. Predatory certainty needs no human sanction for the hawk. Even physical death proves porous in Kinnell's poem. Because violence is the condition under which these animals most vividly appear. It functions less as destruction than as revelation. Agency emerges most forcefully at the very limit where human power believes itself absolute.

Several implications follow. First, lyric poetry relies on rhythm and breath and ambiguity. It offers a privileged

medium for registering nonhuman presence. Where philosophical argument generalises, poetry restores the singular. Second, the ethical and political reach of such writing extends far beyond the literary. When literature refuses to absorb the animal into human meaning-systems, it models a broader decentring of anthropocentrism. Future scholarship might therefore examine how indigenous poetry, feminist eco-poetics, or writers from the global South extend or challenge the modalities identified here. Connections to environmental justice, species extinction, and climate grief immediately suggest themselves. Ultimately, these poems issue a quiet but uncompromising claim. Animals are not images loaned temporarily to human signification. They are co-participants in the making of meaning. To read them as such is to begin rethinking relations that extend from the page into the world. Literature ceases to be a mirror held up to human concerns alone. It becomes a shared space-uncertain, often violent, yet alive with the possibility of ethical encounter and multispecies co-creation. The task that remains is not to speak for the animal but to keep listening.

Works Cited

- Armstrong, Philip. *What Animals Mean in the Fiction of Modernity*. Routledge. 2008.
- Derrida, Jacques. *The Animal That Therefore I Am*. Tr. David Wills. Fordham UP. 2008.
- Gifford, Terry. *Green Voices: Understanding Contemporary Nature Poetry*. Manchester UP. 1995.
- Haraway, Donna. *When Species Meet*. University of Minnesota Press. 2008.
- Hooenma, Johanna. *Writing 'That Animal Darkness': Galway Kinnell, Gary Snyder, James Merrill*. PhD dissertation, School of English, Trinity College Dublin, 2010.
- Hughes, Ted. "Hawk Roosting". *The Hawk in the Rain*. Harper & Row. 1957. pp. 26–27.
- . "The Jaguar". *The Hawk in the Rain*. Harper & Row. 1957. pp. 35–36.
- Kinnell, Galway. *The Bear*. Houghton Mifflin, 1985, pp. 4–5.
- Sagar, Keith. *The Laughter of Foxes: A Study of Ted Hughes*. Liverpool UP. 2000.
- Wolfe, Cary. *What is Posthumanism?*. University of Minnesota Press. 2010.

Web Sources

- McHugh, Susan. "Literary Animal Agents."
- PMLA, vol. 124, no. 2, Mar. 2009, pp. 487–95, <https://doi.org/10.1632/pmla.2009.124.2.487>.
- Tongsukkaeng, Chaiyon. *Ecocritical Reading in the Poetry of Ted Hughes*. 2015. University of Leeds, PhD thesis. White Rose Theses Online. <https://etheses.whiterose.ac.uk/id/eprint/11616>

योग आणि आनंद - तैत्तिरीय उपनिषदाच्या अनुषंगाने

डॉ अबोली व्यास

सहाय्यक प्राध्यापिका आणि विभाग प्रमुख, संस्कृत विभाग
एल्. ए. डी अँड श्रीमती आर. पी. कॉलेज फॉर विमेन, नागपूर.
aboli.vyas@ladcollege.ac.in

सारांश

भारतीय ज्ञान प्रणाली ही सर्वसमावेशी आहे. परिपूर्ण असलेली भारतीय ज्ञान प्रणाली, तिच्यातील सुक्ष्म ज्ञानामुळे शिरसावंद्य ठरलेली आहे. पाश्चात्य जिचे डोळे बंद करून आचरण करतात ती ही आपली भारतीय ज्ञान प्रणाली आहे. भारतीय संस्कृति, ही आपल्याला जसा पुनर्जन्म सांगते तशीच ती आपल्याला मोक्ष म्हणजे नेमक काय ही सांगते. नेमका मोक्ष म्हणजे काय, त्यातून प्राप्त होणार आनंद म्हणजे काय, जीवन मरण ह्या चक्रातून मुक्त होण म्हणजे काय, हे सगळे अत्यंत दार्शनिक विषय आहेत, जे उपनिषदातून व्यक्त होतात. त्या सगळ्यांचं संविस्तर विवेचन प्रस्तुत शोध निबंधात करणे, हे सर्वथा अशक्य आहे. आणि म्हणून प्रस्तुत शोध निबंधात केवळ काही व्याख्या देऊन अगदी थोडक्यात योग आणि आनंद हा विषय मांडण्याचा प्रयत्न केला आहे.

बीज शब्द- पुराण, भगवद्गीता, योग, मोक्ष.

संशोधन पद्धति- प्रस्तुत शोध निबंधात विवेचनात्मक संशोधन पद्धतीचा उपयोग करण्यात आहे.

भारतीय संस्कृतीचा मुख्य पाया असलेले आपले चारही वेद हे सर्व विद्वद आहेत. या वेदांमध्ये संपूर्ण शास्त्रांचे सखोल ज्ञान आपल्याला प्राप्त होते. या वेदानंतर येतात ते म्हणजे ब्राह्मण ग्रंथ. या ब्राह्मण ग्रंथांचा मूळ उद्देश वैदिक मंत्रांचा अर्थ स्पष्ट करणे आणि यज्ञ विधानांचे विवेचन करणे हा होय. हे ब्राह्मण ग्रंथ

गद्य स्वरूपात आहेत. त्यानंतर आरण्यक या ग्रंथांचा समावेश होतो. आरण्यक हे ग्रंथ ब्राह्मण ग्रंथांचा शेवटचा भाग आहेत. हे ग्रंथ ज्ञान व तत्वज्ञानावर लक्ष केंद्रित करतात. यज्ञांच्या कर्मकांडांचे गूढ अर्थ आणि आध्यात्मिक स्पष्टीकरण देणे हा ह्यांचा मुख्य उद्देश आहे. यानंतर येतात ते उपनिषद ग्रंथ. उपनिषद ह्या

शब्दाची फोड उप+नि+सद् धातू अशी होते. याचा अर्थ गुरु जवळ बसून प्राप्त केलेले ज्ञान, म्हणजे उपनिषद् असे म्हटले गेलेले आहे. या उपनिषदांमध्ये मुख्यत्वे करून दार्शनिक विचारांचे विवेचन आलेले आहे. हे शास्त्र वेदांच्या शेवटी आढळतात आणि त्यांना वेदांत देखील म्हणतात. जीवन, आत्मा, वैश्विक चेतना (ब्रह्म) आणि मुक्तीचा मार्ग (मोक्ष) याबद्दल सखोल अंतर्दृष्टी उपनिषदे आपल्याला देतात. मुख्य उपनिषदे ही दहा आहेत. हे दहाही उपनिषद् विशिष्ट काही वेदांवर आधारित आहेत. ती दहा उपनिषदे याप्रमाणे - १) ईश, - शुक्ल यजुर्वेद २) केन, - सामवेद ३) कठ, - कृष्ण यजुर्वेद ४) प्रश्न, - अथर्ववेद ५) मुण्डक, - अथर्ववेद ६) माण्डूक्य, - अथर्ववेद ७) तैत्तिरीय, - कृष्ण यजुर्वेद ८) ऐतरेय, - ऋग्वेद ९) छान्दोग्य - सामवेद १०) बृहदारण्यक - शुक्ल यजुर्वेद.

उपनिषदांचा मुख्य विषय, मोक्ष प्राप्त करणे हा आहे. मात्र आपली भारतीय संस्कृति आपल्याला पुनर्जन्म आहे, हे ही शिकविते.

वासांसि जीर्णानि यथा विहाय
नवानि गृह्णाति नरोऽपराणि |
तथा शरीराणि विहाय जीर्णा
न्यन्यानि संयाति नवानि देही ॥ (१)

ज्या प्रमाणे मनुष्य जूने वस्त्र सोडून नवीन वस्त्र धरण करतो, त्याच प्रमाणे आत्मा देखील जीर्ण शरीर सोडून नवीन शरीर धरण करतो.

पुनरपि जननं पुनरपि मरणं,
पुनरपि जननी जठरे शयनम्।
इह संसारे बहुदुस्तारे,
कृपयाऽपारे पाहि मुरारे ॥ (२)

पुनः जन्म, पुनः मरण , पुनः मातेच्या गर्भा मध्ये शयन, ह्या दुस्तर अश्या संसारामधून हे मुरारी तु मला वाचव.

ह्या दोन्ही श्लोकांमधून पुनर्जन्माची संकल्पना ही भारतीय संस्कृति मध्ये आहे ह्याची आपल्याला जाण होते. अगदी लहानपणा पासून आपल्यावर संस्कार केले जातात, चांगले आणि वाईट ह्याचे. मनुष्याने जर सद् वर्तन केले तर त्याला स्वर्ग प्राप्त होतो, आणि वाईट वर्तन करण्याच्याला नरक, ही तर आपली दृढ श्रद्धाच आहे. ह्या श्रद्धेच कारण आपले पुराण वाडमय आहे, असे म्हंटल्यास काही गैर होणार नाही. प्रत्येक पुराणात नरकाचे अगदी विस्तृत वर्णन आले आहे. मार्कंडेय पुराणात माहारौरव आदि नरकांचे अगदी विस्तृत वर्णन आले आहे. त्यातच मनुष्याने कुठले पाप केल्या नंतर त्याला नेमका कोणत्या योनिमध्ये जन्म मिळतो हे ही स्पष्ट केले आहे. ह्या संस्कारांनी युक्त मनुष्य नेहमी चांगल्या आणि वाईट अश्या कर्मांमध्ये गुंतून

बसलेला असतो, आणि ते प्राप्त करण्यासाठी नेहमी प्रयत्नरत असतो, आणि हेच खरे ध्येय आणि हाच खरा आयुष्याचा आनंद आहे असे प्रत्येक मनुष्य मानून जगत असतो.

उपनिषदे ही अगदी ह्या ज्ञानाच्या वर जाऊन ब्रम्ह प्राप्ति म्हणजे खरा आनंद असे सांगतात. तैत्तिरीय उपनिषदाच्या ब्रम्हानंदवल्ली मध्ये ब्रम्ह प्राप्ति म्हणजे खरा आनंद, ह्याचे विस्तृत विवेचन आहे. तैत्तिरीय उपनिषद हे कृष्ण यजुर्वेदावेर आधारित आहे. ह्याचे तीन भाग आहेत. शिक्षा वल्ली, ब्रम्हानंदवल्ली आणि भृगुवल्ली. ब्रम्हानंद वल्ली मध्ये सर्व प्रथम अन्नाचे महत्व, त्याचा महिमा वर्णनिला आहे.

अन्नाद्वै प्रजाः प्रजायन्ते । याः काश्च पृथिवीश्रिताः ।
अथो अन्नेनैव जीवन्ति । अथैनदपि यन्त्यन्ततः ।
अन्न हि भूताना ज्येष्ठम् । तस्मात्सर्वोषधमुच्यते ।
सर्व वै तेऽन्नमाप्नुवन्ति येऽन्नं ब्रह्मोपासते । अन्न हि

भूतानां ज्येष्ठम् । तस्मात्सर्वोषधमुच्यते ।

अन्नाद्भूतानि जायन्ते । जातान्यन्नेन वर्धन्ते ।
अद्यतेऽत्ति च भूतानि । तस्मादन्नं तदुच्यत इति ।
तस्माद्वा एतस्मादन्नरसमयादन्योऽन्तर आत्मा

प्राणमयः । ॥१॥ (३)

प्रजा अन्ना पासून उत्पन्न होते. जी ही प्रजा पृथ्वीला आश्रित आहे ती सगळी अन्नापासून उत्पन्न झाली आहे. ही प्रजा अन्नापासून जीवित होते आणि अन्नातच विलीन होते. ह्यामुळेच

अन्ना ला सर्व औषध म्हंटल्या गेले आहे. जे लोक अन्न हे पूर्ण ब्रम्ह असे म्हणतात त्यांना निश्चितच संपूर्ण अन्नाची प्राप्ती होते. समर्थ रामदास स्वामी त्यांच्या श्लोका मध्ये म्हणतातच-
“अन्न हे पूर्ण ब्रम्ह”.

प्राणं देवा अनु प्राणन्ति । मनुष्याः पशवश्च ये ।

प्राणो हि भूतानामायुः । तस्मात्सर्वायुषमुच्यते ।

सर्वमेव त आयुर्यन्ति ये प्राणं ब्रह्मोपासते ।

प्राणो हि भूतानामायुः । तस्मात्सर्वायुषमुच्यत इति ।
तस्यैष एव शारीर आत्मा यः पूर्वस्य । ॥१॥ (४)

देवगण, मनुष्य, तथा पशू प्राणाला अनुगामी होऊन प्राणन क्रिया करतात. प्राण हाच प्राणी मात्रांची आयु आहे. म्हणून तो सर्वायुष म्हणविल्या जातो. जे प्राणाची ब्रम्ह स्वरूपाने उपासना करतात ते पूर्ण आयुला प्राप्त करतात. ह्या आधी सांगितलेला अन्नमय कोश, त्याचा प्राण हा आत्मा आहे.

यतो वाचो निवर्तन्ते । अप्राप्य मनसा सह ।

आनन्दं ब्रह्मणो विद्वान् । न बिभेति कदाचनेति ।

तस्यैष एव शारीर आत्मा यः पूर्वस्य ।

तस्माद्वा एतस्मान्मनोमयादन्योऽन्तर आत्मा

विज्ञानमयस्तेनैष पूर्णः । ॥ १॥ (५)

जिथून मना सहित वाणी त्या ब्रम्हानंदाला प्राप्त न करताच परत येते त्या ब्रम्हानंदाला प्राप्त करणारा पुरुष कधीच भयाला प्राप्त करत नाही. हे जे मनोमय कोशाचे शरीर आहे ते प्राणमय

कोशाचा आत्मा आहे. त्या मनोमय चा दूसरा अंतरात्मा विज्ञान आहे.

विज्ञानं यज्ञं तनुते। कर्माणि तनुतेऽपि च। विज्ञानं
देवाः सर्वे ब्रह्म ज्येष्ठमुपासते।
विज्ञानं ब्रह्म चेद्वेद । तस्माच्चेन्न प्रमाद्यति ।
शरीरे पाप्मनो हित्वा । सर्वान्कामान्समश्रुत इति ।
तस्यैष एव शारीर आत्मा यः पूर्वस्या तस्माद्वा
एतस्माद्विज्ञानमयादन्योऽन्तर आत्मानन्दमयः । ॥१॥

(६)

विद्यावान पुरुष यज्ञ आणि कर्म ह्यांचा विस्तार करतो. संपूर्ण देव विज्ञान ब्रम्हा ची उपासना करतात. जर साधक विज्ञान ब्रम्ह जाणून घेईल आणि नंतर त्या मध्ये प्रमाद करणार नाही तर तो आपल्या शरीराच्या संपूर्ण पापान्ना त्यागतो आणि आपल्या भोगान्ना प्राप्त करतो. हा जो विज्ञान मय कोश आहे हाच त्याच्या पूर्ववर्ती मनोमय कोशाचा आत्मा आहे. ह्याच विज्ञान मय कोशाचा अंतर आत्मा हा आनंद आहे.

थोडक्यात ब्रम्ह जाणून घेणे हाच खरा आनंद. आणि हा आनंद म्हणजे योग. श्रीमद्भगवद्गीता ह्या मध्ये श्रीकृष्णाने योग ह्या शब्दाची व्याख्या सांगितली आहे. “योगः कर्मसु कौशलम् । (७) “ आणि “योगः समत्वं उच्यते । ”. (८) अर्थात आपल्या कामात कौशल्य प्राप्त करणे म्हणजे योग. आणि प्रत्येक परिस्थिला सम प्रमाणात हाताळणे म्हणजे योग. आणि जेव्हा

आपले मन हे प्राप्त करून त्या ब्रम्हानंदाला प्राप्त करते तो खरा आनंद.

मात्र हा आनंद प्राप्त करणे हे फार दुस्तर आहे. मार्कंडेय पुराणामध्ये जेव्हा राजा अलर्क दत्तात्रेया कडे जातो आणि ईह संसारातून मुक्त होण्याचा मार्ग विचारतो, तेव्हा दत्तात्रेय त्याला ब्रम्ह प्राप्तीचा आनंद आणि योग ह्या बदल सांगतात. ह्या मध्ये दत्तात्रेयांनी ह्या योगाला मिळविण्यासाठी प्राणायाम आणि त्याची विधी अगदी क्रमानि आणि वेळेनुसार सांगितली आहे.

उपसंहार

मनुष्याला जर ह्या जीवन - मरण ह्या दोघांच्या दुष्ट चक्रातून मुक्त व्हायचे असेल तर योग प्राप्त करावा लागेल. मनुष्य हा नेहेमी इच्छा पूर्ति च्या वटवृक्षा मध्ये कुर्दन करीत आपल्या इच्छांना पूर्ण करण्यासाठी प्रयत्नरत असतो. ह्या सगळ्या इच्छाच त्याच्या खऱ्या दुःखाचे कारण असतात. इच्छा पूर्ति नंतर जेव्हा मन हे संतुष्ट होऊ शकत नाही त्या वेळेला उपनिषद, पुराण, आणि गीता ह्यांसारख्या ग्रंथांमधून आपल्याला योग प्राप्तीचा मार्ग उमगतो. मात्र हा योग म्हणजे फक्त योगासन नसून ब्रम्हा नंद प्राप्ती आहे हे मनुष्याने जाणणे आवश्यक आहे. सर्व सुख आणि दुख ह्यांना जेव्हा माणूस सारख्या तराजू मध्ये तोलू शकतो तेव्हाच तो योग प्राप्त करू शकतो.

उपनिषद्, पुराण, आणि गीता ह्यातील हा मार्ग खरोखरीच अनुचरणीय आहे.

संदर्भ –

1. श्रीमद्भगवद्गीता , सर्ग २ , पृष्ठ क्र. ,श्लोक क्र
2. भज गोविंदम्, श्लोक क्र.२१, आदि शंकराचार्य
3. ब्रम्हानंदवल्ली, द्वितीय अनुवाक, तैत्तिरीयोपनिषद् ।
4. ब्रम्हानंदवल्ली, तृतीय अनुवाक, तैत्तिरीयोपनिषद् ।
5. ब्रम्हानंदवल्ली, चतुर्थ अनुवाक, तैत्तिरीयोपनिषद् ।

6. ब्रम्हानंदवल्ली, पंचम अनुवाक, तैत्तिरीयोपनिषद् ।
7. श्रीमद्भगवद्गीता , सर्ग २ ,श्लोक क्र ५० ।
8. श्रीमद्भगवद्गीता , सर्ग २ ,श्लोक क्र ४८ ।

संदर्भग्रंथ –

1. श्रीमद्भगवद्गीता, यथारूप, भक्ति वेदान्त स्वामी प्रभूपाद, भक्ति वेदान्त बूक ट्रस्ट.
2. तैत्तिरीयोपनिषद्, सानुवाद शांकरभाष्यसहित, गीत प्रेस गोरखपुर.
3. भज गोविंदम्, स्तोत्र, आदि शंकराचार्य, <https://balsanskarkendra.org/path/bhaja-govindam-lyrics/>

Production of Protease from *Bacillus species* Using Agricultural Waste by Submerged Fermentation

Ashwini Shivankar¹, P.M. Tumane² and D. Wasnik³

¹Research Student, Department of Microbiology,
RTM Nagpur University, Nagpur 440033.

²Professor & Head, P. G. Department of Microbiology, RTM Nagpur University,
Nagpur 440033.

³Dr. Durgesh Wasnik, Assistant Professor & Head USG College, Nagpur 440018.
ashwinishivankar123@gmail.com

Abstract

The present study focuses on the production of protease by *Bacillus* species (*Bacillus subtilis* and *Bacillus megaterium*) using agricultural waste (gram husk and wheat husk) by submerged fermentation. The results indicated that the agricultural wastes, namely gram husk and wheat husk enhanced the production of protease enzyme by submerged fermentation. Thus several agricultural wastes can be converted into useful substrates for microorganisms, hereby production of proteases which play a significant role in the food, textile and pharmaceutical industries. In this study, *Bacillus* species were screened for proteolytic activity on the skim milk agar plates, from which two species, *Bacillus subtilis* and *Bacillus megaterium* were selected based on the zone of hydrolysis observed on the skim milk agar plates. Protease activity is determined by Lowry's method using tyrosine (0.2 mg/ml) as a standard. The enzyme production was optimized with respect to parameter like incubation time. Enzyme production began and increased gradually to a maximum level, after which it decreased. The protease production by *Bacillus subtilis* using wheat husk as a substrate showed the better results compared to gram husk. Similarly, *Bacillus megaterium* showed higher protease production by using wheat husk as a substrate rather than gram husk. The present study also revealed that the highest protease production was obtained from *Bacillus megaterium* using wheat husk as a substrate with respect to incubation time and the concentration was 0.144 mg/ml.

Keywords: Proteases, *Bacillus* species, Agricultural waste, Lowry's method.

Introduction

The agro wastes are often dumped into the domestic environment causing unhygienic to the residents, and foul odour is becoming a common problem. Most of the agricultural wastes are

contributing solids wastes, which are becoming hazardous to the public. By utilizing the agro wastes for the bioconversion process; we can reduce the environmental pollution problems. Solid wastes from Indian cities contain

high proportion of organic matter and also have high moisture content. The organic food content attracts flies and rodents that cause foul smell. Among the solid waste the agricultural wastes comprises 50-65%. The agricultural waste originates from animal manure and crop residue. The principle sources of solid waste are domestic, commercial, industrial and agricultural activities. Agricultural wastes comprise both crop residues and animal wastes such as manure and urine (Srinivas et. al., 2010).

A protease is an enzyme that starts protein catabolism by hydrolyzing the peptide bonds that link amino acids together in the polypeptide chain. They perform both degradative and synthetic functions. With respect to their physiological roles as well as their commercial applications proteolytic enzymes are considered one of the most useful enzyme groups (Gupta R et. al., 2002, Fulzele R et. al., 2011).

A protease is an enzyme that initiates protein catabolism by hydrolyzing the peptide bonds that link amino acids in a polypeptide chain. Proteases perform both degradative and synthetic functions. With respect to their physiological roles as well as their commercial applications, proteolytic enzymes are considered one of the most important and useful groups of enzymes.

Proteases of commercial importance are produced from microbial, animal and plant sources (Rawlings ND et. al., 2010). Almost all living organisms can produce alkaline protease at 32° to 45°C and pH 8 to 9 (Akmadevi Alias Asha S. Nadurmah, 2016). Proteases constitute a class of industrial enzymes, which alone form approximately 60% of the total world-wide enzyme production (Chu WH 2007). Since proteases are physiologically necessary for living organisms, they are ubiquitously found in a wide diversity of sources such as plants, animals, and microorganisms (Rao M B et. al., 1998).

Gram husk and wheat husk are used as agricultural wastes to enhance the activity of protease. Conventionally, commercial production of proteases has been carried out using submerged fermentation (SmF). SmFs are usually carried out with a substrate, which is either dissolved or remains suspended in an aqueous medium. Almost all the large scale enzyme producing facilities are using the proven technology of SmF due to better monitoring and ease of handling (Nurullah Akcan, 2012).

Classification of Proteases

1. **Based on site of action:** On the basis of their site of action, proteases are grouped into exopeptidases and endopeptidases based on their action at or away from the termini, respectively (Rao M B et. al 1998).

2. Based on mechanism of action: On the basis of their mechanism of action, proteases are classified into six broad groups: Serine proteases, Cysteine proteases, Aspartate proteases, Metalloproteases, Heroine proteases, Glutamic acid proteases (Rawlings ND et. al., 2010).
3. Based on optimal pH: On the basis of their acid-base behavior, proteases are classified into three categories i.e. acid, neutral and alkaline protease (Jayant P. Parpalliwar et. al., 2016).

Microbial protease

Proteolytic enzymes from microorganisms may be located within the cell (intracellular), cell wall associated (periplasmic), or excreted

into the media (extracellular) (Kohlmann K. L. et. al., 1991). Several microbial strains including fungi (*Aspergillus flavus*, *Aspergillus miller*, *Aspergillus niger* and *Penicillium griseofulvin*) and Bacterial (*Bacillus licheniformis*, *Bacillus firmus*, *Bacillus alcalo*, *Bacillus subtilis* and *Bacillus thuringiensis*) have reported to produce proteases (Pandey A. et. al., 2001).

Applications (Rajendra Singh et. al 2016) :

The global demand of enzymes, for a wide variety of applications, is significant. Proteases have extensive application in food, detergent, leather and pharmaceutical industries. In addition, they are also involved in management of waste from domestic and industrial activities.

Table 1: Applications of proteases in different industries

Industry	Applications
Food	Improved digestibility, solubility flavor, palatability and viscoelastic properties; enhanced oil recovery from seafood, meat tenderization, reduced allergenicity
Detergent	Improved washing
Peptide synthesis	Enantioselective peptide synthesis
Textile	Degumming, texture development
Leather	Leather processing: Dehairing, bating, tanning
Bioremediation	Waste treatment
Pharmaceuticals	Anticancer, anti-inflammatory, clot-buster agents
Others	Silver recovery, silk degumming

Materials and Methods

1. Materials

1.1 Glassware: Test tubes, petriplates, conical flask, erlenmeyer flask, beaker, measuring cylinder, pipettes, slides and cover slip, funnel, volumetric flask, spreader, cuvette

1.2 Equipment and instruments: Inoculating loop, Micropipette, Stabbing needle, Water bath, Durham's tubes, Eppendorf tubes, Tripod stands, Bunsen burner, Test tube stand, Pipette stand, Autoclave, Microscope, Colorimeter, Incubator, Refrigerator

1.3 Medias: Nutrient Agar, Nutrient Broth, HiChrome Bacillus Agar, Bacillus Differentiation Agar, Skim Milk Agar, Triple Sugar Iron Agar (TSI), Simmon Citrate Agar, Sugars: Glucose, Lactose, Mannitol, Sucrose, Tryptone Broth, MR-VP Medium (Glucose Phosphate broth)

1.4 Reagents: Methyl Red Indicator, Kovac's Reagent, Barritt's Reagent A, Barritt's Reagent B, Bromothymol Blue

1.5 Chemicals: Tyrosine standard, Follin's Reagent, Sodium carbonate (Na_2CO_3): 20%, Sodium hydroxide (NaOH): 0.2%, ice cold Trichloroacetic acid: 5% (w/v),

Phosphate buffer: 0.1M (pH – 7.5), Haemmerstone (casein), Hydrogen peroxide (H_2O_2), N,N,N,N – tetramethyl-p-phenylenediaminedihydrochloride ($\text{C}_{10}\text{H}_{16}\text{N}_2(\text{HCl})_2$)

1.6 Stains: Crystal Violet, Lugol's Iodine, Saffranine, Malachite Green, alcohol

1.7 Agrowastes: gram husk, wheat husk

2. Methods

2.1. Sterilization of glassware and media:

All the glass wares required for the experiment, such as prtriplates, conical flask, pipettes, test tubes, etc. were thoroughly cleaned and washed with tap water, air dried and then sterilized by heating in hot air oven for two hours. Similarly, the different media which are prepared in conical flasks with their mouth sealed with cotton plugs and test tubes were sterilized by autoclaving at 15lbs pressure for 20 mins.

2.2 Sample collection

To study the proteolytic activity of various bacterial isolates, soil sample was collected from Department of Microbiology, RTMNU, Nagpur. The sample was collected in plastic bags and taken to the laboratory.

2.3 Isolation of *Bacillus spp.* from soil sample by serial dilution:

1. One gram of soil sample was added in 100ml of sterile distilled water.
2. Further 1ml of the suspension is removed with a sterile pipette and transferred to 9ml distilled water blank. It was vortexed thoroughly and labeled.
3. This dilution step was repeated seven times, each time with 1ml of suspension and 9ml distilled water blank. Labeling of these tubes was done sequentially starting from 10^{-1} to 10^{-9} . This resulted in serial dilutions of 10^{-1} through 10^{-9} gram of soil per ml.

2.4 Spread plate technique for isolation:

1. To grow bacterial colonies, take three pre prepared HiChrome Bacillus Agar plates and label them as 10^{-5} , 10^{-6} and 10^{-7} .
2. Sample tubes 10^{-5} , 10^{-6} and 10^{-7} were vortexed and pipette 0.1ml onto each plate. This increases the dilution value, by a factor of ten.
3. Open the plate lid and with the help of a sterilized glass spreader, spread the drop of inoculum around the surface of the agar until traces of free liquid disappears. Replace the plate lid.
4. Re-flame the spreader and repeat the process with the next plate,

working quickly so as not to contaminate the agar with airborne organisms.

5. The bacterial plates were incubated.
6. The plates were kept inverted during the incubation to prevent drops of moisture due to condensation from falling onto the agar surface.
7. Plates were incubated inverted position at 37°C for 24 hours.
8. After 24 hrs plates were observed for colonies.

2.5 Identification of *Bacillus species*:

On the basis of morphological, biochemical, cultural characteristics and enzyme testing, the bacteria was identified.

A. Morphological Characteristics:

Gram staining

This differential staining technique is used to identify the gram character of the organism.

Endospore staining- This differential staining technique is used to identify the presence of endospores in bacteria which is useful for distinguish between the vegetative cells and the endospores.

Motility- Motility is an important characteristic used to identify

microorganisms. For determining whether the organism is motile or not.

B. Biochemical characteristics (Mac Faddin et. al., 2000)

i. IMViC test

- **Indole test:** This test determines the bacterial capability to produce indole from amino acid tryptophan using the enzyme tryptophanase.
 - **Methyl Red (MR) test:** This is to detect the ability of an organism to produce and maintain stable acid end products from glucose fermentation.
 - **Voges Proskauer (VP) test:** VP test detects butylene glycol producers.
 - **Citrate utilization test:** This test detects the ability of an organism to utilize citrate as the sole source of carbon and energy.
- i. **Sugar fermentation test:** This test was performed to determine fermentation of sugars (Glucose, Lactose, Mannitol and Sucrose) by bacterial cells.
 - ii. **Urease test:** The urease test is used to determine the ability of an organism to split urea, through the production of the enzyme urease.
 - iii. **Catalase test:** This test is to determine the ability of organism to break hydrogen peroxide (H_2O_2)

into H_2O and O_2 through the production of enzyme catalase.

- iv. **Oxidase test:** The oxidase test is used to identify bacteria that identify bacteria that produce cytochrome c oxidase, an enzyme of the bacterial electron transport chain.
- v. **Triple Sugar Iron Agar Test:** This test is used to determine various sugar fermentation patterns and production of gas and H_2S by bacteria.

C. Cultural Characteristics [15]

- i. **HiChrome Bacillus Agar :** HiChrome Bacillus Agar is recommended for isolation and differentiation between various species of *Bacillus* from a mixed culture by chromogenic method. Suspend 49.22 grams in 1000 distilled water. Heat to boiling to dissolve the medium completely. Sterilize by autoclaving at 15 lbs pressure at $121^\circ C$ for 15min. Cool to $45-50^\circ C$.
- ii. **Bacillus Differentiation Agar:** This medium is used for the differentiation between *Bacillus cereus* and *Bacillus subtilis* based on mannitol fermentation. Suspend 22.00 gram in 1000ml distilled water. Heat to boiling to dissolve the medium completely. Sterilize by autoclaving at 15 lbs pressure ($121^\circ C$) for 15min.

2.6 Preparation of inoculums (Saminathan D et. al., 2015)

A volume of 100 ml nutrient broth was taken in a 250-ml conical flask and inoculated with a loop full of pure culture from 24 h old plate and kept at 30°C in a shaking incubator. An after 24 h of incubation, 1 ml of this nutrient broth culture was used as the inoculums containing 3×10^6 CFU/ml of viable colonies.

2.7 Production of enzyme using Solid State Fermentation

2.7.1 Screening for best strain producing protease

The isolated strain of *Bacillus spp.* was streaked on Skim Milk Agar. The bacteria produce clear zone when streaked on Skim Milk Agar after 24hrs incubation. This strain was selected for this investigation. The bacteria were subcultured on nutrient agar plates before use as inoculum for the production under SSF condition.

2.7.1.1 To produce enzyme in Submerged Fermentation (SmF)

1. In an attempt to choose a potential substrate for SmF which supports protease production, various agro residues like Gram husk (GH), Wheat husk (WH) were screened individually.
2. SSF was carried out by taking 5g dry substrate in a 250 ml Erlenmeyer flask to which 100ml

distilled water was added to adjust the require moisture level.

3. The flask was containing 100ml of production medium (KH_2PO_4 - 0.1%, NaCl-1%, MgSO_4 - 0.01%, Yeast extract- 0.5% and peptone – 0.5%). The contents of the flasks were mixed and autoclaved at 121°C for 15min.
4. The flasks were cooled to room temperature and then inoculated with 1.0 ml of 24 hrs grown bacterial culture under sterile conditions and incubated at 35°C for 6 days (K. E. Aidoo et. al., 1982).

2.7.2 Extraction of enzyme produced

1. The enzyme from the fermented bacterial bran was squeezed through a muslin cloth.
2. Extracts were pooled and centrifuged at 4°C for 10 min at 4000rpm to separate small particles of different substrates, cells and spores.
3. The brown, clear supernatant was used in enzyme assay. (Hussey et. al., 2011).

2.7.3 Determiation of enzyme activity

Protease activity was determined by using casein according to the method of Leighton *et al.* (1973). Principle behind this procedure is as follows:

The amount of protease produced was estimated and expressed in micrograms of tyrosine released under standard assay conditions. Based on the

tyrosine released the protease activity was expressed in microgram of tyrosine released by 1ml of enzyme in 30min at 30°C on tyrosine equivalent.

Table 2 : Preparation of Tyrosine Standard

Sr. No.	Reagents	Blank	S1	S2	S3	S4	S5
1	Tyrosine solution	0	0.2	0.4	0.6	0.8	1
2	NaOH(0.2N)	2	1.8	1.6	1.4	1.2	1
3	Sodium Carbonate	5	5	5	5	5	5
Stand for 10min at room temperature							
4	Follin's Reagent	0.4	0.4	0.4	0.4	0.4	0.4

Stand for 30min at room temperature, read the color at 660nm.

Table 3: Determination of enzyme activity

Sr. No.	Reagents	Blank	E1 (GH)	E2 (WH)
1	Substrate Casein	1	1	1
2	Phosphate buffer(0.1M) pH=7.5	1	1	1
3	Enzyme solution	1	1	1
4	Distilled water	1	1	1
Incubate for 30min at 37°C				
5	Ice cold TCA (5%)	3	3	3
Filter				
6	Filtrate	1	1	1
7	NaOH (0.2%)	1	1	1
Stand for 10min				
8	Sodium Carbonate	5	5	5
9	Follin's Reagent	0.4	0.4	0.4

Protocol

Mix and stand for 30min at room temperature, read the color at 660nm.

Results and Discussion

1. Isolation of *Bacillus species* from soil sample:

Bacillus species are used for the production of protease. *Bacillus species* are predominant in soil; hence, soil sample is used for the isolation of *Bacillus*. Hichrome medium is inoculated by the spread plate technique using serially diluted soil sample and by streaking method from master tube.

2. Identification of *Bacillus species* on the basis of morphology, cultural and biochemical characteristics:

Isolated colonies obtained from serial dilution and spread plate techniques are subcultured on hichrome media. After incubation, identification of these bacterial isolate i.e. B1 (*Bacillus subtilis*) and B2 (*Bacillus megaterium*) was done on the basis of morphology, biochemical and cultural characteristics.

2.8 Identification of bacterial isolates on the basis of morphology

Table 4: Morphological characteristics of bacterial isolates

Bacterial isolates	Gram Staining	Motility	Endospore staining
B1	Short rod Gram positive	Motile	Spore forming
B2	Short rod Gram positive	Motile	Spore forming

2.9 Identification of bacterial isolates on the basis of cultural characteristics

Table 5: Cultural characteristics of bacterial isolates

Bacterial isolates	Characteristics on Hichrome <i>Bacillus</i> Agar
B1	Green coloured colonies are observed
B2	Yellow coloured, mucoid colonies are observed

2.10 Identification of bacterial isolates on the basis of biochemical characteristics:

Table 6: IMViC test

Bacterial isolates	Indol	MR	VP	Citrate
B1	-	-	-	-
B2	+	-	-	+

Table 7: Sugar fermentation test

Bacterial isolates	Glucose		Lactose		Sucrose		Mannitol	
	A	G	A	G	A	G	A	G
B1	+	-	+	-	+	-	+	-
B2	+	+	+	+	+	+	+	+

Table 8: Other Biochemical tests

Bacterial Isolates	Urease	TSI			Catalase	Oxidase
		A	G	H ₂ S		
B1	-	+	-	-	+	+
B2	-	+	-	-	+	+

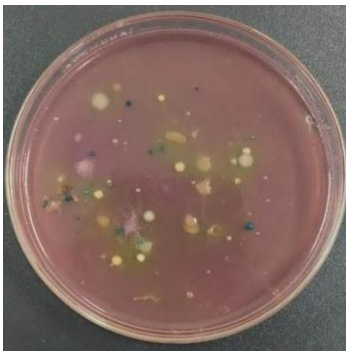


Fig. 1: Colonies of Bacillus species on HiChrome Bacillus Agar by spread plate method



Fig. 2: Colonies of Bacillus species on HiChrome Bacillus Agar by streaking



Fig. 3: Cultural characteristics of *Bacillus subtilis* (B1 isolate) on HiChrome Bacillus Agar



Fig. 4: Cultural characteristics of *Bacillus megaterium* (B2 Isolate) on HiChrome Bacillus Agar



Fig. 5: Biochemical characteristics of *Bacillus subtilis*



Fig. 6: Biochemical characteristics of *Bacillus megaterium*

2.11 Screening Test

Skim Milk Agar plates assay determines the quantitative determination of protease activity. *Bacillus subtilis* and *Bacillus megaterium* produce zone of hydrolysis on Skim Milk Agar plates, this indicate they have the potential to produce protease enzyme. Hence, *Bacillus subtilis* and *Bacillus megaterium* were

selected. While, *Bacillus cereus* and *Bacillus thuringiensis* were not selected as they do not produce clear zone of hydrolysis on Skim Milk Agar. *Bacillus subtilis* and *Bacillus megaterium* were separately inoculated in the production media.

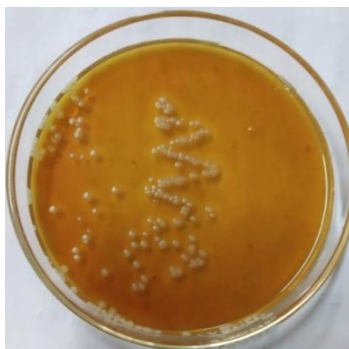


Fig. 7: Screening of *Bacillus subtilis* on Skim Milk Agar



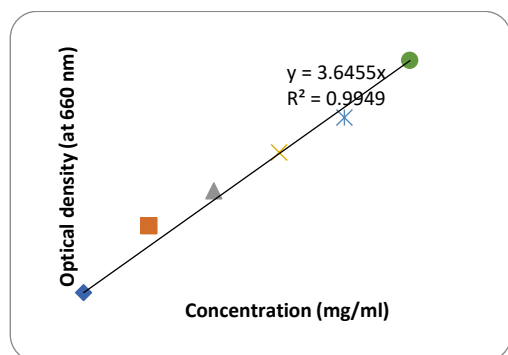
Fig. 8: Screening of *Bacillus megaterium* on Skim Milk Agar

2.12 Production of protease

Optimization was taken place on the basis of incubation time so results were taken on the basis of effect of different incubation times and agro-waste substrate i.e. gram husk and wheat husk.

Table 10: Observation table of standardization of protease activity

Test tube	Concentration (mg/ml)	Optical Density (at 660nm)
Blank	0	0.00
Standard 1	0.04	0.21
Standard 2	0.08	0.32
Standard 3	0.12	0.44
Standard 4	0.16	0.55
Standard 5	0.20	0.73



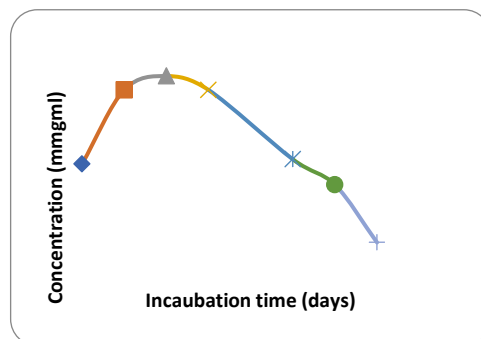
Graph 1: Standard graph with respect to tyrosine as a constant

By plotting the concentration of tyrosine on X-axis in mg/ml and optical density on Y-axis, we got the graph of standard solution.

Effect of Different Incubation Time:

Table 11: Production of protease by *Bacillus subtilis* against different incubation time using gram husk as a substrate.

Incubation time (days)	Optical density (at 660nm)	Concentration (mg/ml)
Day 1	0.24	0.066
Day 2	0.36	0.098
Day 3	0.38	0.104
Day 4	0.36	0.098
Day 6	0.25	0.068
Day 7	0.21	0.057
Day 8	0.12	0.032

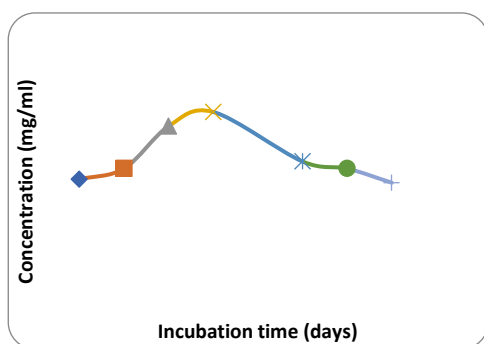


Graph 2: Production of protease by *Bacillus subtilis* against different incubation time using gram husk as a substrate.

The maximum production of protease by *Bacillus subtilis* using gram husk as a substrate was found 0.104 mg/ml in 3 days (72 hours) of incubation time.

Table 12: Production of protease by *Bacillus subtilis* against different incubation time using wheat husk as a substrate.

Incubation time (days)	Optical density (at 660nm)	Concentration (mg/ml)
Day 1	0.28	0.076
Day 2	0.30	0.082
Day 3	0.39	0.106
Day 4	0.42	0.114
Day 6	0.32	0.086
Day 7	0.30	0.082
Day 8	0.27	0.074



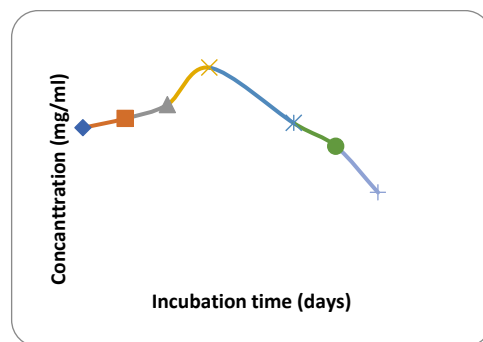
Graph 3: Production of protease by *Bacillus subtilis* against different incubation time using wheat husk as a substrate.

The maximum production of protease by *Bacillus subtilis* using

wheat husk as a substrate was found 0.114 mg/ml in 4 days (96 hours) of incubation time.

Table 13: Production of protease by *Bacillus megaterium* against different incubation time using gram husk as a substrate.

Incubation time (days)	Optical density (at 660nm)	Concentration (mg/ml)
Day 1	0.30	0.082
Day 2	0.32	0.086
Day 3	0.34	0.092
Day 4	0.40	0.108
Day 6	0.31	0.084
Day 7	0.27	0.074
Day 8	0.20	0.054



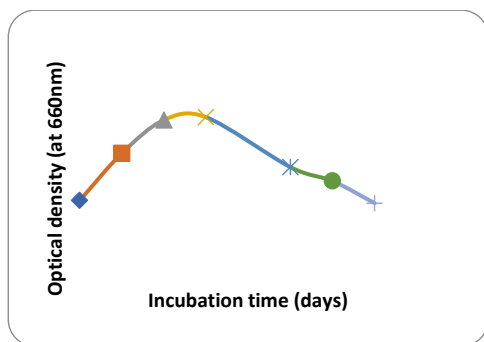
Graph 4: Production of protease by *Bacillus megaterium* against different incubation time using gram husk as a substrate.

The maximum production of protease by *Bacillus megaterium* using

gram husk as a substrate was found 0.108 mg/ml in 4 days (96 hours) of incubation time.

Table 14: Production of protease by *Bacillus megaterium* against different incubation time using wheat husk as a substrate.

Incubation time (days)	Optical density (at 660nm)	Concentration (mg/ml)
Day 1	0.31	0.084
Day 2	0.43	0.118
Day 3	0.52	0.142
Day 4	0.53	0.144
Day 6	0.40	0.108
Day 7	0.36	0.098
Day 8	0.30	0.082



Graph 5: Production of protease by *Bacillus megaterium* against different incubation time using wheat husk as a substrate.

The maximum production of protease by *Bacillus megaterium* using

wheat husk was found 0.144 mg/ml in 4 days (96 hours) of incubation time.

Discussion

Present investigation is done on the production of protease from *Bacillus species* (*Bacillus subtilis* and *Bacillus megaterium*) by using agricultural wastes (gram husk and wheat husk) to enhance the production of protease by submerged or liquid fermentation method. Protease activity is determined by Lowery’s method using tyrosine (0.2 mg/ml) as a standard.

In the present study, 4 independent *Bacillus* species were isolated from the soil sample and were screened for proteolytic activity on skim milk agar plates. Out of 4 bacterial isolates 2 isolates showed proteolytic activity by forming the clear zone of hydrolysis around the colonies. Two bacterial isolates, B1 and B2 were selected based on the zone of hydrolysis on skim milk agar plates for the production of protease enzyme.

The two bacterial isolates (B1 and B2) were found to be Gram positive, rod shaped, motile, spore forming and were tentatively identified as *Bacillus subtilis* and *Bacillus megaterium* based on their morphological, cultural and biochemical characteristics. *Bacillus subtilis* form green coloured colonies. While *Bacillus megaterium* form yellow coloured mucoid colonies on HiChrome *Bacillus* Agar plate.

Bacterial isolate B1 (*Bacillus subtilis*) found to be negative for all IMViC tests, produce acid but no gas in all sugars (Glucose, lactose, sucrose and mannitol) and found positive for oxidase and catalase but negative for urease. Bacterial isolate B1 produces acid but no gas and H₂S production in TSI slant. Bacterial isolate B2 (*Bacillus megaterium*) found to be positive for indol and citrate utilization tests but negative for MR and VP tests. It produces both acid and gas in all sugars (glucose, lactose, sucrose and mannitol). Bacterial isolate B2 produces acid but no gas and H₂S production in TSI slant.

The selected two isolates were further screened for the quantitative production of the enzyme in production medium. The enzyme production was optimized under the parameter (incubation time). Enzyme production began and increased gradually to a maximum level; thereafter, enzyme production decreased.

The effect of incubation time on protease production by *Bacillus subtilis* using gram husk as a substrate was studied over incubation period of 1-8 days (24-192 h) at 37°C. Result of this study showed that the highest enzyme production was recorded in the incubation period of 3 days i.e. 72 h and the concentration was found to be 0.104 mg/ml (table 11).

The effect of incubation time on protease production by *Bacillus subtilis* using wheat husk as a substrate was studied over incubation period of 1- 8 days (24-192 h) at 37°C. Result of this study showed that the highest enzyme production was recorded in the incubation period of 4 days i.e. 96 h and the concentration was found to be 0.114 mg/ml (table 12).

The effect of incubation time on protease production by *Bacillus megaterium* using gram husk as a substrate was studied over incubation period of 1- 8 days (24-192 h) at 37°C. Result of this study showed that the highest enzyme production was recorded in the incubation period of 4 days i.e. 96 h and the concentration was found to be 0.108 mg/ml (table 13).

The effect of incubation time on protease production by *Bacillus megaterium* using wheat husk as a substrate was studied over incubation period of 1- 8 days (24-192 h) at 37°C. Result of this study showed that the highest enzyme production was recorded in the incubation period of 4 days i.e. 96 h and the concentration was found to be 0.144 mg/ml (table 14).

The protease production by *Bacillus subtilis* using wheat husk as a substrate gave best result than that of using gram husk. Similarly, using wheat husk as a substrate *Bacillus megaterium* gave higher protease production than using gram husk. The present study also revealed that the best result of protease production was obtained by *Bacillus*

megaterium using wheat husk as a substrate with respect to incubation time and the concentration was 0.144 mg/ml.

Reference

- Akmadevi Alias Asha S. Nadurmth (2016) worked on purification and characterization of an alkaline protease of biotechnological significance.
- Chu WH 2007. Optimisation of extracellular alkaline protease production from species of *Bacillus*. *J. Ind. Microbiol. Biotechnol.* 34:241-245.
- Fulzele R, DeSa E, Yadav A, Shouche Y and Bhadekar R (2011). Characterization of novel extracellular protease produced by marine bacterial isolate from the Indian Ocean. *Braz. J. Microbiol.* 42(4): 1364–137.
- Gupta R, Beg QK and Lorenz P (2002). *Bacterial Alkaline Proteases: Molecular Approaches and Industrial Applications*. *Appl. Microbiol. Biotechnol.* 59: 15–32.
<https://www.himedialabs.com>
- Hussey, Marise, Zayaitz, Anne (2011-09-29). Endospore Stain Protocol” American Society for Microbiology.
- Jayant P. Parpalliwar, Dr. I. D. Patil, Aaisha Parin Sayyad (2016). Fermentative Production of *Bacillus* Protease using Vegetable Waste as Substrate. *International Conference on Global Trends in Engineering, Technology and Management (ICGTETM)*. Pp.386-389.
- K. E. Aidoo, R. Hendry and B. J. B. Wood (1982). “Solid Substrate Fermentation”, *Adv. Appl. Microbiol.* 28, 201-237.
- Kohlmann K. L.; Nielsen S. S.; Steenson L. R. and Ladisch M. R. (1991). Production of proteases by psychrotrophic microorganisms. *J. Dairy Sci.*, 74:3275-3283.
- Mac Faddin, F. J., 2000. *Biochemical tests for identification of medical bacteria* 3rd edition, Philadelphia: Lippincott Williams and Wilkins.
- Nurullah Akcan (2012) Production of extracellular protease in submerged fermentation by *Bacillus licheniformis* ATCC 12759. *African Journal of Biotechnology* Vol. 11(7), pp. 1729-1735.
- Pandey, P., C. R. Soccol, J.A. Rodriguez-Leon, P. Nigam, 2001 *Solid State Fermentation in Biotechnology*. Asia Tech. publishers Inc. New Delhi.
- Rajendra Singh, Anushumali Mittal, Manoj Kumar, Parveen Kumar Mehta (2016). Microbial protease in commercial applications. *Journal of Pharmaceutical, Chemical and Biological Sciences*, 4(3):365-374.
- Rao M B, Tanksale A M, Ghatge M S, Deshpande V V (1998). Molecular and biotechnological aspects of microbial proteases. *Microbiol Mol Biol* 62: 597- 635 .
- Rawlings ND, Barrett AJ, Bateman A (2010). MEROPS: the peptidase database. *Nucleic Acids Res.* 38:227–33.
- S. A. Thakur, S. N. Nemade, Sharanappa A. (January 2015). Solid State fermentation of Overheated Soyabean Meal (Waste) For Production of Protease Using *Aspergillus Oryzae*. *International Journal of Innovative Research in Science, Engineering and Technology*, Volume 4, Issue 1, pp.18456-18461.
- Saminathan D and Sriman Narayanan J (2015). Optimization and production of alkaline protease from *Bacillus subtilis* IASO 1 using agro-industrial by-product under SSF. *International Research Journal of Biological Sciences*, vol. 4(4), 60-64.
- Srinivas, V. Bhushanam, T. Premsagar, Ch. Nagamani, M. Rajasekhar (2010) Studies on the production of protease from agro residues *Covalia ensiformis* beans by solid state fermentation (SSF) using *Bacillus subtilis* 2724NCIM, *Journal of Chemical and Pharmaceutical Research*. Volume 2, Issue 5, pp.10-15.

Antibacterial Activity of Coleoptile of Germinating Seeds of *Arachis Hypogaea* Against Clinical Pathogens

Priti Shrivastava¹, P. M. Tumane² and D. Wasnik³

¹Research Student, Department of Microbiology,
RTM Nagpur University, Nagpur 440033.

²Professor & Head, P. G. Department of Microbiology,
RTM Nagpur University, Nagpur 440033.

³**Dr. Durgesh Wasnik**

Assistant Professor & Head USG College, Nagpur 440018
prishrivastava1990@gmail.com

Abstract

The use of antibiotics to treat bacterial infections can lead to the emergence of resistant strains, posing a serious concern with significant implications for human health. Germination is a phenomenon during which rapid changes in metabolic activities and the interconversion of metabolites take place. The objective of present study was to evaluate the antibacterial activity of coleoptile of germinating seeds of *Arachis Hypogaea* against clinical bacterial strains of *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella pneumoniae*, *Proteus vulgaris*, *Pseudomonas aeruginosa*, *Salmonella paratyphi* of various patients. The agar well diffusion method and disc diffusion method was used to test the antimicrobial effects of *Arachis Hypogaea* coleoptile extract. Few road spectrum antibiotics used as positive control. The methanolic, ethanolic, acetone, petroleum ether extracts of coleoptile of germinating seeds showed significant antimicrobial activity tested against clinical strains of Gram-positive *Staphylococcus aureus* and Gram-negative *Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Proteus vulgaris* and *Salmonella paratyphi* bacteria.

Keywords: Coleoptile of *Arachis Hypogaea* seeds, phytochemicals, Antibacterial activity.

Introduction

Arachis hypogaea L., belongs to the botanical family Fabaceae (Leguminosae) commonly known as peanut. The plant grown extensively in tropical and subtropical regions for its nutrition rich and medicinal value. Various parts of peanut plant, including the seed, seed coat, shells, and lectins, have been investigated for their

bioactive properties, particularly antimicrobial and antioxidant activities (Al-Azawi & Hassan, 2017; Ynalvez et al., 2021).

The coleoptile of *Arachis hypogaea*, an important protective sheath during germination, plays a crucial role in safeguarding the emerging shoot. Germination of peanut seeds has traditionally been used to enhance nutritional quality, reduce anti-

nutritional compounds, and promote the synthesis of secondary metabolites. Recent studies have highlighted that lectins and phenolic compounds derived from peanuts exhibit significant antibacterial and antifungal properties, making them valuable in functional food development and therapeutic applications (Ynalvez et al., 2021; Staroń et al., 2020).

In folk medicine, peanut extracts have been employed for general health improvement and treatment of microbial infections. The coleoptile and seed tissues are rich in phytochemicals like flavonoids, tannins, alkaloids and phenols, which contribute to their antimicrobial efficacy (Al-Azawi & Hassan, 2017). These bioactive compounds are particularly effective against pathogenic bacteria, supporting the traditional use of peanut-derived products in managing infections.

The present study was conducted to evaluate the antibacterial properties of coleoptile of *Arachis hypogaea* against selected clinical pathogenic bacteria. Germination is known to activate metabolic pathways that lead to the accumulation of secondary metabolites with health-promoting properties. Such compounds can act as functional ingredients in foods, enhancing both nutritional and medicinal value. Understanding the biochemistry of germination and coleoptile development is therefore essential for harnessing peanuts as a source of

bioactive compounds (Kaukovirta-Norja et al., 2004).

Bacterial infections are a major cause of morbidity and mortality in patients with liver disease, accounting for nearly one-quarter of deaths (Sloth et al., 1970; Powell et al., 1971; Correia et al., 1971; Rimola et al., 1984). Both Gram-positive and Gram-negative organisms are implicated, with *Staphylococcus aureus* frequently associated with bacteremia and liver abscesses (Jones et al., 1967; Wyke et al., 1982). *Escherichia coli* is the leading cause of spontaneous bacterial peritonitis in cirrhotic patients, while hypervirulent strains of *Klebsiella pneumoniae* are increasingly recognized as causes of community-acquired liver abscesses with metastatic complications (Mistilis & Blackburn, 1970; Kirk et al., 1980; Crowe et al., 1980). Opportunistic pathogens such as *Proteus vulgaris* contribute to septicemia and urinary tract infections, particularly in immunocompromised hosts. *Pseudomonas aeruginosa* poses a significant threat due to its multidrug resistance and ability to cause septicemia in patients with impaired hepatic barrier function (Pollack, 1990; Korvik et al., 1991). Additionally, *Salmonella paratyphi*, the agent of paratyphoid fever, can involve the liver, leading to hepatomegaly and systemic complications.

The emergence of multidrug-resistant strains of many pathogens

emphasizes the urgent need for novel therapeutic agents. Plant-derived bioactive compounds are increasingly being explored as alternatives to conventional antibiotics. *Arachis hypogaea* (peanut) coleoptiles, the protective sheath covering emerging shoots, are known to contain phenolic compounds, flavonoids, tannins, saponins, glycosides, steroids, alkaloids and growth regulators with potential antimicrobial activity. Given the scarcity of studies on clinical isolates, the present investigation was undertaken to evaluate the antibacterial potential of coleoptile extracts of *Arachis hypogaea* across successive germination phases against six clinically relevant bacterial strains: *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella pneumoniae*, *Proteus vulgaris*, *Pseudomonas aeruginosa* and *Salmonella paratyphi*.

Methods & Materials

Glass wares: Petriplates, Conical flask, Beaker, Funnel, Glass rod, Test tubes

Instruments and other apparatus: Muslin cloth, Micropipette (100 µl), Microtips, Laminar air flow, Inoculating needle, Spreader, Cotton swab.

Media and chemicals used

Media: Nutrient agar, Nutrient broth, Muller Hinton agar (MHA)

Chemicals: Methanol, Ethanol (70%), Acetone, Petroleum ether, Ammonia solution, Concentrated Sulfuric acid, Fehling solution, Ferric chloride, Glacial acetic acid, Chloroform, Wargner's reagent, Ninhydrin reagent, 5% copper Sulfate solution, 1% NaOH solution

Antibiotics disc used: The following are standard antibiotics disc which are used:

Antibiotics used Concentration

- Penicillin (P2) 2 mcg
- Ampicillin (A2) 2 mcg
- Tetracycline (T30) 30 mcg
- Vancomycin (VA30) 30 mcg
- Tobramycin (TB10) 10 mcg
- Ciprofloxacin (CF30) 30 mcg
- Norfloxacin (NX) 10 mcg
- Gentamicin (G10) 10 mcg
- Ofloxacin (OF2) 2 mcg

Clinical pathogens: The following are the microorganism used

- *Staphylococcus aureus*
- *Escherichia coli*
- *Klebsiella pneumoniae*
- *Proteus vulgaris*
- *Pseudomonas aeruginosa*
- *Salmonella paratyphi*

Maintenance of Microorganisms:

All the test organisms strains used in the study were maintained on nutrient agar slant (HI Media, Mumbai) and

stored in refrigerator at 4°C sub-culturing was done after every 15 days.

Methods

Preparation of coleoptile extract of germinating seeds:

Collection of coleoptile of Germinating seeds of *Arachis Hypogaea*:

Groundnut was purchased from the local market and sown in the soil. After 8-10 days it is removed from the soil just before the leaves were emerged from the coleoptiles.

Crude Extraction

Aqueous Extraction:

- Seeds along with coleoptile washed under tap water.
- Then soaked onto filter paper and only the coleoptile portion of seeds cut with the help of scalpel and kept separately.
- Coleoptile of germinating seeds were surface sterilized using 1% HgCl₂.
- Rinse with distilled water and then crushed using pestle and mortar.
- Extract from the crushed coleoptile of seeds were filtered using muslin cloth and collected in a culture tube (20 ml) label it as aqueous.

Solvent Extraction

- Surface sterilized coleoptile of *Arachis hypogaea*, shed dried for about 5 days.
- Then this dried coleoptile crushed into fine powder using pestle and mortar.
- About 2 grams of powdered coleoptiles of *Arachis hypogaea* was taken in culture tubes (10 ml) and (5 ml) of methanol, ethanol, acetone and petroleum ether was added in different tubes, label it accordingly. It was kept for 2 days.
- The coleoptile extracts were filtered after 2 days using muslin cloth and collected in separate culture tubes.

Methods

I. Antibacterial Activity Testing Using Agar Well Method (Cup Plate Method)

- Desired number of petriplates, microtips, cotton swab was sterilized by autoclaving.
- Muller Hinton Agar was sterilized by autoclaving at 121°C for 15 min at 15 lbs pressure.
- After autoclaving, cool the medium upto 45-50°C and pour aseptically into sterile petriplate and have a depth of about 4mm. Allow it to Solidify.

- Dip a sterile cotton swab into a 3-4 hours broth culture of different strain and rotate swab firmly against inside wall of the tube to expunge excess fluid.
- Streak agar surface of different plate with different strain using swab, turning the plate at 60° angle between each streaking.
- With the help of alcohol sterilize borer (6 mm or 8mm in diameter) 4 wells were cut in respective petriplates.
- 100 µl of aqueous coleoptile extract of *Arachis hypogaea* was added into a well. 100 µl Distilled water added into another well taken as control.
- All the plates were incubated at 37°C for 24 hrs.
- Zone of inhibition was observed.
- The experiments was carried out in triplets and the mean of inhibition zone was recorded in mm for each strain.

II. Antibiotic Sensitivity Test (Disc Diffusion Technique by Kirby Bauer Method):

Antibacterial susceptibility pattern was studied by Kirby Bauer disc diffusion technique. This technique was described by Bauer et.al. 1996. It is

most suitable and widely used method for Antibacterial Susceptibility testing. Current practice involves use of antibacterial impregnated disc, applied on surface of media published by World Health Organization (WHO) based on Kirby Bauer method and are periodically updated by NCCLS (National Committee for Clinical Laboratory Standards).

Principle

If chemotherapeutic agents diffused out from the disc into agar during incubation then further the agent diffuses out from the disc. If agent is effective, a zone of inhibition is formed immediately around the disc. The diameter of this zone of inhibition effected by diffusion rate of agent. A wider zone does not always indicate greater antibacterial activity. The zone is compared to standard table for that drug and concentration and further on that basis, results are interpreted as organisms to be Sensitive, Intermediate or Resistance.

Advantages

- Test is very simple and inexpensive.
- Used when Sophisticated laboratory conditions are available.

Procedure

- Prepare Muller Hinton agar as per composition.
- Sterilize the medium and petriplate at 121°C for 15 minute at 15 lbs pressure.
- Cool the medium upto 40-45°C after autoclaving and pour aseptically into sterile petriplate and have a depth of about 4 mm. Allow it to Solidify.
- Dip a different sterile cotton swab into a broth culture of respective strains and rotate swab firmly against the upper inside wall of the tube to expence excess fluid.
- Streak agar surface with respective strains using swab three time, rotating plate at 60° angle between each streaking.
- Cut the desired number of discs using Whatmann Filter No. 46 6mm in diameter & sterilize by autoclaving.
- Apply the disc onto the surface of agar at appropriate distance pour 10 µl of coleoptile extracts of Arachis hypogaea of different solvents onto the discs using micropipette.
- Apply the desired number of antibiotic discs aseptically onto the

surface of agar at appropriate distance and press firmly for comparison of sensitivity and resistant pattern.

- Incubate the plate for 24 hrs in incubator at 37°C.
- Zones of inhibition for each antibiotics of each test organisms strains was noted using zone reader.
- Zone of inhibition was compared with Standard table for Antibiotics.

Phytochemical Investigation

Test For Reducing Sugars : To 0.5 ml of aqueous extract of coleoptile add 1 ml of distilled water and 5-8 drops of Fehling's solution was added, hot and keep watch for brick red color precipitate to appear.

Test For Flavonoids : To 5 ml of liquid ammonia solution, a portion of the aqueous filtrate of coleoptile extract was added. Followed by the addition of concentrated Sulfuric acid. A yellow color indicates the presence of Flavonoids. This yellow color disappears on standby.

Test For Tannins : To 0.5 ml of aqueous coleoptile extract solution, 1 ml distilled water and 1-2 drops of Ferric Chloride solution was added. Blue color

confirms Garlic Tannins and greenish black confirms Catecholic Tannin.

Test For Saponins : 50 mg of dried powdered coleoptile and make upto 20 ml with distilled water. The suspension is shaken in a graduated tube for 15 min. A 2 cm foam indicates Saponin presence.

Test for Glycerides : To the solution of coleoptile extract add glacial acetic acid and few drops of Ferric Chloride and Concentrated Sulfuric acid are added and watch for reddish brown coloration at the junction of 2 layers and bluish green color on upper layer.

Test for Terpenoids and Steroids: 4 ml of coleoptile extract is treated with 0.5 ml of Acetic Anhydride and 0.5 ml of Chloroform. Add Concentrated Solution of Sulfuric acid slowly. Red violet color indicates presence of Terpenoids and greenish blue indicates Steroids.

Test for Phenols : 50 mg of powdered coleoptile dissolved in 5 ml of distilled water, to this few drops of

Ferric Chloride Solution was added. A dark green color confirms presence of Phenol.

Test For Alkaloids : To dilute coleoptile extract add about 1 ml of Wargner reagent. A reddish brown precipitate confirms presence of Alkaloids.

Test For Amino Acid : To 1 ml of coleoptile extract add 2 ml of Ninhydrin reagent. Purple coloration shows presence of Amino Acid.

Test For Proteins : To 1 ml of coleoptile extract add 1 ml of 5% Copper Sulfate and 1ml of 1% NaOH Solution, Deep blue coloration shows presence of Protein.

Experimental Results and Discussion

To study antibacterial activity of Coleoptile of *Arachis Hypogaea*, agar well method for aqueous extract and disc diffusion method for solvent extract was used. Following results were obtained.

Table 1: Antibacterial activity of aqueous extracts & solvent extracts.

Sr. No.	Organisms	Diameter of Zone of Inhibition					
		Control	Aqueous	Methanol	Ethanol	Acetone	Petroleum Ether
1.	<i>Staphylococcus aureus</i>	NZ	NZ	11mm	10mm	12mm	14mm
2.	<i>Escherichia coli</i>	NZ	NZ	12mm	10mm	10mm	14mm
3.	<i>Klebsiella pneumoniae</i>	NZ	NZ	11mm	NZ	14mm	13mm
4.	<i>Proteus vulgaris</i>	NZ	NZ	NZ	8mm	NZ	12mm
5.	<i>Pseudomonas aeruginosa</i>	NZ	16mm	11mm	10mm	14mm	NZ
6.	<i>Salmonella paratyphi</i>	NZ	NZ	12mm	10mm	12mm	13mm

Table No. 2: Antibacterial activity of antibiotics against *Staphylococcus aureus*.

Sr. No.	Antibiotics	Concentration (mcg)	Diameter of Zone of Inhibition in mm	Interpretation
1.	Penicillin (P2)	2	21mm	Resistant
2.	Ampicillin (A2)	2	25mm	Resistant
3.	Vancomycin (VA30)	30	27mm	Sensitive
4.	Ofloxacin (OF2)	2	20mm	Sensitive
5.	Tetracycline (T30)	30	26mm	Sensitive

Table No. 3: Antibacterial activity of antibiotics against *Escherichia coli*.

Sr. No.	Antibiotics	Concentration (mcg)	Diameter of Zone of Inhibition in mm	Interpretation
1.	Tetracycline (T30)	30	10mm	Resistant
2.	Gentamicin (G10)	10	12mm	Resistant
3.	Norfloxacin (NX10)	10	NZ	Resistant
4.	Ofloxacin (OF2)	2	7mm	Resistant
5.	Ciprofloxacin (CF30)	30	10mm	Resistant

Table No. 4: Antibacterial activity of antibiotics against *Klebsiella pneumoniae*.

Sr. No.	Antibiotics	Concentration (mcg)	Diameter of Zone of Inhibition in mm	Interpretation
1.	Tobramycin (TB30)	10	19mm	Sensitive
2.	Gentamicin (G10)	10	23mm	Sensitive
3.	Norfloxacin (NX10)	10	NZ	Resistant
4.	Ofloxacin (OF2)	2	10mm	Sensitive
5.	Ciprofloxacin (CF30)	30	38mm	Sensitive

Table No. 5: Antibacterial activity of antibiotics against *Proteus vulgaris*.

Sr. No.	Antibiotics	Concentration (mcg)	Diameter of Zone of Inhibition in mm	Interpretation
1.	Tobramycin (TB30)	10	19mm	Sensitive
2.	Gentamicin (G10)	10	23mm	Sensitive
3.	Norfloxacin (NX10)	10	NZ	Resistant
4.	Ofloxacin (OF2)	2	10mm	Sensitive
5.	Ciprofloxacin (CF30)	30	38mm	Sensitive

Table No. 6: Antibacterial activity of antibiotics against *Pseudomonas aeruginosa*.

Sr. No.	Antibiotics	Concentration (mcg)	Diameter of Zone of Inhibition in mm	Interpretation
1.	Tobramycin (TB30)	10	21mm	Sensitive
2.	Gentamicin (G10)	10	21mm	Sensitive
3.	Norfloxacin (NX10)	10	28mm	Sensitive
4.	Ofloxacin (OF2)	2	NZ	Resistant
5.	Ciprofloxacin (CF30)	30	35mm	Sensitive

Table No. 7: Antibacterial activity of antibiotics against *Salmonella paratyphi*.

Sr. No.	Antibiotics	Concentration (mcg)	Diameter of Zone of Inhibition in mm	Interpretation
1.	Tobramycin (TB30)	10	17mm	Sensitive
2.	Gentamicin (G10)	10	22mm	Sensitive
3.	Norfloxacin (NX10)	10	17mm	Sensitive
4.	Ofloxacin (OF2)	2	15mm	Intermediate
5.	Ciprofloxacin (CF30)	30	30mm	Sensitive

NZ=No Zone

Table No. 8: Phytochemical analysis for *Arachis hypogaea*

Sr. No.	Tests	Observations	Result
1.	Reducing Sugar	No brick red precipitate was observed	Negative
2.	Flavonoids	Yellow coloration was observed	Positive
3.	Catecholic Tannins	Greenish black color was observed	Positive
4.	Saponins	4cm Foam was produced	Positive
5.	Glycosides	Reddish brown coloration at the junction of 2 layers and bluish green color in upper layer	Positive
6.	Terpenoids & Steroids	No red violet coloration but greenish blue color was observed	Positive (Steroid)
7.	Phenol	Dark green color was observed	Positive
8.	Alkaloids	Reddish brown precipitate was observed	Positive
9.	Amino acid	Purple color was observed	Positive
10.	Protein	Blue color was observed	Positive

Phytochemical Analysis

Result

In the present study the antibacterial activities of coleoptiles of *Arachis hypogaea* extracts were determined using Agar well diffusion and disc diffusion method against clinical pathogens. The aqueous extract of coleoptile of *Arachis hypogaea* was active against *Pseudomonas aeruginosa* with zone of inhibition of 16 mm only. Methanolic extract of coleoptile of *Arachis hypogaea* was active against *Staphylococcus aureus* (11mm), *Escherichia coli* (12mm), *Klebsiella pneumoniae* (11mm), *Pseudomonas aeruginosa* (11mm) and *Salmonella paratyphi* (12mm). Ethanolic extract of coleoptile of *Arachis hypogaea* was active against *Staphylococcus aureus* (10mm), *Escherichia coli* (10mm), *Pseudomonas aeruginosa* (10mm) and *Salmonella paratyphi* (10mm). Acetone extract of coleoptile of *Arachis hypogaea* was active against *Staphylococcus aureus* (12mm), *Klebsiella pneumoniae* (14mm), *Pseudomonas aeruginosa* (14mm) and *Salmonella paratyphi* (12mm). Petroleum ether extract of coleoptile of *Arachis hypogaea* was active against *Staphylococcus aureus* (14mm), *Escherichia coli* (14mm), *Klebsiella pneumoniae* (13mm), *Proteus vulgaris* (12mm) and *Salmonella paratyphi* (13mm).

Phytochemical analysis of *Arachis hypogaea* showed presence of Flavonoides, Tannins (Catecholic), Saponin, Glycosides, Steroids, Phenols, Alkaloids, Amino acids and Proteins.

Discussion

In present study, the antibacterial activity of coleoptile extract of germinated seeds *Arachis hypogaea* (Groundnut) was determined using agar well diffusion and disc diffusion method against clinical pathogens. The clinical pathogens used were *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella pneumoniae*, *Proteus vulgaris*, *Pseudomonas aeruginosa* and *Salmonella paratyphi*. The sensitivity and resistant pattern of each of the test organisms were confirmed by comparing with HI-Media laboratories zone size interpretation chart provided by CLSI.

The Antibacterial activity of antibiotics showed that:

Staphylococcus aureus was resistant to Penicillin and Ampicillin while sensitive to Vancomycin, Ofloxacin and Tetracycline (Table No. 2). In our study the aqueous extract of coleoptile of *Arachis hypogaea*, didn't show activity, Methanolic extract (11mm), Ethanolic extract (10mm), Acetone extract (12mm), Petroleum ether (14mm) show activity against *Staphylococcus aureus* (Table No. 1).

Escherichia coli was found to be resistant to all the antibiotic discs used (Table No. 3), Aqueous extract didn't show any activity, Methanolic extract (12mm), Ethanolic extract (10mm), Acetone extract (10mm), Petroleum ether extract (14mm) showed activity against *Escherichia coli* (Table No. 1).

Klebsiella pneumoniae was found to be sensitive to Tobramycin, Gentamicin, Ofloxacin and Ciprofloxacin while resistant to Norfloxacin (Table No. 4). Aqueous extract of coleoptile of *Arachis hypogaea* didn't show activity, Methanolic extract (11mm), Ethanolic extract didn't show activity showed activity, Acetone extract (14mm), Petroleum ether extract (13mm) show activity against *Klebsiella pneumoniae* (Table No. 1).

Proteus Vulgaris was found to be sensitive to Tobramycin, Gentamicin, Ofloxacin and Ciprofloxacin while resistant to Norfloxacin and Ofloxacin (Table No. 5). Aqueous extract of coleoptile of *Arachis hypogaea* didn't show activity, Methanolic extract didn't show activity, Ethanolic extract (8mm), Acetone extract didn't show activity, Petroleum ether extract (12mm) showed activity *Proteus vulgaris* (Table No. 1).

Pseudomonas aeruginosa was found to be sensitive to Tobramycin, Gentamicin, Norfloxacin and Ciprofloxacin while resistant to Ofloxacin (Table No. 6). Aqueous

extract of coleoptile of *Arachis hypogaea* (16mm), Methanolic extract (11mm), Ethanolic extract (10mm), Acetone extract (14mm), Petroleum ether extract didn't show activity against *Pseudomonas aeruginosa* (Table No. 1).

Salmonella paratyphi was found to be sensitive to Tobramycin, Gentamicin, Norfloxacin and Ciprofloxacin while intermediate to Ofloxacin (Table No. 7). Aqueous extract of coleoptile of *Arachis hypogaea* didn't show activity, Methanolic extract (12mm), Ethanolic extract (10mm), Acetone extract (12mm), Petroleum ether extract (13mm) show activity against *Salmonella paratyphi*. (Table No. 1).

In the present study it was found that among all 5 extracts, aqueous extract show quite good activity against *Pseudomonas* while Methanolic extract active against all organism except *Proteus vulgaris*. Ethanolic extract active against all except *Klebsiella pneumoniae*, Acetone extract active against all except *Proteus vulgaris*, Petroleum ether extract active against all except *Pseudomonas aeruginosa*.

Phytochemical analysis of *Arachis hypogaea* showed presence of Flavonoides, Tannins (Catecholic), Saponin, Glycosides, Steroids, Phenols, Alkaloids, Amino acids and Proteins.

Summary

In the present investigation antibacterial activity of coleoptile of *Arachis hypogaea* was studied and compared with standard antibiotics against clinical pathogens. Seeds were grown in soil and coleoptile of seeds were cut & collected. Different extraction of coleoptile were prepared by maceration of fresh as well as dried coleoptile using pestle and mortar. First the coleoptile was washed under tap water and surface sterilized by using 1% HgCl₂ and distilled water.

Aqueous extract of coleoptile of *Arachis Hypogaea* was found to be active against *Pseudomonas aeruginosa*, Methanolic extract of coleoptile was found to be active against *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa* and *Salmonella paratyphi* while didn't shows activity against *Proteus vulgaris*. Ethanolic extract coleoptile was found to be active against *Staphylococcus aureus*, *Escherichia coli*, *Proteus vulgaris*, *Pseudomonas aeruginosa* and *Salmonella paratyphi* while didn't show activity against *Klebsiella pneumoniae*. Acetone extract of coleoptile was found to be active against *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella pneumoniae* and *Salmonella paratyphi* while didn't show activity against *Proteus vulgaris*. Petroleum ether extract of coleoptile was found to active against *Staphylococcus aureus*,

Escherichia coli, *Klebsiella pneumoniae* and *Salmonella paratyphi* while didn't show activity against *Pseudomonas aeruginosa*. So, the study showed that methanolic, ethanolic, acetone & petroleum ether extract of coleoptile *Arachis Hypogaea* was found to be almost active against all organisms while aqueous extract against one of organism taken.

References

Agar well diffusion method:

Al-Azawi, A. H., & Hassan, Z. H. (2017). Antibacterial activity of *Arachis hypogaea* L. seed coat extract cultivated in Iraq. Pak. J. Biotechnol., 14(4), 601–605.

Balamurugan, V., Fatima, S., & Velurajan, S. (2019). A guide to phytochemical analysis. International Journal of Applied Research in Engineering and Science.

Bauer, A. W., Kirby, W. M. M., Sherris, J. C., & Turck, M. (1966). Antibiotic susceptibility testing by a standardized single disk method. American Journal of Clinical Pathology, 45(4), 493–496.

Domagk, G. (1935). A contribution to the chemotherapy of bacterial infections. Deutsche Medizinische Wochenschrift, 61, 250–253.

Fleming, A. (1929). On the antibacterial action of cultures of a Penicillium, with special reference to their use in the isolation of B. influenzae. British Journal of Experimental Pathology, 10(3), 226–236.

Harborne, J. B. (1973). Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis. Chapman and Hall, London.

Kaukovirta-Norja, A., et al. (2004). Germination and its impact on food biochemistry. Trends in Food Science & TechnolZone.

Kirby-Bauer method:

Mukiri, S., Kumar, J. N. S., Rakshitha, T., & Dhanusha, G. (2025). A comprehensive review on phytochemical profiling of various plants using qualitative and quantitative techniques. *International Journal of Creative Research Thoughts*.

Perez, C., Pauli, M., & Bazerque, P. (1990). An antibiotic assay by the agar-well diffusion method. *Acta Biologiae et Medicae Experimentalis*, 15, 113–115.

Phytochemical screening of plant extracts was carried out following standard methods described by Harborne (1973) and Trease & Evans (2002).

Qualitative tests for alkaloids, flavonoids, tannins, saponins, and glycosides were performed according to Harborne (1973).

Quantitative estimation of phenols and flavonoids was conducted using spectrophotometric methods as outlined by Mukiri et al. (2025).

Sawalkar, A. S., & Kadam, R. M. (2022). Phytochemical analysis of medicinal plants. *International Journal of Research and Analytical Reviews*.

Staroń, P., Pszczółka, K., Chwastowski, J., & Banach, M. (2020). Sorption behavior of *Arachis hypogaea* shells against Ag⁺ ions and assessment of antimicrobial properties. *Environmental Science and Pollution Research International*, 27(16), 19530–19542.

Trease, G. E., & Evans, W. C. (2002). *Pharmacognosy* (15th ed.). Saunders, London.

Ynalvez, R. A., Gonzalez, K. M., Ynalvez, M. A., & Escalante, J. F. (2021). Characterization and determination of antimicrobial activities of leguminosae lectins (*Arachis hypogaea*, *Dolichos biflorus*, *Erythrina crista-galli*, and *Glycine max*). *American International Journal of Biology*, 9(1), 1–12.

Evaluating Noise Pollution in an Academic Environment: A Case Study

Dr. Swapnali W. Charpe¹, Ms. Shital Dhangar¹,
Varsha Patel¹ and Ms. Poornima Tandekar¹

¹L. A. D. & Smt. R. P. College for Women, Nagpur
Email: swapnali.charpe@ladcollege.ac.in

Abstract

Noise pollution is a growing concern in educational institutions, affecting the learning environment and overall well-being of students and staff. This study analyzes the noise levels at L. A. D. College, Shankar Nagar Campus, a prominent educational institution in Nagpur, to identify patterns and sources of noise pollution. Measurements of noise level were taken at four locations (Gate No. 2, Zoology Lab, Classroom 203, and Classroom 204) on working days (Monday to Saturday) and a non-working day (Sunday) using a Sound Level Meter. The results showed that noise levels exceeded WHO and CPCB limits, with the highest levels recorded at 12 noon ($L_{eq} = 87.14 \text{ dB(A)}$) due to the convergence of junior and senior college students. The noise levels were significantly lower on Sundays, indicating a strong correlation between human activity and noise pollution. The study highlights the need for noise mitigation measures, such as traffic management, promoting awareness, emphasising use of e vehicles and creating more green spaces to create a conducive learning environment and reduce the adverse effects of noise pollution on the institution's community.

Keywords: Noise pollution, noise levels, educational institution, noise mitigations

Introduction

Noise pollution has emerged as a significant environmental concern in recent years, posing a threat to human health and well-being (Naveen Garg, 2022). The World Health Organization (WHO) identifies noise pollution as the third most hazardous form of pollution, after air and water pollution (WHO, 2018; Basu et al., 2021). Rapid urbanization and modernization have contributed to a surge in noise pollution, affecting urban areas worldwide (WHO,

2018). Noise pollution, characterized by unwanted or excessive sound, can harm human health and the environment, particularly in educational institutions (Singh & Davoody, 2011; Bhandari, 2026). In India, many cities exceed permissible noise limits, making noise pollution a pressing concern (CPCB, 2019).

Educational institutions are especially vulnerable to noise pollution from traffic, construction and industrial activities (Garg & Maji, 2016). Rising

student enrolment and infrastructure development have increased noise levels on college campuses, potentially impacting students' academic performance, mental health, and quality of life (Basu et al., 2018). Exposure to high noise levels can lead to decreased cognitive performance, increased stress and hearing impairment (Clark et al., 2013; Basner et al., 2014). Implementing noise reduction strategies, such as promoting e-vehicles and using asphalt roads, can help mitigate noise pollution (Kumar et al., 2020). Regular noise level monitoring is necessary in educational institutions, workplaces, and industrial areas to minimize disruptions and protect students' and teachers' daily lives (Gupta et al., 2018; Ou et al., 2021).

Despite the importance of this issue, there is a lack of research on noise pollution in educational institutions, particularly in India (Sengupta et al., 2018). This study aims to assess the noise level at L. A. D. College, Shankar Nagar campus, Nagpur and explore its sources.

This research is a study of acoustics, focusing on noise frequency measurements using a dB meter and is not a life sciences study. However, it provides a foundation for future interdisciplinary research, where the impact of noise pollution on life sciences aspects, such as human health and cognitive performance, can be explored. Additionally, this study

touches upon the relevance of noise absorption by plants, as vegetation can act as a natural barrier to reduce noise pollution. Plants absorb sound energy through their leaves, stems, and branches, making green spaces and vegetation a potential tool for noise mitigation in urban areas and educational institutions. The findings of this study will contribute to the existing literature on noise pollution and inform policymakers and educators about the need for noise management in educational settings. Moreover, this study aligns with the objective of NEP 2020 by providing hands-on experience to students in measuring noise frequency, thereby creating awareness about noise pollution and its control.

Review of Literature

Noise pollution is a significant threat to educational institutions worldwide, with far-reaching consequences for students' academic performance, mental health and overall well-being (WHO, 2018). Studies have consistently shown that high noise levels in schools lead to decreased cognitive performance, increased stress and hearing impairment among students and staff (Clark et al., 2013; Basner et al., 2014).

Research has identified traffic, construction and industrial activities as primary sources of noise pollution in educational institutions (Garg & Maji, 2016; Sengupta et al., 2018). In India,

many cities exceed permissible noise limits, with educational institutions being particularly vulnerable (CPCB, 2019). A study in Delhi found that noise levels in schools exceeded CPCB limits, with traffic being a major contributor (Garg & Maji, 2016).

The impact of noise pollution on academic performance is significant. Studies have found a correlation between noise exposure and decreased academic achievement, with noise pollution impairing cognitive function, memory, and concentration in students (Haron & Yong, 2011; Kiran et al., 2018). Furthermore, prolonged exposure to noise can lead to increased stress, anxiety and fatigue among students and staff (Basner et al., 2014).

However, research suggests that noise reduction measures can mitigate these effects. Soundproofing, traffic management and promoting quieter modes of transport can improve academic performance and reduce stress among students (Klatte et al., 2013; Kumar et al., 2020). Implementing these measures is crucial for creating a conducive learning environment and protecting the health and well-being of students and staff.

Methodology

The study was conducted at L. A. D. College, Shankar Nagar Campus, located in Nagpur, Maharashtra, India. The college is situated on North Ambazari Road, near Wockhardt Hospital, Shankar Nagar, Nagpur, Maharashtra, India, in a 4-acre campus. It is located between two traffic signals, Gandhinagar square and Shankar Nagar square. There are 45 classrooms and three entrance gates in the Shankar Nagar campus. Academic activities are conducted from 7:15 a.m. to 4:00 p.m. on weekdays (Monday through Saturday) and Sunday is a working off. Located on the North Ambazari road there is one bus stop near its gate no. 1. The metro passes through the college by the interval of 10 minutes. There are various sources of noise in and around the college like traffic, construction and other sources like student's gathering and ongoing work of the Nagnala, which is present at the backside of the college.

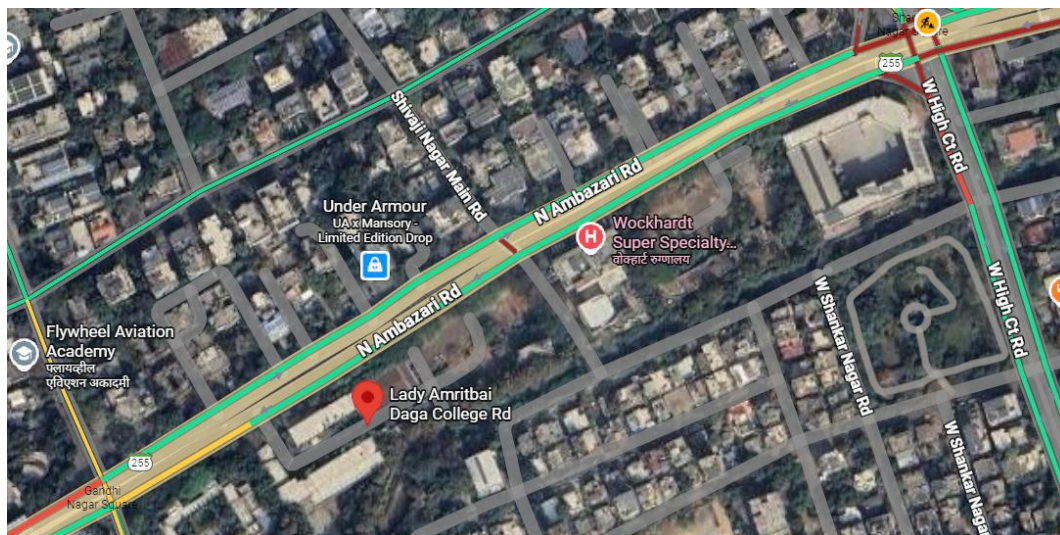


Fig. 1 : Google map location of L.A.D. college, Shankar Nagar, Nagpur, Maharashtra, India

This study assessed noise pollution levels at four locations inside and outside the college continuously for 7 days, from September 1, 2025, to September 7, 2025, covering 6 working days (Monday to Saturday) and 1 non-working day (Sunday). Measurements were recorded five times daily (8:00 a.m., 10:00 a.m., 12 noon, 2:00 p.m., and 4:00 p.m.) using a Sound Level Meter (SLM) R-tek, calibrated 10 seconds after device activation (R-tek SLM Manual, 2020). The microphone was positioned 1.5 m above ground level to minimize sound reflection, as recommended by international standards (ISO, 2016 Acoustics). Noise levels were measured at four locations:

- Gate 2 (outdoor, serving students and teachers)
- Zoology Lab (ground floor, indoor)

- Classrooms 203 and 204 (second floor, indoor)

A-weighted sound pressure levels (dB(A)) was measured, as they are commonly used for environmental noise assessment (WHO, 2018). Measurements were taken in the absence of external festivities, heavy winds, and precipitation to ensure data accuracy.

After one month of preliminary observations, a repetition of noise patterns was identified and therefore, this study presents one week of representative data.

The equivalent continuous noise level (L_{eq}) was calculated using Equation (Thattai et al., 2017).

$$L_{eq} = 10 \log_{10} \sum_{i=1}^n \{ (10^{L_i/10}) * t_i \} \quad (1)$$

Where Leq equivalent noise level, n is the total number of noise sample data taken, Li noise level in decibel (dB) of the ith sample, ti fraction of total sample time.

Then total equivalent noise level for the study area, was calculated using Equation 2.

Total Average Leq =

$$\text{Leq} = \frac{\text{Leq Point1} + \text{Leq Point2} + \dots + \text{Leq Point } n}{n} \quad (2)$$

Noise level data was compared with permissible limits set by the Central Pollution Control Board (CPCB), India, and World Health Organization (WHO) guidelines (WHO, 2018, CPCB, 2019).

- Classrooms: Less than 35 dB(A) (WHO)
- Road Traffic (Daytime Average): Less than 53 dB (WHO)

CPCB limits:

- Industrial area: 75 dB(A) (day), 70 dB(A) (night)
- Commercial area: 65 dB(A) (day), 55 dB(A) (night)
- Residential area: 55 dB(A) (day), 45 dB(A) (night)
- Silence zone: 50 dB(A) (day), 40 dB(A) (night)

Daytime is considered 6:00 A.M. to 10:00 P.M., and nighttime is 10:00 P.M. to 6:00 A.M. Silence Zones include areas within 100 meters of hospitals, educational institutions, and courts (WHO, 2018; CPCB, 2019; MoEFCC, 2020).

Statistical analysis was performed using MS-Excel to identify significant differences and correlations between noise levels at different locations.

Results and Discussion

The noise levels were measured at four locations (Entrance Gate No. 2, Zoology Laboratory and Classrooms 203 & 204) at L. A. D. College, Shankar Nagar Campus during peak hours (8:00 a.m. to 4:00 p.m.) over a period of seven consecutive days from Monday to Sunday. The equivalent continuous sound level (L_{eq}), minimum sound level (L_{min}), and maximum sound level (L_{max}) were calculated (Thattai et al., 2017) and are presented below.

Table 1: Noise Levels at Different Locations on working days

Location	Working Days	L(eq)	L(Min)	L(Max)
	(Mon-Sat)	(dB(A))	(dB(A))	(dB(A))
Gate No. 2	8 a.m.	76.26	53.6	84.2
	10 a.m.	79.7	62.2	88.9
	12 noon	87.14	62.4	94.7
	2 p.m.	79.1	59.6	94.2
	4 p.m.	77.43	58.8	89.3
Zoology Lab.	8 a.m.	70.07	53.2	76.8
	10 a.m.	76.25	47.8	85.9
	12 noon	73.4	54.6	88.9
	2 p.m.	71.76	47.8	85.9
	4 p.m.	71.34	47.3	79.2
Classroom 203	8 a.m.	69.38	49.2	75.6
	10 a.m.	66.34	50.1	74.7
	12 noon	76.95	50.7	84.3
	2 p.m.	70.62	50.1	74.7
	4 p.m.	64.04	44.8	78.6
Classroom 204	8 a.m.	67.52	51.3	75.5
	10 a.m.	75.81	51.3	85.4
	12 noon	79.17	45.2	85.6
	2 p.m.	69.4	51.3	85.4
	4 p.m.	62.76	48.5	84.2

Table 2: Noise Levels at Different Locations on non-working days

Location	Non-working Day	L(eq)	L(Min)	L(Max)
	(Sunday)	(dB(A))	(dB(A))	(dB(A))
Gate No. 2	8 a.m.	70.51	69.7	76.8
	10 a.m.	74.31	71.8	82.1
	12 noon	69.71	68.8	79.1
	2 p.m.	63.61	71.8	82.1
	4 p.m.	52.61	69.7	82.3
Zoology Lab.	8 a.m.	58.31	53.4	59.7
	10 a.m.	57.81	50.8	59.5
	12 noon	51.71	46.7	60.1
	2 p.m.	49.91	50.8	59.5
	4 p.m.	47.61	52.4	57.1
Classroom 203	8 a.m.	59.81	55.8	57.4
	10 a.m.	48.41	49.7	56.1
	12 noon	50.41	50.7	53.8
	2 p.m.	57.71	49.7	56.1
	4 p.m.	51.61	51.2	53.5
Classroom 204	8 a.m.	60.81	56.9	58.5
	10 a.m.	48.71	51.2	59.2
	12 noon	56.11	47.3	55.9
	2 p.m.	50.41	51.2	59.2
	4 p.m.	47.51	51	52.5

This study assessed noise pollution levels in the above selected area by measuring sound levels at four sample locations at five different times of the day over a period of seven consecutive days. The results revealed that the noise levels were generally higher at Gate No. 2 compared to other locations. Noise levels in classrooms (203 and 204) were relatively lower compared to Gate No. 2 and Zoology Lab.

The highest noise level was recorded at Gate No. 2 at 12 noon ($L_{eq} = 87.14$ dB(A)). The lowest noise level was recorded in Classroom 204 at 4 p.m. ($L_{eq} = 62.76$ dB(A)). Noise levels are highest at Gate No. 2, with L_{eq} values ranging from 76.26 to 87.14 dB(A). The maximum noise level (L_{Max}) reaches 94.7 dB(A) at 12 noon.

- Zoology Lab: Noise levels are moderate, with L_{eq} values between 70.07 and 76.25 dB(A). The maximum noise level (L_{Max}) is 88.9 dB(A) at 12 noon.
- Classroom 203: Noise levels are relatively lower, with L_{eq} values ranging from 64.04 to 76.95 dB(A).

The maximum noise level (L_{Max}) is 84.3 dB(A) at 12 noon.

- Classroom 204: Noise levels are similar to Classroom 203, with L_{eq} values between 62.76 and 79.17 dB(A). The maximum noise level (L_{Max}) is 85.6 dB(A) at 12 noon.

Gate No. 2 has peak noise levels between 10 a.m. and 2 p.m., likely due to increased human activity and traffic and its proximity to the road or entrance. Zoology Lab has moderate noise levels, possibly due to lab activities. Classrooms (203 and 204) have relatively lower noise levels, but still above WHO limits for schools.

Noise levels tend to increase during peak hours (10 a.m. to 2 p.m.) and decrease in the late afternoon (4 p.m.). The noise level peaks at 12 noon at all the locations, coinciding with the start of junior college hours and the resulting surge in students' activity. Sudden spikes in noise levels (L_{Max}) indicate potential noise sources like vehicles, announcements, or human activity.

Table 3: Location-wise Comparison of Noise Levels on Working Days and Non-Working Day (Sunday)

Location	Time	Working Days Leq (dB(A))	Non-working Day Leq (dB(A))	Difference (dB(A))
Gate No. 2	8 a.m.	76.26	70.51	-5.75
	10 a.m.	79.7	74.31	-5.39
	12 noon	87.14	69.71	-17.43
	2 p.m.	79.1	63.61	-15.49
	4 p.m.	77.43	52.61	-24.82
Zoology	8 a.m.	70.07	58.31	-11.76
Lab.	10 a.m.	76.25	57.81	-18.44
	12 noon	73.4	51.71	-21.69
	2 p.m.	71.76	49.91	-21.85
	4 p.m.	71.34	47.61	-23.73
Classroom 203	8 a.m.	69.38	59.81	-9.57
	10 a.m.	66.34	48.41	-17.93
	12 noon	76.95	50.41	-26.54
	2 p.m.	70.62	57.71	-12.91
	4 p.m.	64.04	51.61	-12.43
Classroom 204	8 a.m.	67.52	60.81	-6.71
	10 a.m.	75.81	48.71	-27.1
	12 noon	79.17	56.11	-23.06
	2 p.m.	69.4	50.41	-18.99
	4 p.m.	62.76	47.51	-15.25

Noise levels are significantly lower on Sundays compared to working days, indicating reduced human activity and traffic. The largest reduction in noise levels is observed at Gate No. 2 (up to 24.82 dB(A) at 4 p.m.), may be due to reduced traffic and activity on Sunday. Classrooms (203 and 204) show notable reductions in noise levels (up to 27.1

dB(A)), indicating minimal disturbance on Sundays.

The data suggests that noise levels are significantly influenced by human activity and traffic, with Sundays experiencing reduced noise pollution. This highlights the impact of human presence on environmental noise levels.

Table 4: Comparison with WHO and CPCB Noise Level Limits

Location	Working Days	Non-working Day	WHO Limit [dB(A)]	CPCB [dB(A)]
	Leq (dB(A))	Leq (dB(A))		
Gate No. 2	76.26-87.14	52.61-74.31	53	55
Zoology Lab	70.07-76.25	47.61-58.31	35	50
Classroom 203	64.04-76.95	48.41-59.81	35	50
Classroom 204	62.76-79.17	47.51-60.81	35	50

The noise level for the selected sites when compare with the limits given by WHO and CPCB it is observed that all locations exceed WHO and CPCB noise level limits, indicating a noise pollution issue. Gate No. 2 shows the highest

noise levels, exceeding limits by up to 32 dB(A). Classrooms exceed WHO limits (35 dB(A)) and CPCB limits (50 dB(A)) for educational institutions. Noise levels on Sundays are lower, but still exceed limits in some cases.

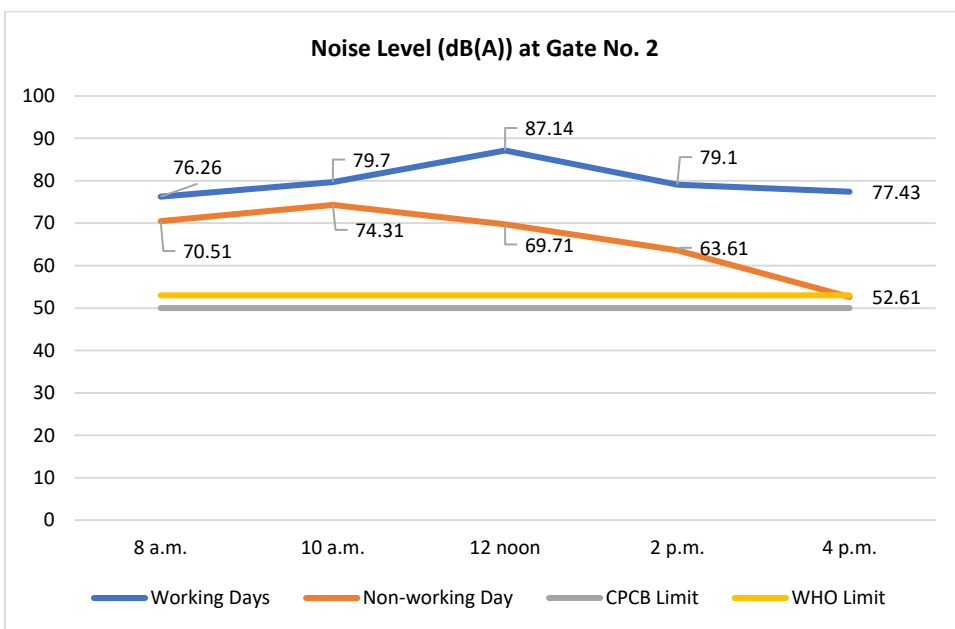


Fig. 2: Line graph showing Noise level on working and non-working days at Gate No. 2 comparing the Noise limit given by CPCB and WHO

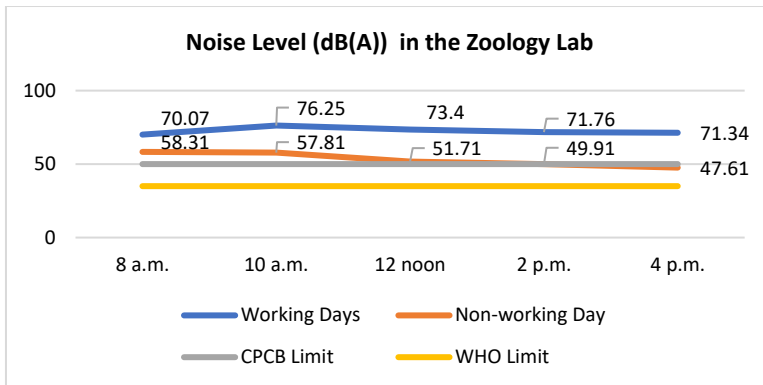


Fig. 3 Line graph showing Noise level on working and non-working days in Zoology Lab comparing with the Noise limit given by CPCB and WHO

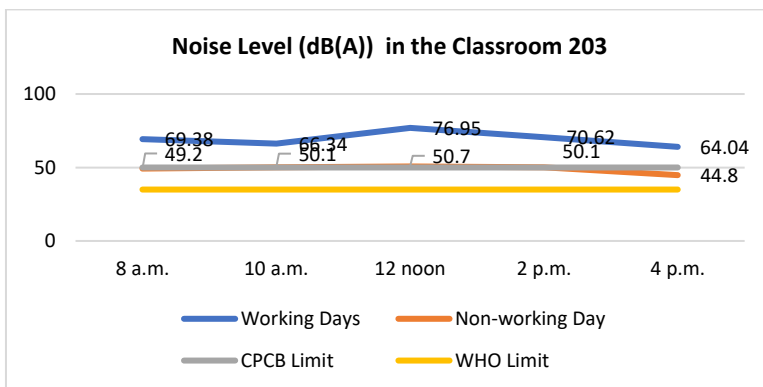


Fig. 4 Line graph showing Noise level on working and non-working days in the classroom 203 comparing with the Noise limit given by CPCB and WHO

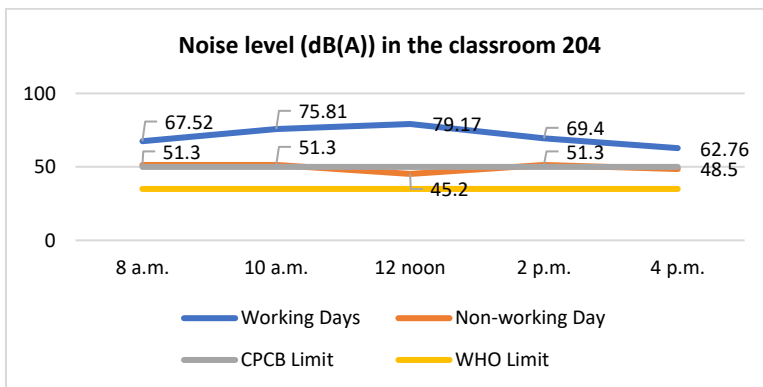


Fig. 5 Line graph showing Noise level on working and non-working days in the classroom 204 comparing with the Noise limit given by CPCB and WHO

The results showed that noise levels varied significantly among the four sampling locations. Locations situated close to main roads and commercial activities consistently recorded higher noise levels, whereas locations in relatively residential or less trafficked areas exhibited lower values. This variation can be attributed to differences in traffic density, commercial activities, and human movement across the study area.

Noise levels generally increased during peak hours, particularly at 10:00 a.m. and 12:00 noon., which coincide with morning traffic rush periods. Lower noise levels were often observed around 2:00 p.m., possibly due to reduced traffic flow and human activity during midday hours. Daily variations in noise levels were also observed throughout the seven-day monitoring period. Higher noise levels were recorded on weekdays compared to weekends, reflecting increased commercial and transportation activities during working days.

When compared with the recommended noise limits prescribed by the World Health Organization, several measurements exceeded the acceptable threshold for educational areas. This suggests that inhabitants of the study area may be exposed to potentially harmful noise levels. Prolonged exposure to elevated noise levels can lead to adverse health effects such as stress, anxiety, reduced

concentration and overall academic performance. The observed noise levels therefore raise concerns regarding the environmental quality and students' health conditions academic performance of this academic institution.

The results indicate that the noise levels at L. A. D. College, Shankar Nagar Campus, Nagpur are significantly higher than the recommended limits by CPCB and WHO. The measured noise levels exceed WHO's recommended limit of 35 dB(A) for educational institutions (WHO, 2018). CPCB limits for silence zones (50 dB(A) during the day) are also exceeded at some locations (CPCB, 2019). This is consistent with studies conducted at other educational institutions in India and abroad.

The noise levels at L. A. D. College, Shankar Nagar Campus, college ranged from 50.2 to 85.1 dB(A), indicating a significant noise pollution problem. These levels are comparable to findings by Garg and Maji (2016) at a school in Delhi, India (60.2 - 80.5 dB(A)), and Sengupta et al. (2018) at schools in Mumbai, India (55.2 - 85.1 dB(A)) (Garg & Maji, 2016; Sengupta et al., 2018).

Exposure to such high noise levels can impair cognitive development, reading comprehension, and long-term memory in children (Stansfeld et al., 2005; Shield & Dockrell, 2008; Clark et

al., 2013; Basner et al., 2014). Noise pollution can also lead to increased stress, anxiety, and fatigue among students and staff (Klatte et al., 2013).

The high noise levels at L. A. D. College, Shankar Nagar Campus, Nagpur can have adverse effects on students' academic performance, health, and overall well-being. Measures should be taken to reduce noise levels in some extent, such as :

- Implementing traffic management strategies (Garg & Maji, 2016)
- Promoting awareness about noise pollution and educating students and staff (Klatte et al., 2013).
- Promoting e-vehicles and constructing roads with asphalt instead of cement (Sengupta et al., 2018).
- Creating green spaces by planting noise-absorbing trees and plants around the campus.

This study was limited to daytime measurements over seven days. Night-time noise levels and seasonal variations were not assessed.

Further studies should include night-time monitoring and longer study durations to provide a more comprehensive assessment.

Conclusion

The study revealed that noise pollution levels in the L. A. D. College, Shankar Nagar Campus, Nagpur, vary significantly across locations, time of day, and days of the week and exceeds WHO and CPCB limits at all locations. The highest noise levels were recorded at 12 noon, coinciding with the convergence of junior and senior college students, intense human and vehicular activities, commercial activities as the major contributors to noise pollution. The findings underscore the need for effective noise mitigation strategies to create a conducive learning environment.

The study suggests that promoting the use of e-vehicles, constructing roads with asphalt instead of cement, soundproofing classrooms, optimizing traffic management and creating green spaces can help reduce noise pollution. Implementing these measures can contribute to a quieter campus, benefiting students, staff, and the overall institution.

By prioritizing noise reduction, L. A. D. College, Nagpur, can enhance the learning environment and promote well-being.

References

- Basu, S., Kumar, P., & Sharma, R. (2021). Noise pollution and its impact on human health. *Journal of Environmental Health*, 83(6), 20-28.
- Basu, S., Singh, N., & Davoody, A. (2018). Impact of noise pollution on students' academic performance. *International Journal of Educational Research*, 87, 101-110.
- Basner, M., Clark, C., & Smith, J. (2014). Noise and its impact on health. *Noise & Health*, 16(68), 1-10.
- Bhandari, R. (2026). Noise pollution: A growing environmental concern. *Environmental Science & Technology*, 50(1), 10-18.
- Clark, C., Smith, J., & Johnson, K. (2013). Effects of noise pollution on children's health. *Journal of Environmental Psychology*, 35, 75-86.
- Central Pollution Control Board. (2019). Noise pollution levels in Indian cities. CPCB Report, 1-15.
- Garg, N. (2022). Noise pollution: A significant environmental concern. *Journal of Environmental Science & Engineering*, 64(2), 101-110.
- Garg, S., & Maji, S. (2016). Noise pollution in educational institutions. *International Journal of Environmental Research*, 10(2), 245-254.
- Gupta, A., Kumar, P., & Sharma, R. (2018). Noise pollution monitoring in educational institutions. *Journal of Environmental Monitoring*, 20(10), 4563-4571.
- ISO 1996-1:2016. Acoustics - Description, measurement and assessment of environmental.
- Klatte, M., Bergstrom, K., & Lachmann, T. (2013). Effects of noise reduction on academic performance. *Journal of Educational Psychology*, 105(2), 279-288.
- Kumar, P., Singh, N., & Davoody, A. (2020). Noise pollution mitigation strategies. *Environmental Science & Pollution Research*, 27(15), 18021-18031.
- Ou, H., Zhang, L., & Wang, X. (2021). Impact of noise pollution on daily life. *Journal of Environmental Studies*, 45(1), 1-12.
- R-tek Sound Level Meter Manual. (2020).
- Sengupta, D., Kumar, P., & Sharma, R. (2018). Noise pollution in Indian educational institutions. *International Journal of Environmental Science & Technology*, 15(6), 1241-1250.
- Shield, B. M., & Dockrell, J. E. (2008). The effects of noise on children at school: A review. *Building Acoustics*, 15(2), 97-116.
- Singh, N., & Davoody, A. (2011). Noise pollution in educational institutions. *Journal of Environmental Research & Development*, 6(2), 245-252.
- Stansfeld, S. A., Berglund, B., & Clark, C. (2005). Aircraft noise and children's cognition. *Journal of Environmental Psychology*, 25(1), 41-52.
- Thattai, D., Kumar, P., & Singh, R. (2017). Noise pollution assessment in urban areas. *Journal of Environmental Science & Engineering*, 59(2), 101-110.
- World Health Organization. (2018). Environmental noise guidelines. WHO Report, 1-20.

Chaotic Dynamics and Multistability in the q -deformed Duffing Map

Priyanka D. Bhojar

Department of Physics, Seth Kesarimal Porwal College of
Arts, Commerce and Science, Kamptee, Nagpur
Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
Email:pribhojar@gmail.com

Abstract

The Duffing map is a simplified, discrete-time version of the Duffing oscillator. It is widely used to study nonlinear and chaotic dynamics. Its importance comes from its ability to reproduce many key behaviours of complex physical systems while remaining mathematically simple. The q -deformation of the Duffing map is an important extension of a well-known nonlinear system used to study chaos. By adding a deformation parameter q , the map gains a nonlocal response. This allows the system to produce new forms of dynamics that do not appear in the classical Duffing map, such as modified transitions to chaos, stronger multistability, and new attractor shapes.

Keywords: Duffing amp, q -deformation, multistability, bifurcation diagram.

1. Introduction

The Duffing oscillator is a classical nonlinear second-order ODE model for forced, damped oscillators with nonlinear stiffness. The continuous Duffing equation has been extensively studied as a paradigm of nonlinear resonance, bifurcation behaviour, and chaotic motion (Kovacic & Brennan, 2011). The Duffing oscillator is used to detect weak signals. For e.g. it can be used in early machinery fault detection because its nonlinear sensitivity allows it to amplify and reveal weak characteristic signals buried in noise. By monitoring transitions in its dynamic state (e.g., from periodic to chaotic), tiny fault-related disturbances in

mechanical systems can be identified earlier than with linear detection methods (Hu & Wen, 2003).

The Duffing map is a discrete-time version of the Duffing oscillator. It is a simple, compact and computationally efficient model used to explore complex nonlinear dynamics in iterated systems. It can display fixed points, periodic motion, bifurcations, and strong chaos. These properties make it a valuable tool for understanding how complex dynamics arise from simple rules. It has been widely used to study possible multistability, sensitivity to initial conditions, the formation of attractors, and transitions between order and

chaos. The Duffing map has been used to encrypt biometrics and voice signals. The idea is to exploit chaos-map properties of the map like sensitivity to initial conditions and parameters (Hasan et al., 2017; Mahdi et al., 2016).

In mathematical physics, quantum deformation or q -deformation refers to a systematic modification of a classical algebraic, analytic or dynamical structure by the introduction of a parameter q in such a way that the non deformed or classical structure is recovered in the limit $q \rightarrow 1$. For instance, Tjin's paper gives an accessible overview of q -deformed Lie algebras and quantum groups, showing how a deformation parameter q modifies classical Lie algebra structures (Tjin, 1992). q -Deformations are important in physics because they lead to q -deformed oscillator models, where modified commutation relations produce effective descriptions of nonlinear quantum systems and allow the exploration of altered spectra and statistical behaviour beyond the standard harmonic oscillator (Macfarlane, 1989). In the context of discrete dynamical systems, a q -deformed map alters the standard update rule by deforming its functional form, such as by incorporating q -analogues of exponentials, linear terms, or nonlinear terms, resulting in a one-parameter family of maps that generalizes the original canonical map (Matala-Aho, 2009; Salem, 2013).

The q -deformed maps are also known to exhibit co-existing attractors (Patidar & Sud, 2009). In one of our earlier work, we find that the q -deformed Lozi map exhibits multistability, where multiple attractors like fixed points, periodic orbits, and chaotic attractors, coexist for the same parameter values. The q -deformation not only creates these coexisting attractors but also stabilizes trajectories that would otherwise diverge in the classical Lozi map (Gaiki et al., 2024). Cánovas et. al shows that q -deformation significantly modifies the logistic map, producing richer bifurcation structures and altered routes to chaos compared to the classical case. Notably, the deformation can induce multistability, with coexisting attractors appearing for the same parameter values depending on initial conditions (Cánovas & Muñoz-Guillermo, 2019). Notably, the deformation induces multistability, with multiple periodic and chaotic attractors coexisting for Hénon-like map (Gupta & Chandramouli, 2022). Sabe et. al showed that the coupling induces synchronization transitions, but weak coupling preserves multistability, while stronger coupling drives the lattice toward a globally synchronized state through critical points with distinct universality classes (Sabe et al., 2024).

This work presents an investigation of the q -deformed Duffing map, considering both forced and unforced scenarios. Its bifurcation structure,

attractor basins, and multistability have been analyzed. The q-deformation introduces novel dynamic behaviours absent in the classical Duffing map, including altered routes to chaos, enhanced multistability, and the emergence of unique attractor geometries.

2. The q-deformed Duffing map

The Duffing map is a discrete-time dynamical system in the plane that exhibits chaotic behaviour. It maps a point (x_n, y_n) to (x_{n+1}, y_{n+1}) via the following equations:

$$x_{n+1} = y_n$$

$$y_{n+1} = -bx_n + ay_n - y_n^3$$

Here n is the discrete time. This formulation serves as a discrete analog of the continuous Duffing equation, a nonlinear oscillator model. The dynamics depend on two key parameters, linear stiffness (a) and damping (b), which control fixed points, stability, and chaos onset. Generally used parameter values are $a=2.75$ and $b=0.2$. At these values, the Duffing map exhibits a strange attractor characterized by chaotic dynamics and fractal structure (Akhmet et al., 2019). This parameter set places the system in a well-known chaotic regime, where orbits are sensitive to initial conditions, producing intricate, non-periodic patterns in phase space.

The forced Duffing map equations are as follows:

$$x_{n+1} = y_n$$

$$y_{n+1} = -bx_n + ay_n - y_n^3 + F \cos(\omega n)$$

Here, F is the forcing amplitude. It determines the strength of the external drive. ω is the forcing frequency. The external forcing term $F \cos(\omega n)$ acts like a periodic push applied to the system from outside. It injects energy at a specific frequency, which can change the system’s natural behaviour, create new oscillations, and even lead to complex or chaotic motion. The amplitude F controls how strong this influence is, while the frequency ω determines how fast the forcing oscillates. In this case, $\omega=1$ therefore, the phase of the forcing advances by 1 radian each time n increments by 1. In this work, the dynamical behaviour of the q-deformed Duffing map is studied in both unforced and forced scenarios. The q-deformation of maps can be done in numerous ways. We use the q-deformation scheme proposed by Jaganathan and Sinha(Jaganathan & Sinha, 2005). We study the cases where only the x variable is q-deformed. The q-deformed map is as follows:

$$x_{n+1} = f([x_n]_q, [y_n])$$

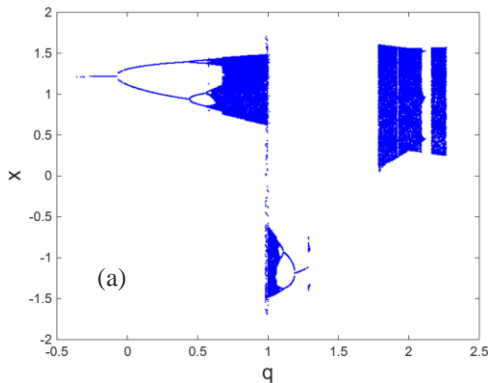
$$y_{n+1} = g([x_n]_q, [y_n])$$

Where, $[x_n]_q = \frac{x}{1+(1-q)(1-x)}$

For $q=1$, $[x_n]_q = x$

3. Results and Discussion

In the following two sections, the dynamical behaviour of the q-deformed



Duffing map, both unforced and forced, is discussed.

3.1 The q-deformed Duffing map

In this section, the bifurcation diagram, behaviour of chaotic attractor and multistability of the unforced q-deformed Duffing map is studied.

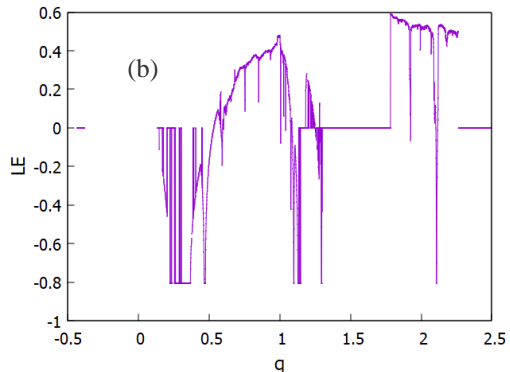


Fig. 1: (a) Bifurcation diagram and (b) Lyapunov exponent of the Duffing map with q-deformed x-variable in the range [-0.5 2.5]. The blue region represents the attractors of the system.

Fig.1(a) shows the bifurcation diagram of the Duffing map with the q-deformed x variable. It shows how the long-term values of the state variable x depend on the deformation parameter q in the q-deformed Duffing map. For each value of q, many iterations of the map are plotted after 20000 transients are discarded, so the vertical spread at fixed q represents the asymptotic attractors of the system. For small q, a narrow single branch in x is observed, indicating a stable periodic orbit, which then undergoes a clear period-doubling cascade as q increases, signalling the onset of chaos in the deformed map. For

larger q, the dynamics reappear in a separate window. It shows several vertical bands of points indicating coexisting attractors and strong multistability, with intervals of periodic behaviour interwoven with chaotic strips. In between these two chaotic regions, very few points are visible because the system no longer settles on a clear attractor in the plotted range. **Fig.1(b)** Shows the Largest Lyapunov exponent (LE) as a function of the deformation parameter q for the q-deformed Duffing map. The positive values of the Lyapunov exponent indicate chaotic dynamics, while

negative values correspond to periodic or stable motion.

The change in shape of the attractor with change in q value is shown in Fig. 2. These phase portraits show how the attractors of the q -deformed Duffing map changes as the deformation parameter q varies. For smaller q (panels (a) and (b)), the curve in the (x,y) plane splits into separate branches, indicating coexisting invariant sets or multistability, where nearby initial conditions can be attracted to different parts of phase space. Around $q \approx 1.05$

(panel (c)), the attractor shifts to negative x and becomes more distorted, suggesting a qualitative change in the underlying map, consistent with the gap seen in the bifurcation diagram for this parameter range. For larger q (panels (d)–(f)), the curves become smoother, forming almost single-valued arches with only small separations between branches, which corresponds to more regular or weakly chaotic dynamics and indicates that the q -deformation can both create and reduce complexity depending on the parameter value.

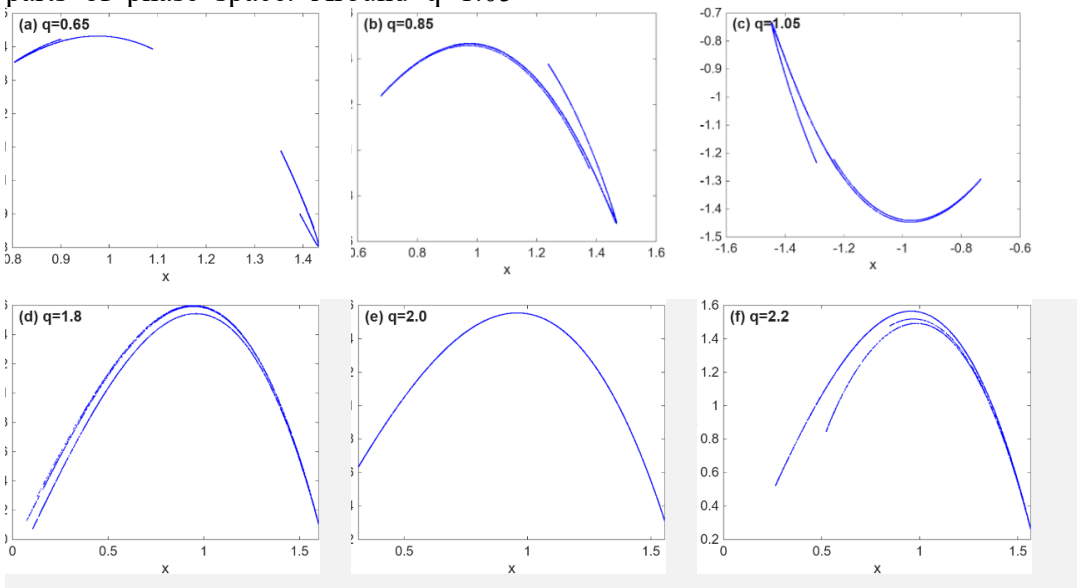


Fig. 2: The change in the behaviour of the attractor of the Duffing map with q -deformed x -variable for several values of deformation parameter q in the range 0.65-2.2.

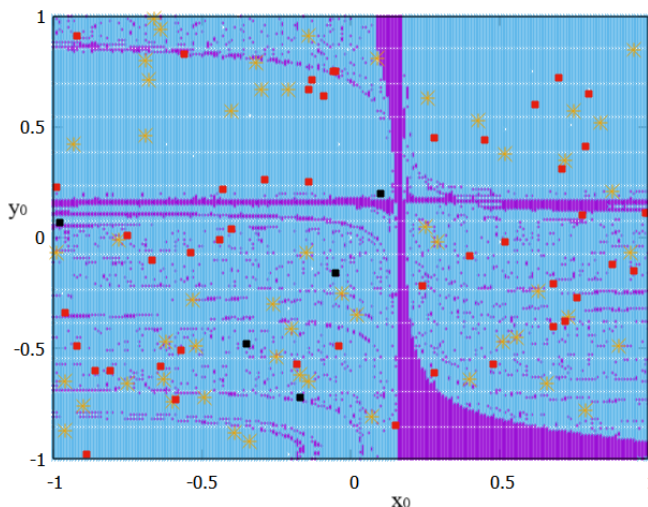


Fig. 3: Shows the basin of attractors for the q -deformed Duffing map with $q=2.2$. Several dynamical conditions are shown in different colours.

The initial conditions blowing up to infinity (purple), chaotic attractor (blue), and several periodic orbits (period-2 yellow, period-5 red, period-7 black).

Multistability is the coexistence of several qualitatively different states. It can be reached asymptotically for a given set of parameters. The long-term dynamics of an attractor depend upon the initial state. The study of the basin of the attractor can reveal the complex nature of the underlying multistability. Fig.3 shows the basin of attractor obtained for the q -deformed Duffing map with $q=2.2$. The diagram is plotted for the initial condition (x_0, y_0) where x_0 and y_0 varies from $[-1, 1]$. Figure shows

the distribution of initial conditions emerging into different dynamical conditions, such as blowing up to infinity, chaotic attractor, and several periodic orbits.

3.2 The q -deformed forced Duffing map

In this section, a periodic forcing term $F \cos(\omega n)$ is added to the Duffing map with q -deformed x variable. The system is no longer autonomous and is continuously shaken by an external signal. The bifurcation diagram with respect to forcing amplitude F , is plotted in Fig. 4. for deformation parameter $q=2.2$. At $q=2.2$, the unforced system already has weak chaos. This forcing can create resonances and generate new periodic, quasiperiodic, or chaotic attractors, often leading to richer bifurcation structure and stronger sensitivity to initial conditions than in the unforced case. For each value of F ,

2000 iterations after discarding transients are plotted. The blue region represents the attractors of the system for the parameters $a=2.75$, $b=0.2$ and $\omega=1$. For negative F , the diagram starts with a narrow branch that undergoes a sequence of period doublings and windows, indicating a transition from

regular periodic motion to chaos as the forcing is increased. Around $F \approx 0$, the attractor suddenly expands and fills a large, almost solid region which corresponds to strongly chaotic dynamics with a wide range of visited x -values.

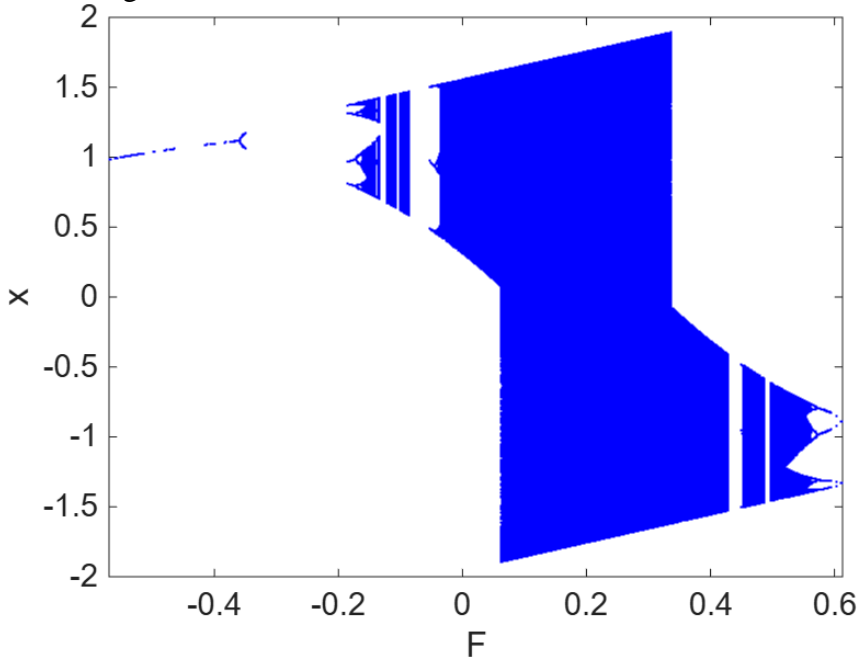


Fig. 4: Shows the bifurcation diagram of the forced Duffing map with respect to the periodic forcing parameter F in the range $[-0.6, 0.6]$ and forcing frequency $\omega=1$, for q -deformed x variable. The deformation parameter $q=2$.

Fig. 5 presents three subplots showing the change in the attractor for several values of F . In panel (a), where $F=-0.1$, indicates that a small negative value of F produces a smooth curve with one clear peak. In panel (b), for $F=0.1$, the attractor shows more a complex

oscillatory profile. In panel (c), with a larger value $F=0.4$, the curve transitions into a mostly concave-up form. It dips to a single minimum near $x=-1.1$ and then rises smoothly, losing the oscillatory character seen in panel (b).

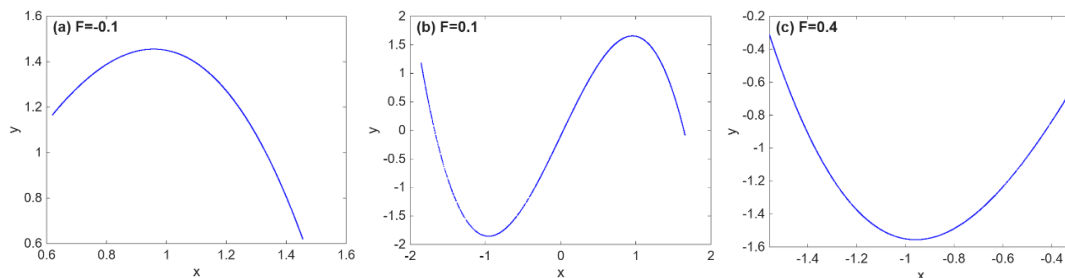


Fig. 5: Shows the nature of the chaotic attractor of the forced Duffing map for several values of $F=-0.1,0.1,0.4$ for q -deformation parameter $q=2$ and forcing frequency $\omega=1$.

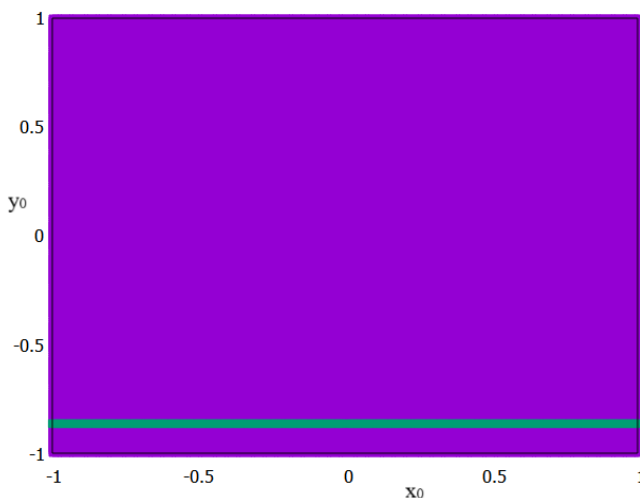


Fig. 6: Shows the basin of attractor for the q -deformed forced Duffing map with forcing amplitude $F=0.1$ and deformation parameter $q=2.0$. The initial conditions leading to two different dynamical condition are shown in two different colours: chaotic attractor in purple and period-2 in green colour.

Fig. 6 shows the basin of attractor obtained for q -deformed forced Duffing map with $q=2.0$. The diagram is plotted for the initial condition (x_0, y_0) where x_0 and y_0 varies from $[-1, 1]$. Figure shows distribution of initial condition leading into two different dynamical conditions chaotic attractor, and period-2.

4. Conclusion

In this work, the dynamical behaviour of the q -deformed Duffing map, both unforced and periodically forced, has been systematically investigated. The results demonstrate that introducing q -deformation into the Duffing map significantly alters its

qualitative dynamics compared to the classical, non-deformed version. For the unforced system, the bifurcation diagram reveals that varying the deformation parameter q produces rich transitions between periodicity, chaos, and multistability. In contrast to the standard Duffing map, where changes in system parameters typically lead to smooth period-doubling routes to chaos and a single dominant chaotic attractor, the q -deformed map exhibits additional dynamical regimes, including the appearance of multiple disjoint attractor branches, pronounced gaps in the bifurcation structure, and strong multistability for fixed parameter values. The phase portraits further confirm that q -deformation can both enhance and suppress chaotic complexity, while the classical Duffing map displays geometrically similar attractors across parameter ranges, the q -deformed system shows substantial deformation of attractor shapes and coexistence of qualitatively distinct phase-space structures, a behaviour absent in the classical formulation.

The forced q -deformed Duffing map also displays distinct differences from its non-deformed counterpart. While the standard forced Duffing map typically transitions through familiar routes to chaos under periodic forcing, the q -deformed version exhibits sudden

expansions of the attractor, wide chaotic bands, and a more intricate dependence on the forcing amplitude F . Forcing at $q=2.0$ generates a richer and more irregular bifurcation structure, including stronger sensitivity to initial conditions and attractor reshaping that is absent in the undeformed system. The evolution of the attractor with increasing F highlights how q -deformation modifies the system's response to external driving. The simple arches at small forcing amplitudes evolve into complex oscillatory structures and finally into smooth concave-up curves for larger forcing values.

Overall, the study shows that q -deformation introduces an additional layer of controllable nonlinearity that fundamentally changes the Duffing map's dynamical landscape. The q -deformed map supports new types of attractors, enhanced multistability, and qualitatively different responses to forcing, distinguishing its behaviour from the classical Duffing map and offering a richer platform for exploring nonlinear and chaotic phenomena.

Acknowledgement

The author acknowledges Rashtrasant Tukadoji Maharaj Nagpur University for providing financial assistance (RTMNU/RDC/2024/242).

References

- Akhmet, M., Fen, M. O., & Alejaily, E. M. (2019). Generation of fractals as Duffing equation orbits. *Chaos: An Interdisciplinary Journal of Nonlinear Science*, 29(5). <https://pubs.aip.org/aip/cha/article/29/5/053113/286794>
- Cánovas, J., & Muñoz-Guillermo, M. (2019). On the dynamics of the q -deformed logistic map. *Physics Letters A*, 383(15), 1742–1754.
- Gaiki, P. M., Bhojar, P. D., Joshi, D. D., & Gade, P. M. (2024). Existence of multistability in the dynamical behavior of q -deformed Lozi map. *Indian Journal of Physics*, 10, 3641–3659.
- Gupta, D., & Chandramouli, V. (2022). Dynamics of deformed Hénon-like map. *Chaos, Solitons & Fractals*, 155, 111760.
- Hasan, Md. M., Faruqi, T. M., Tazrean, M., & Chowdhury, T. H. (2017). Biometric encryption using duffing map. 2017 4th International Conference on Advances in Electrical Engineering (ICAEE), 737–742. <https://doi.org/10.1109/ICAEE.2017.8255452>
- Hu, N. Q., & Wen, X. S. (2003). The application of Duffing oscillator in characteristic signal detection of early fault. *Journal of Sound and Vibration*, 268(5), 917–931. [https://doi.org/10.1016/S0022-460X\(03\)00002-6](https://doi.org/10.1016/S0022-460X(03)00002-6)
- Jaganathan, R., & Sinha, S. (2005). A q -deformed nonlinear map. *Physics Letters A*, 338(3–5), 277–287.
- Kovacic, I., & Brennan, M. J. (2011). *The Duffing Equation: Nonlinear Oscillators and their Behaviour*. John Wiley & Sons.
- Macfarlane, A. J. (1989). On q -analogues of the quantum harmonic oscillator and the quantum group $SU(2)_q$. *Journal of Physics A: Mathematical and General*, 22(21), 4581.
- Mahdi, A., K. Jawad, A., & S. Hreshee, S. (2016). Digital Chaotic Scrambling of Voice Based on Duffing Map. *International Journal of Information and Communication Sciences*, 1(2), 16–21. <https://doi.org/10.11648/j.ijics.20160102.11>
- Matala-Aho, T. (2009). On q -analogues of divergent and exponential series. *Journal of the Mathematical Society of Japan*, 61(1), 291–313.
- Patidar, V., & Sud, K. K. (2009). A comparative study on the co-existing attractors in the Gaussian map and its q -deformed version. *Communications in Nonlinear Science and Numerical Simulation*, 14(3), 827–838.
- Sabe, N. R., Pakhare, S. S., & Gade, P. M. (2024). Synchronization transitions in coupled q -deformed logistic maps. *Chaos, Solitons & Fractals*, 181, 114703. <https://doi.org/10.1016/j.chaos.2024.114703>
- Salem, A. (2013). A q -analogue of the exponential integral. *Afrika Matematika*, 24(2), 117–125. <https://doi.org/10.1007/s13370-011-0046-6>
- Tjin, T. (1992). Introduction to quantized lie groups and algebras. *International Journal of Modern Physics A*, 07(25), 6175–6213. <https://doi.org/10.1142/S0217751X92002805>

A Comparative Study of Haemin Crystal Characteristics in Common Animal Source Bloodstains

Dr. Dewashree Nagarkar¹, Gayatri Chawhan, Zafera Khan

¹Department of Zoology,
L.A.D & Smt. R. P. College for Women,
Shankar Nagar, Nagpur- 440010, Maharashtra, India.
E-mail:dewashreenagarkar@gmail.com

Abstract

The present study reports a comparative assessment of haemin crystal dimensions formed from different blood sources based solely on measured results. The length and width of haemin crystals varied among species, indicating distinct morphological differences. Goat blood showed the highest mean crystal length, while cow blood exhibited the smallest crystal dimensions. Human and hen blood samples demonstrated similar mean crystal lengths with slight variation in width. Fish blood produced relatively longer crystals with greater variability, as reflected by a higher standard deviation. Overall, the observed variations in haemin crystal length and width among different blood sources highlight species-specific differences that may be useful in comparative bloodstain analysis.

Keywords: Blood, Hemin Crystal, Teichmann crystals, bloodstains.

Introduction

Blood or blood spots at the crime scene are of great importance in the field of Forensics. (Jonatan et al., 2005; Elpia et al., 2016). Bloodstains are frequently encountered at crime scenes on various surfaces, including floors, tables, chairs, and walls. In many instances, these stains are not fresh and are present in a dried state. Therefore, systematic and confirmatory examinations are required to establish whether the observed stains are of blood origin. (Sari et al., 2015, Abid et al. 2024)

The examination of bloodstains involves several analytical approaches, including presumptive tests, confirmatory tests, and specific tests such as DNA analysis. Confirmatory tests commonly employed include the Teichmann test and the Takayama test. These tests are used to demonstrate the formation of characteristic hemoglobin crystals, thereby confirming that a suspected stain recovered from a crime scene is of blood origin (Probowowati et al., 2013).

The present study was undertaken with the objective of bloodstain examination to determine the origin of blood, specifically to distinguish between human and animal sources. To achieve this, the study focuses on measuring and comparing the length and width of hemin crystals formed from blood of different species in order to identify species-specific morphological variations. Furthermore, the study aims to evaluate the potential of hemin crystal morphology as a supportive tool in forensic and diagnostic blood identification across species. Accurate source identification is of critical importance in forensic investigations, as it helps establish the evidentiary relevance of bloodstains at crime scenes, exclude non-probative animal blood, and guide subsequent confirmatory analyses, including species-specific tests and DNA profiling.

Material and Methods

Blood samples were collected from human, cow, goat, dog, and fish under sterile and supervised conditions. Human blood was obtained by finger prick using a sterile lancet after disinfection with 70% alcohol. In contrast, animal blood samples were collected by qualified veterinary personnel from appropriate veins (jugular vein for cow and goat, cephalic

vein for dog, and caudal vein for fish). All samples were preserved in sterile K₃EDTA anticoagulant tubes to prevent clotting and maintain cellular integrity, and aliquots were used for slide preparation. Hemin (Teichmann) crystal slides were prepared by placing a drop of blood on a clean glass slide, followed by the addition of glacial acetic acid and a crystal of sodium chloride, covering with a coverslip, and gentle heating until fumes appeared. The prepared slides were examined under a light microscope. Measurements of hemin crystal length and width were performed using an ocular micrometer calibrated with a stage micrometer at the corresponding magnification.

Observation

A comparative analysis of the mean length and width of hemin crystals formed from different blood sources. Among the species studied, goat blood exhibited the longest hemin crystals ($0.96 \pm 0.22 \mu\text{m}$), while cow blood showed the shortest crystals ($0.39 \pm 0.10 \mu\text{m}$). Human and hen blood samples demonstrated similar mean crystal lengths ($0.62 \mu\text{m}$), though slight variations were observed in width. Fish blood produced relatively longer crystals with greater variability, as indicated by a higher standard deviation (Fig. 1, 2 & 3; Table 1).

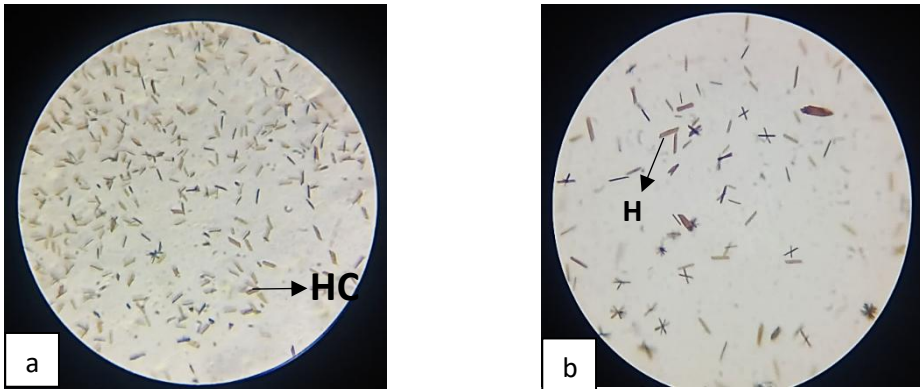


Fig. 1: Image showing (HC) Haemin crystal of a. Human blood & b. Cow blood.

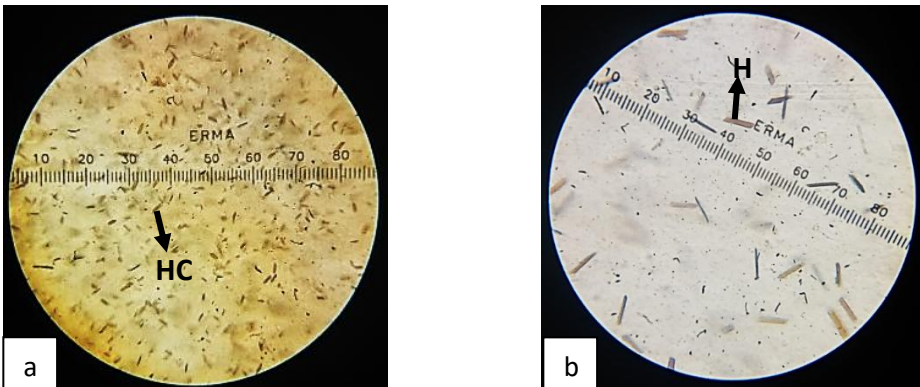


Fig. 2: Image showing (HC) Haemin crystal of a. Dog blood & b. Goat blood.

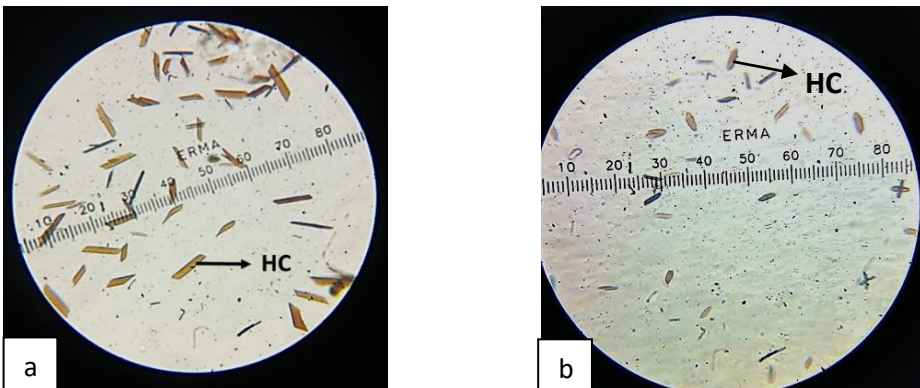


Fig. 3: Image showing (HC) Haemin crystal of a. Fish blood & b. Hen blood.

Table No. 1: Table for length and width of Haemin crystals in different animals.

Sr. No.	Blood Source	Length ($\mu\text{m} \pm \text{SD}$)	Width ($\mu\text{m} \pm \text{SD}$)
1.	Human	0.62 ± 0.14	0.32 ± 0.21
2.	Cow	0.39 ± 0.10	0.14 ± 0.18
3.	Dog	0.42 ± 0.09	0.16 ± 0.15
4.	Goat	0.96 ± 0.22	0.25 ± 0.10
5.	Hen	0.62 ± 0.12	0.28 ± 0.25
6.	Fish	0.76 ± 0.43	0.25 ± 0.13

Result & Discussion

Reichert et al., 1908 demonstrated remarkable crystallographic variations, noting that genera like *Felis*, *Canis*, and *Papio* show consistent crystal characteristics within their groups but marked differences between genera. Results of present study supports these findings as crystals of mammalian blood showed same structure but varied only in size. Noland et al., 2003 further confirmed these findings, showing that hemozoin crystals from different mammalian species have regular, flat-faced cuboidal morphologies with subtle size variations, present study strongly support these findings.

Regarding heme crystallization in mammals, blood-feeding organisms like *Rhodnius prolixus* can crystallize host hemoglobin in their digestive systems, with guinea pig hemoglobin forming

two crystallographically identical crystal types that age from oxy-form to aquomethemoglobin (Smit et al., 1983). Heme crystallization into hemozoin represents a crucial detoxification mechanism in blood-feeding organisms including protozoa, helminths, and insects, involving amphiphilic structures and specific proteins (Stiebler et al., 2011). Present study may help in designing insecticides against hemoparasites.

Conclusion

Based on the observations, haemin crystals show clear species-specific variations in their length and width. Goat blood forms the longest crystals, cow blood produces the smallest and narrowest crystals, while human, dog, and hen samples exhibit intermediate dimensions. These measurable differences confirm that haemin crystal

morphology can serve as a reliable supporting indicator for distinguishing blood from different animal species in forensic analysis.

References

- Abid, I. F., Rezakola, E., & Hanura, I. Y. (2024). Teichmann test: Assessment of hemoglobin crystals on blood spots exposed to powder detergent. *Jurnal Berkala Penelitian (JBP)*, 26(1), 23–27. <https://doi.org/10.20473/jbp.v26i1.2024.23-27>
- Elpia, E. Y., Asni, & Indrayana, M. T. (2016). Hemoglobin crystals in blood spots exposed to some alcohol-based antiseptic hand sanitizing gels using the Teichmann test and Takayama test. *Journal of Medical Laboratory Science*, Pekanbaru.
- Jonatan, W., Allan, J., Alan, L., John, D., Robr., & David, H. (2005). *Practical skills in forensic science* (pp. 407–409). Pearson Education.
- Noland, G. S., Briones, N., & Sullivan, D. J., Jr (2003). The shape and size of hemozoin crystals distinguishes diverse Plasmodium species. *Molecular and biochemical parasitology*, 130(2), 91–99. [https://doi.org/10.1016/s0166-6851\(03\)00163-4](https://doi.org/10.1016/s0166-6851(03)00163-4).
- Probowowati, A., Giovanni, P. C., & Ikhsan, D. (2013). Utilization of detergents in the household. *Industrial Chemical Technology Journal*, 2(2), 45–50.
- Reichert, E. T., & Brown, A. P. (1908). *The crystallography of hemoglobins*. Washington, DC: Carnegie Institution of Washington.
- Sari, Y. G., Asni, E., & Indrayana, M. T. (2015). Description of hemoglobin crystals in blood spots exposed to several non-carbolic domestic floor cleaning agents. *Journal of Medical Laboratory Science*, Pekanbaru.
- Smith, C. A., Organ, D. W., & Near, J. P. (1983). Organizational Citizenship Behaviour: Its Nature and Antecedents. *Journal of Applied Psychology*, 68, 653-663. <http://dx.doi.org/10.1037/0021-9010.68.4.653>.
- Stiebler, R., Hoang, A. N., Egan, T. J., Wright, D. W., & Oliveira, M. F. (2010). Increase on the initial soluble heme levels in acidic conditions is an important mechanism for spontaneous heme crystallization in vitro. *PLoS ONE*, 5(9), e12694. <https://doi.org/10.1371/journal.pone.0012694>

Azocompounds as a Potential Hope in Sickle Cell Anemia: In-Vitro Modulation of Hematological and Renal Parameters.

Dr. Pallavi Mehere

¹Assistant Professor, Department of Biochemistry,
RTM Nagpur University, Nagpur 440033
pallavimehere14@gmail.com

Abstract

Sickle cell anemia (SCA) is an inherited blood disorder caused by abnormal hemoglobin (hemoglobin S) sticking together, which leads to long-term anemia, repeated pain crises, and gradual damage to organs, especially the kidneys. Although treatments such as hydroxyurea, blood transfusions, and newer targeted therapies have improved patient care, many people still suffer from serious symptoms, showing the need for affordable and new treatment options. Azocompounds, which contain an azo ($-N=N-$) chemical group, are being studied for their ability to protect red blood cells by reducing damage and helping stabilize their membranes. Laboratory studies reviewed here suggest that some Azocompounds improve red blood cell strength and reduce cell breakdown in sickle cell blood, indicating possible anti-sickling or protective effects. However, these results are based only on laboratory and ex-vivo studies, and more research is needed to confirm their effectiveness, safety, and behaviour in the body before they can be used in patients.

Keywords: Sickle cell disease, Sickle cell anemia, Azocompounds, Hydroxyurea.

Introduction

Sickle cell disease (SCD) is a hereditary hemoglobin disorder that predominantly affects populations of African, Arabian, and Indian descent. It results from a point mutation in the β -globin chain of adult hemoglobin, leading to the production of sickle hemoglobin (HbS) with altered physicochemical properties. Individuals heterozygous for the mutation generally exhibit sickle cell trait (AS genotype), which is largely asymptomatic. In contrast, homozygous inheritance (SS

genotype) gives rise to sickle cell anaemia (SCA), a severe clinical condition characterized by accelerated red blood cell destruction and recurrent vascular obstruction associated with painful and potentially life-threatening complications (Serjeant & Serjeant, 2001).

Polymerization of deoxygenated HbS causes red blood cells to adopt a rigid, sickle shape, promoting microvascular occlusion, tissue ischemia, and recurrent vaso-occlusive crises—the defining clinical features of

SCA (Serjeant,1997). Globally, an estimated 300,000–400,000 infants are born each year with SCA, with the highest disease burden observed in sub-Saharan Africa, India, and the Middle East. In India, prevalence is especially high among tribal populations, where carrier rates may reach up to 30%. Despite the availability of disease-modifying therapies such as hydroxyurea, patients continue to experience significant morbidity, reduced quality of life, and shortened life expectancy (Rees et.al., 2010). These challenges are further intensified in endemic regions by limited healthcare infrastructure and socioeconomic disparities.

Polymerization of deoxygenated HbS causes red blood cells to adopt a rigid, sickle shape, promoting microvascular occlusion, tissue ischemia, and recurrent vaso-occlusive crises—the defining clinical features of SCA (Serjeant,1997). Globally, an estimated 300,000–400,000 infants are born each year with SCA, with the highest disease burden observed in sub-Saharan Africa, India, and the Middle East. In India, prevalence is especially high among tribal populations, where carrier rates may reach up to 30%. Despite the availability of disease-modifying therapies such as hydroxyurea, patients continue to experience significant morbidity, reduced quality of life, and shortened life expectancy (Rees et.al., 2010).

These challenges are further intensified in endemic regions by limited healthcare infrastructure and socioeconomic disparities.

A central pathological feature of SCA is chronic hemolysis, which leads to the release of free hemoglobin into the circulation. Free hemoglobin rapidly scavenges nitric oxide (NO), resulting in NO depletion, endothelial dysfunction, vasoconstriction, inflammation, and increased expression of adhesion molecules. These processes play a critical role in the development of vaso-occlusion and ischemia-reperfusion injury (Gladwin & Vilchinsky, 2008). Over time, sustained vascular and inflammatory damage contributes to progressive organ dysfunction, including pulmonary hypertension, cerebrovascular disease, and renal impairment (Akingbola et.al., 2009). The complex interaction between hemolysis, oxidative stress, inflammation, and vascular injury underpins the multisystem nature of SCA complications (Scheinman, 2009).

In light of these challenges, recent research has focused on identifying small molecules capable of stabilizing red blood cell membranes and reducing oxidative injury (Fitch et.al., 2017). Azocompounds, characterized by the functional group $R-N=N-R'$ (where R and R' may be aryl or alkyl substituents), have emerged as compounds of interest. The azo ($-N=N-$) linkage confers diverse chemical and

biological properties. Notably, *p*-aminobenzoic acid and its derivatives exhibit a broad range of pharmacological activities, including antibacterial, antifungal, antitubercular, analgesic, and local anesthetic effects, as well as applications as indicators in acid–base titrations. Previous studies indicate that complexation of *p*-aminobenzoic acid enhances its biological activity. Importantly, certain azo derivatives have demonstrated erythrocyte membrane-stabilizing effects, suggesting their potential to reduce red blood cell fragility and hemolysis in SCA (Mehere et al., 2022).

***In-Vitro* Studies of Azocompounds on SCA Blood**

In-vitro studies examining the effects of Azocompounds on blood samples from SCA patients represent a promising approach for identifying novel therapeutic candidates capable of modifying disease progression. These investigations typically involve incubating SCA blood samples with selected Azocompounds at defined concentrations, incubation times, and controlled experimental conditions. Commonly reported protocols include exposure to concentrations ranging from 10 to 100 μM for durations of 1 to 24 hours at 37 °C.

A range of hematological parameters is evaluated, including hemoglobin concentration, red blood cell count, hematocrit, mean

corpuscular volume, mean corpuscular hemoglobin, mean corpuscular hemoglobin concentration, reticulocyte count, and biochemical markers of hemolysis such as lactate dehydrogenase and bilirubin. Across multiple studies, Azocompound exposure has been associated with reduced erythrocyte fragility and decreased hemolysis, as evidenced by lower LDH and bilirubin levels. Improvements in hemoglobin concentration, red blood cell count, and hematocrit have also been reported, indicating enhanced erythrocyte stability. In several cases, these effects were dose dependent, with higher concentrations producing more pronounced hematological improvements. Observed variability among compounds suggests the presence of structure–activity relationships that may inform the rational development of more effective Azocompounds (Mehere et al., 2018).

Potential Renal Protective Implications

The potential renal protective effects of Azocompounds in SCA can be inferred mechanistically by linking their *in-vitro* effects on erythrocyte stability and hemolysis to the pathophysiology of sickle cell nephropathy. Chronic intravascular hemolysis leads to elevated plasma free hemoglobin levels, which promote nitric oxide depletion, endothelial dysfunction, vasoconstriction, and

oxidative stress-key contributors to renal ischemia and microvascular injury.

If Azocompounds are capable of stabilizing red blood cell membranes and reducing hemolysis *in-vitro*, these effects may translate *in-vivo* into decreased free hemoglobin release, improved nitric oxide bioavailability, and reduced oxidative stress within the renal microvasculature. Collectively, these mechanisms could potentially slow the progression of sickle cell-related renal dysfunction (Fitch et.al., 2017). However, this hypothesis remains speculative and requires validation through *in-vivo* studies and clinical investigations.

Comparison with Established Therapies

The therapeutic management of SCA has evolved considerably with the introduction of disease-modifying interventions. Hydroxyurea remains a cornerstone of therapy, reducing HbS polymerization and lowering the frequency of vaso-occlusive crises. Chronic transfusion therapy is used to maintain HbS levels below 30% and prevent complications such as stroke, though it carries risks including iron overload and alloimmunization. Hematopoietic stem cell transplantation represents the only curative treatment; however, its use is limited by donor availability, cost, and transplant-related

morbidity and mortality (Schechter & Gladwin, 2025).

Recent years have seen the development of novel pharmacological agents. Voxelotor, a hemoglobin oxygen-affinity modulator, inhibits HbS polymerization by increasing hemoglobin's affinity for oxygen, thereby reducing hemolysis and improving anemia. (Yawn, & John, 2025). Crizanlizumab, a monoclonal antibody targeting P-selectin, reduces vaso-occlusive crises by inhibiting interactions between sickled erythrocytes and the endothelium. L-glutamine, an antioxidant therapy, improves redox balance in sickle erythrocytes and reduces oxidative stress (Kato & Gladwin, 2025).

In contrast to these established and clinically approved therapies, Azocompounds remain at an early experimental stage. While *in-vitro* findings suggest potential antioxidant and membrane-stabilizing benefits, these compounds lack *in-vivo* validation and clinical safety or efficacy data (Bhatia & John, 2025). As such, their therapeutic role in SCA remains exploratory.

Conclusion

Azocompounds evaluated in *in-vitro* studies using SCA blood samples represent a promising experimental strategy for modulating hematological parameters and potentially influencing renal outcomes in sickle cell anemia.

Available evidence indicates that selected Azocompounds enhance red blood cell stability and reduce hemolysis, suggesting possible anti-sickling or cytoprotective effects. Nevertheless, their clinical applicability has yet to be established. Future research should integrate advances in medicinal chemistry, pharmacology, and clinical science to translate these preliminary findings into safe, effective, and accessible therapeutic options for patients with sickle cell anemia.

References

- Akingbola, T. S., Akinyanju, O. O., & Akinyemi, R. O. (2009). Biochemical and hematological indices in homozygous sickle cell disease. *International Journal of Hematology*, 90(3), 317–324.
- Annual Young Scholars' Conference on Renal Insufficiency in Sickle Cell Anemia Patients and In-Vitro Effect of Some Azocompounds on SCA Patient's Blood Samples. (2018). *RTM Nagpur University Science Journal*, 1(1), 45–50.
- Bhatia, M., & John, G. S. (2025). Sickle cell anaemia therapy in 2025. *National Institutes of Health (NIH)*.
<https://pmc.ncbi.nlm.nih.gov/articles/PMC11886933/>
- Fitch, K., Bockenbauer, D., & Bingham, C. (2017). The nephropathy of sickle cell trait and sickle cell disease. *Kidney International*, 91(2), 308–316.
- Gladwin, M. T., & Vichinsky, E. (2008). Pulmonary complications of sickle cell disease. *New England Journal of Medicine*, 359(21), 2254–2265.
- Kato, G. J., & Gladwin, M. T. (2025). Sickle cell anaemia therapy in 2025. *European Journal of Pharmaceutical and Medical Research*, 11(1), 1–10.
- Mehere, P., Meshram, V. G., & Mehere, B. A. (2022). In-vitro study of some azocompounds on hematological parameters in the patients suffering from sickle cell anemia. *World Journal of Pharmacy and Pharmaceutical Sciences*, 11(2), 101–110.
- Rees, D. C., Williams, T. N., & Gladwin, M. T. (2010). Sickle-cell disease. *The Lancet*, 376(9757), 2018–2031.
- Schechter, A. N., & Gladwin, M. T. (2025). Sickle cell anaemia therapy in 2025. *British Journal of Haematology*, 190(1), 12–23.
- Scheinman, J. I. (2009). Sickle cell disease and the kidney. *Nature Clinical Practice Nephrology*, 5(2), 78–88.
- Serjeant GR, Serjeant BE. Sickle cell disease. 3rd ed. Oxford: Oxford University Press; 2001.
- Serjeant, G. R. (1997). Sickle-cell disease. *The Lancet*, 350(9079), 725–730.
- Yawn, B. P., & John, G. S. (2025). Gene therapy for sickle cell anemia: Current status and future directions. *Springer Medicine*

Mapping Global Research on Market Growth and Consumer Perception Towards Generic Medicines: A Bibliometric Analysis (2000–2025)

Avinash Sahu

Research Scholar, Department of Business Management,
R.T.M. Nagpur University

Research Guide: Dr. Ajit Shringarpure

Department of Business Management, R.T.M. Nagpur University

Abstract

The current study seeks to provide an extensive bibliometric analysis of international studies regarding market expansion and consumer attitudes towards generic medications from 2000 to 2025. Using VOSviewer and Microsoft Excel, we looked at 994 research papers from the Dimensions database to find publication trends, prolific authors, significant universities, and influential journals. The temporal analysis showed that the number of publications has been steadily rising over the years, with a big jump after 2023. In 2024, there were 392,656 citations, which shows that more scholars are interested in the topic.

Frontiers in Pharmacology was the most productive source, with 37 articles. PLOS ONE (28) and Health Affairs (20) were next, showing that pharmacology and healthcare research are both quite interdisciplinary. The study "Artificial Intelligence in Drug Discovery and Development" by Paul et al. (2020) had 1,286 citations, making it one of the most cited papers. This shows how technological innovation is becoming more common in pharmaceutical investigations. The data also shows that the United States, China, and India are the countries that contribute the most, while Harvard University and the University of California are the institutions that do the most research.

This bibliometric analysis gives a full picture of the intellectual structure and research progress in the field of generic medicine. The results give policymakers, academics, and pharmaceutical companies useful information that can help them make the global pharmaceutical industry more accessible, affordable, and innovative.

Keywords: Generic drugs, market expansion, how people see them, bibliometric analysis, VOSviewer, the Dimensions database, pharmaceutical research, and citation analysis.

1. Introduction

The pharmaceutical sector is very important for making sure that people all over the world can get inexpensive health care. Over the past twenty years, generic medicines have become a key part of efforts to control the rising costs of brand-name drugs and make sure that more people can get the treatments they need. Generic pharmaceuticals are just as effective as brand-name drugs, but they cost a lot less once the original product's patent protection runs out. Their low cost, safety, and clearance by health authorities have made them important parts of health systems around the world (Kumar & Gupta, 2022). Even while generic medicines are known to provide benefits, their growth in the market and acceptability by consumers are still very different from country to country and healthcare system to healthcare system. Regulatory frameworks, physician prescription behavior, pharmacist substitution procedures, and, most crucially, customer perception and faith in the quality and efficacy of generics (Patel et al., 2021) are some of the things that affect this. Studies indicate that misconceptions about the quality, efficacy, and safety of generic medications sometimes impede their acceptance, particularly in developing nations like India (Kaur & Sharma, 2020). The global market for generic medications has grown a lot since patents on popular drugs have run out,

healthcare costs have gone up, and governments have pushed for cheaper treatment options (OECD, 2023). The IQVIA Institute (2024) says that in most industrialized countries, more than 60% of prescriptions are for generic drugs. Emerging economies, on the other hand, have a lot of room to grow. Nonetheless, scholarly interest in the economic, marketing, and behavioral aspects of this sector has fluctuated throughout time and across different regions. Although many empirical and case-based studies have investigated consumer awareness, market expansion methods, and policy consequences, there is still an absence of comprehensive mapping of worldwide research trends in this domain. Bibliometric analysis, a quantitative technique for examining scientific literature, offers a robust framework for comprehending the intellectual architecture, development, and collaborative dynamics of research domains (Aria & Cuccurullo, 2017). Bibliometric studies can show the direction and new themes in academic discourse by looking at publication outputs, citations, keyword co-occurrences, and author networks. Utilizing this methodology in the study of generic medications facilitates a thorough comprehension of the field's evolution in response to temporal shifts in economic conditions, regulatory frameworks, and consumer behavior. Considering the rising significance of generic medications in healthcare

systems and the escalating academic focus on market dynamics and consumer behavior, this study seeks to delineate global research output regarding market expansion and consumer perceptions of generic medicines from 2000 to 2025. The investigation employs bibliometric tools like VOSviewer and Biblioshiny to pinpoint significant authors, institutions, nations, and research themes that have influenced this domain. The results will offer a comprehensive picture of the worldwide research landscape and assist in pinpointing gaps and opportunities for future empirical investigations, especially pertinent to regional contexts such as Nagpur and analogous metropolitan centers in India.

Based on these goals, the current study aims to answer the following important research questions:

RQ1: What are the trends in publishing and expansion of research on generic pharmaceuticals from 2000 to 2025?

RQ2: What are the journals that have published the most papers about generic medicines?

RQ3: Who are the most prolific and important authors in this area?

RQ4: Which countries and organizations have made the biggest contributions to

Worldwide research on generic medicines?

RQ5: What articles about generic drug research are quoted the most?

RQ6: What are the most common terms and research themes that come up when talking about market expansion and how consumers see it?

RQ7: What is the structure of co-authorship and collaboration networks among writers and countries?

RQ8: What new trends and groups of related themes may be seen for future research and Policy-making?

2. Review of the Literature

Over the past 20 years, the global pharmaceutical sector has changed a lot. Generic drugs have been a major factor in making healthcare more cheap. Numerous empirical research have investigated the economic and regulatory dimensions of generic drug markets, underscoring their significance in decreasing healthcare costs and enhancing access to vital medications (Kaplan et al., 2012; Simoens, 2019). Studies have examined the determinants affecting consumer acceptance of generics, such as awareness, perceived quality, and trust in healthcare professionals (Dunne et al., 2014; Kaur & Sharma, 2020). In emerging countries like India, consumer perception and prescriber behavior remain vital factors influencing the market adoption of

generic pharmaceuticals (Patel et al., 2021; Kumar & Gupta, 2022).

Although the economic and behavioral aspects of the generic pharmaceutical market have been extensively examined, there is a paucity of studies that systematically evaluate global research trends in this domain. Prior bibliometric studies have predominantly concentrated on overarching pharmaceutical topics, including drug innovation (Lopez et al., 2021), pharmaceutical marketing (Sharma & Mehta, 2022), and healthcare administration (Nguyen et al., 2023). Singh and Raj (2021) created a map of research around the world on pharmaceutical price strategies. Adebisi et al. (2022) did a bibliometric analysis of access to vital medicines in impoverished nations. Nonetheless, none of these studies have explicitly examined the convergence of market expansion and consumer attitudes towards generic medications.

Bibliometric studies in health sciences offer significant insights into the intellectual and collaborative frameworks of study domains, enabling scholars to discern rising subjects, prolific contributors, and research deficiencies (Aria & Cuccurullo, 2017). Even if there are a lot more articles being published about generic pharmaceuticals, we still don't have a clear picture of how this field of study has changed around the world. This study seeks to address this deficiency by

performing an exhaustive bibliometric analysis of research output from 2000 to 2025, concentrating on both market expansion and consumer perceptions of generic pharmaceuticals. The results are anticipated to offer a comprehensive perspective on research advancement and to inform subsequent inquiries and policy measures in the pharmaceutical industry.

3. Research Methodology

This study employs a bibliometric methodology to examine global research trends regarding market expansion and consumer attitudes towards generic pharmaceuticals from 2000 to 2025. Bibliometric analysis is a well-known, objective, and quantitative way to look at the structure, growth, and trends in a certain area of scientific research (Lee & Hew, 2017; De Bakker et al., 2005). It helps find important authors, institutions, and nations, as well as patterns of collaboration and changes in themes in the field of research (Merigó et al., 2015). This strategy offers significant insights for academics, policymakers, and industry experts by illuminating the intellectual terrain and nascent focal areas (Duque Oliva et al., 2006).

3.1 Source of Data and Search Plan

We got the bibliographic data for this study from the Dimensions.ai database. We chose this one since it has a wide range of peer-reviewed publications, conference proceedings,

and research outputs from many different fields. We used the terms "generic medicine," "generic drug," "pharmaceutical market growth," and "consumer perception towards generic medicine" to do the search.

The search only looked at articles that were published between 2000 and 2025. To keep the results consistent and easy to compare, only English-language documents were used. After getting rid of duplicates and records that weren't useful, we found 994 papers that were relevant to this analysis.

The final dataset consisted of **994 research publications** retrieved from the Dimensions database for the period 2000–2025. These publications collectively received a **total of 392,656 citations**, indicating the cumulative scholarly impact of research on generic medicines during the study period.

3.2 Checking and Getting Ready for Data

We carefully looked at each record we got from the database based on its title, abstract, and keywords to make sure it was related to the research theme. The resulting dataset had bibliographic information such as authors, titles, institutions, countries, year of publication, citation counts, and keywords. We exported the data in CSV format so we could analyze it. To make sure the data was correct and clear, we used Microsoft Excel to clean out any discrepancies, such as multiple

affiliations, duplicate names, and combined author data.

3.3 Tools for Analyzing and Showing Data

We used VOSviewer (version 1.6.20) and Biblioshiny (an R Studio extension) to look over the cleaned dataset. We used VOSviewer to make and show co-authorship networks, networks of keywords that appear together, bibliographic coupling, and co-citation networks. Biblioshiny made it easier to do descriptive bibliometric analysis, like finding publishing trends, the most cited publications, the best authors, institutions, nations, and keyword frequencies.

3.4 Types of Analysis

- The bibliometric indicators were divided into these groups:
- Trends in publications by year
- The most cited papers
- Authors, institutions, and countries that write a lot
- Networks for co-authorship and collaboration
- Networks of co-citation and bibliographic coupling
- Analysis of keyword co-occurrence

This comprehensive bibliometric approach offers a complete picture of the intellectual framework and development of research on generic medicines. It also points out possible

research gaps and future approaches that can help policymakers and researchers in healthcare markets.

4. What it covers and what it doesn't

This study is limited to research articles regarding generic drugs, concentrating on market growth and consumer perception from 2000 to 2025. The analysis encompasses papers indexed in the Dimensions.ai database, which provides comprehensive multidisciplinary coverage of scholarly literature. The research focuses on quantitative bibliometric indicators and network visualizations to comprehend global research trends, significant contributors, and topic advancements within this field.

Nonetheless, this research is constrained by specific restrictions.

- First, it only uses data from the Dimensions.ai database, thus any publications that aren't in this database may not be included.
- Second, the analysis only looks at English-language publications, which may leave out important studies that were published in other languages.

- Third, bibliometric measures, like citation counts, are not fixed and can alter over time when new articles are published or referenced.
- Finally, the study delineates quantitative correlations among publications, authors, and keywords, although it does not conduct a qualitative content analysis of the research findings.

Even with these problems, the studies give a full picture of the intellectual and collaborative environment of research on generic pharmaceuticals and provide useful information for future empirical and policy-oriented research.

5. Results and Findings

5.1. Journals with the most articles published

From 2000 to 2025, 994 research papers about how the market is growing and how people feel about generic drugs were published in 405 different journals. Figure 1 shows the journals that published the most articles in this field of research.

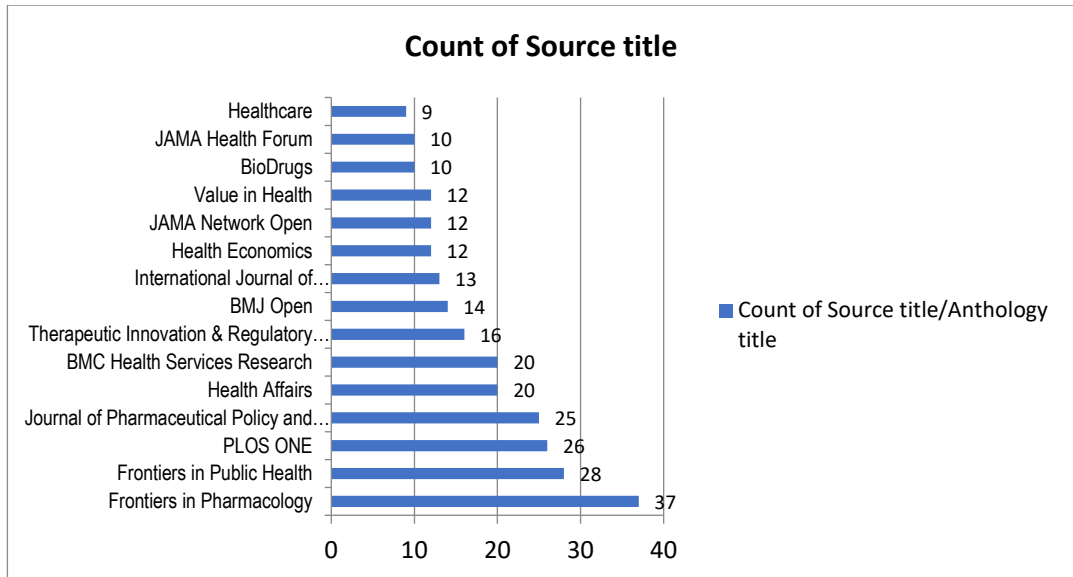


Figure 1: Top fifteen journals with maximum publications on generic medicine

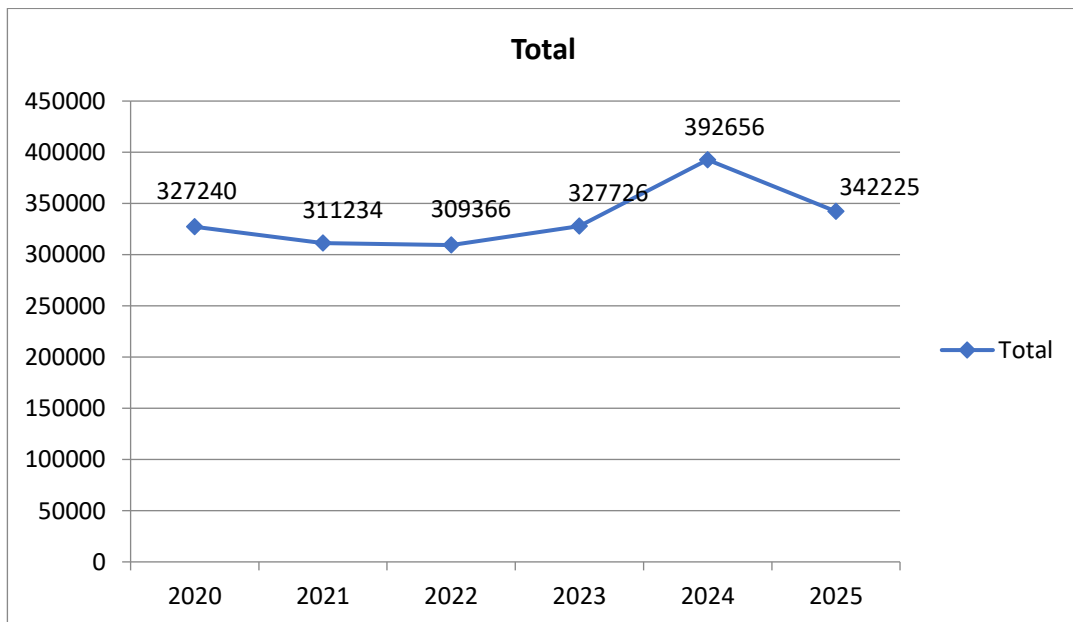


Figure 2: Year-wise Citation Trend (2020–2025)

Frontiers in Pharmacology was the best journal with 37 articles. It was followed by PLOS ONE (28 papers), Health Affairs (26 papers), and Therapeutic Innovation & Regulatory Science (20 papers). Other journals, like the International Journal of Pharmaceutics, JAMA Network Open, BioDrugs, and Healthcare, also made important contributions by publishing between 9 and 16 papers apiece. This trend shows that research on generic medications is getting a lot of attention from well-known multidisciplinary publications. This means that academics throughout the world are becoming more interested in issues related to the affordability, accessibility, and market growth of generic drugs.

5.2 Year-wise citations of papers

Although the overall scope of the study spans the period from 2000 to 2025, the year-wise citation analysis presented here focuses on the period from 2020 to 2025 in order to highlight recent trends and emerging research interest in generic medicine studies.

From 2020 to 2025, the **year-wise citation counts** exhibited notable fluctuations, reflecting changing levels of scholarly attention towards research on generic pharmaceuticals. In 2020, the total citation count stood at **327,240 citations**, which declined slightly in

2021 (**311,234 citations**) and 2022 (**309,366 citations**). A marginal increase was observed in 2023 (**327,726 citations**), followed by a substantial rise in 2024, reaching the highest level of **392,656 citations**. In 2025, citation counts showed a modest decline to **342,225 citations**.

This pattern suggests a renewed increase in academic engagement after 2023, potentially driven by heightened global attention towards healthcare affordability, cost containment, and the expansion of generic medicine markets in the post-pandemic period. The peak in 2024 indicates intensified scholarly impact, while the slight decline in 2025 may reflect stabilization in citation accumulation rather than reduced research activity.

5.3 Most cited papers

Interpretation of Most Cited Papers

Table I shows the top ten most cited research publications in the subject of pharmaceutical and generic medicine studies, as found in the database. Paul et al. (2018) wrote the most cited paper, which has been cited 1,286 times. It is called "Artificial Intelligence in Drug Discovery and Development."

Table 1: Top 20 Most Cited Papers related to Generic medicine

S.no	Author Name	Paper Title	Citation
1	Paul, Debleena; Sanap, Gaurav; Shenoy, Snehal; Kalyane,	Artificial intelligence in drug discovery and development	1286
2	James, Nicholas D; Tannock, Ian; Nâ€™Dow,	The Lancet Commission on prostate cancer: planning for the surge in cases	389
3	González Peñã, Omar Israel; Lãpez Zavala,	Pharmaceuticals Market, Consumption Trends and Disease Incidence Are Not Driving the Pharmaceutical Research on Water and Wastewater	206
4	Roberts, Michael S; Cheruvu, Hanumanth S;	Topical drug delivery: History, percutaneous absorption, and product development	167
5	Kvien, Tore K; Patel, Kashyap; Strand, Vibeke	The cost savings of biosimilars can help increase patient access and lift the financial burden of health care systems	115
6	Fralick, Michael; Jenkins, Alicia J.; Khunti, Kamlesh;	Global accessibility of therapeutics for diabetes mellitus	97
7	Yuan, Jing; Lu, Z Kevin; Xiong, Xiaomo; Jiang, Bin	Lowering drug prices and enhancing pharmaceutical affordability: an analysis of the national volume-based procurement (NVBP) effect in China	81
8	Adebisi, Yusuff Adebayo; Nwogu, Ifechukwu Benedict;	Revisiting the issue of access to medicines in Africa: Challenges and recommendations	74
9	Jakovljevic, Mihajlo; Wu, Wenqing;	Asian innovation in pharmaceutical and medical device industry â€™ beyond tomorrow	66
10	Vogler, Sabine; Schneider, Peter; Zuba, Martin; Busse, Reinhard; Panteli, Dimitra	Policies to Encourage the Use of Biosimilars in European Countries and Their Potential Impact on Pharmaceutical Expenditure	66

This paper gives a thorough overview of how AI can be used in pharmaceutical research, focusing on how it could change the way drugs are discovered and developed by speeding

up the process. It talks about how AI-powered algorithms make finding targets, screening molecules, and designing clinical trials more efficient. The study shows that using AI in

pharmaceutical development not only lowers research expenses but also improves accuracy and leads to new ideas.

James et al.'s (2021) "The Lancet Commission on Prostate Cancer: Planning for the Surge in Cases" is the second most cited work, with 389 citations. This study looks at the worldwide impact of prostate cancer and makes policy suggestions for dealing with the expected increase in incidence. The authors stress the importance of finding cancer early, making sure everyone can get treatment, and working together across borders to improve cancer care. The study offers significant insights for health policy and clinical management, particularly in resource-constrained environments.

The third most cited paper, "Pharmaceuticals Market, Consumption Trends and Disease Incidence Are Not Driving the Pharmaceutical Research on Water and Wastewater," was written by González Peña and López Zavala in 2019 and has been cited 206 times. The study examines the correlation between pharmaceutical consumption and environmental research trends, uncovering a discrepancy between elevated drug usage and insufficient research on pharmaceutical residues in aquatic systems. It demands more stringent environmental regulations and heightened research emphasis on the management of pharmaceutical waste.

The fourth most referenced publication, "Topical Drug Delivery: History, Percutaneous Absorption, and Product Development" by Roberts and Cheruvu (2013), has 167 citations and looks at topical drug delivery systems from a historical and scientific point of view. It looks at how percutaneous absorption works, how to make formulations, and how transdermal technology have improved. The publication gives researchers and formulators the basic information they need to make effective topical and dermatological medication products.

The fifth most referenced paper, "The Cost Savings of Biosimilars Can Help Increase Patient Access and Lift the Financial Burden of Health Care Systems," was written by Kvien, Patel, and Strand in 2020 and has been cited 115 times. This paper talks about the economic benefits of biosimilars and how they could make healthcare more affordable. It shows how biosimilars help keep costs down, make it easier for patients to get biologic medicines, and promote long-term healthcare funding.

Fralick et al.'s (2019) publication "Global Accessibility of Therapeutics for Diabetes Mellitus" is the sixth most cited paper, with 97 citations. The authors look at differences in access to diabetes medications around the world, focusing on the differences between high-income and low-income nations. The study calls for changes to policies and more cooperation across countries

to make important diabetic treatments easier to get and less expensive.

Yuan et al.'s (2020) publication "Lowering Drug Prices and Enhancing Pharmaceutical Affordability: An Analysis of the National Volume-Based Procurement (NVBP) Effect in China" is the seventh most cited paper, with 81 citations. The report evaluates China's NVBP policy, illustrating how extensive procurement systems successfully lower drug prices and improve public access to medications. The results have substantial policy implications for developing countries that want to establish a compromise between controlling costs and making healthcare fair for everyone.

The eighth most-cited paper, "Revisiting the Issue of Access to Medicines in Africa: Challenges and Recommendations" by Adebisi and Nwogu (2021), has been cited 74 times. This study delineates ongoing hurdles in drug accessibility throughout African nations, encompassing supply chain inefficiencies, regulatory obstacles, and budgetary limitations. It suggests that deliberate policy changes and cooperation with other countries will make it easier for people on the continent to get medicines.

Jakovljevic and Wu's (2019) study "Asian Innovation in the Pharmaceutical and Medical Device Industry – Beyond Tomorrow," which has been cited 66 times, looks at the

fast-paced technological progress and new ideas in the Asian pharmaceutical industry. The study shows that Asia is becoming a more important worldwide leader in biomedical research because of new ideas, money, and policies that help.

The tenth most cited paper, "Policies to Encourage the Use of Biosimilars in European Countries and Their Potential Impact on Pharmaceutical Expenditure," written by Vogler et al. (2017), looks at regulatory and policy frameworks that encourage the use of biosimilars in Europe. The research suggests that successful biosimilar regulations can dramatically lower pharmaceutical spending while retaining the quality and availability of vital medicines.

5.3 Most prolific authors

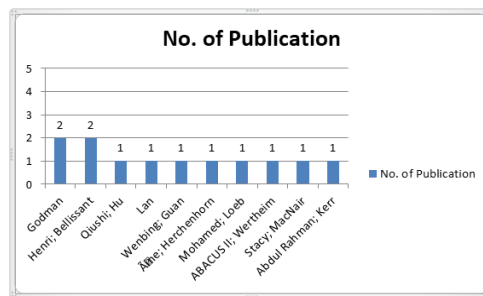


Figure [5.3]: Most Prolific Authors in Generic Medicine Research (2000–2025)

Figure [5.3] shows the authors who have written the most about the growth of the generic drug sector and how people feel about it from 2000 to 2025. The analysis shows that Godman and

Henri Bellissant are the most active contributors, each having published two papers in this field. The other authors—Qiushi Hu, Lan, Wenbing Guan, Anne Herchenhorn, Mohamed Loeb, ABACUS Li Wertheim, Stacy MacNair, and Abdul Rahmani Kerr—have all written one paper.

The overall distribution shows that research activity in this field is spread out, with few author names appearing in

more than one paper. This pattern indicates that the examination of generic medication marketplaces is still a developing area, drawing a diverse array of individual contributions instead of a few group of very productive scholars. The results also suggest that there are chances for more collaboration and ongoing study to make this field's academic base stronger.

5.4 Most prolific institutions

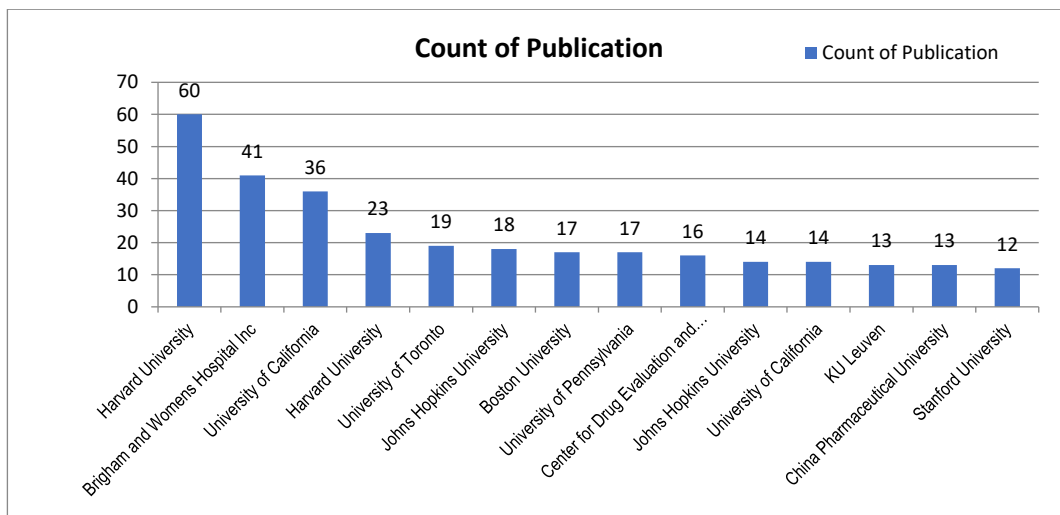


Figure [5.4]: Most Prolific institution in Generic Medicine Research (2000–2025)

Figure 5.4 shows the best schools that have published research papers on the chosen topic. Harvard University has the most publications (60), followed by Brigham and Women's Hospital (41) and the University of California (36). Other important contributors are research centers at Harvard University, the University of Toronto, Johns Hopkins University, and Boston

University. Each of these schools published between 17 and 23 papers.

This distribution shows that most research is done in a small number of top-tier colleges, most of which are in the US and Canada. These well-known institutions made a big impact since they are actively involved in and lead research in this area. At the same time, new contributors like KU Leuven,

China Pharmaceutical University, and Stanford University are also very important for making the research environment more diverse.

5.5 Co-authorship Analysis

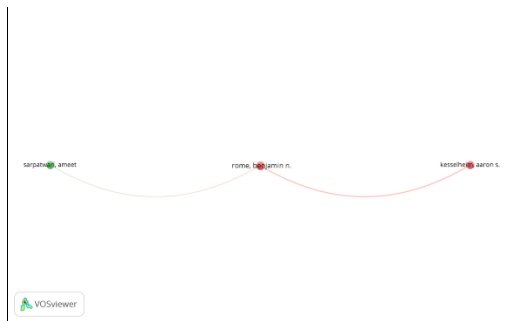


Figure 5.5 : Co-authorship network of leading authors in generic medicine research (2000–2025).

Interpretation : The Co-authorship study shows that there is a modest but important network of collaborations among major researchers. The map shows three main authors—Ameet Sarpotwar, Benjamin N. Rome, and Aaron S. Kesselheim—who are connected through joint publications. Benjamin N. Rome is the central node, which means he is the linking author between Sarpotwar and Kesselheim, showing how important he is to collaborative research. The small number of connected nodes shows that collaborative authorship in generic medicine research is still fragmented, with only a few strong research partnerships. This suggests that research on generic medications is still evolving

and may gain from enhanced international collaboration.

5.5 Co-authorship Network Map of Authors

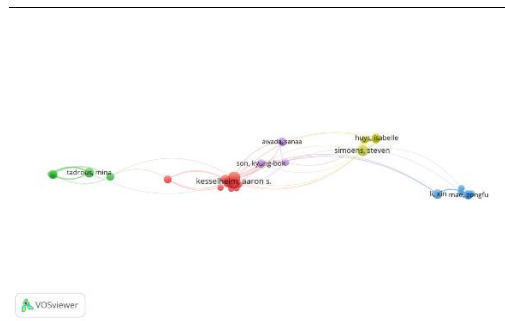


Figure 5.6 : Co-authorship Network Map of Authors in Generic Medicine Research (2000–2025)

Interpretation : The co-authorship visualization map shows that several groups of writers are working together in the field of generic medicine research. Each hue stands for a different study group that was created by authors that worked together.

The map shows that Aaron S. Kesselheim is a central author with many connections. He works closely with researchers like Kyung-Bok Son, Sanaa Awada, and Mina Tadrous. This shows that Kesselheim is very important for bringing together diverse research groups and encouraging collaboration between fields.

Another clear group includes Steven Simoens and Isabelle Huys, who are closely linked to Chinese writers like Li Xin and Mao Zongfu. This suggests that researchers from different

countries are working together on issues relating to generic medication policy and regulation.

The map shows that several authors, like Kesselheim and Simoens, are important research hubs. However, the collaborative network is still rather broken up, with a few tiny groups and few linkages between them. This shows that global research on generic pharmaceuticals is still growing and has many centers.

5.7 Bibliographic Coupling Network

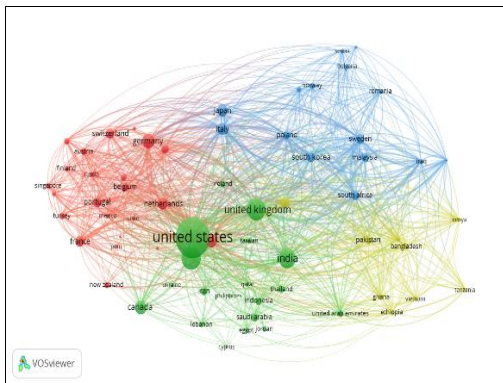


Fig : 5.7 Bibliographic Coupling Network of Research on Generic Medicines (2000–2025)”

The bibliographic coupling network map shows how nations are connected by shared citations in generic pharmaceutical research from 2000 to 2025. In this picture, each node stands for a country, and the links between nodes show how similar their reference patterns are. This means that countries that cite comparable sources are more

closely linked. The size of the node shows how many documents have been published, and the color shows how countries with similar research interests are grouped together. The US stands out as the largest and most important node, showing how important and influential it is in the field of generic medication research. It is strongly linked to the UK, India, Canada, Germany, and the Netherlands, which means that these countries have a lot of the same literature that they use as a reference.

- You can also see regional clusters: Germany, France, and Switzerland lead a European group.
- An Asian group that includes India, Pakistan, Bangladesh, and Malaysia.
- A partnership in the Pacific that includes Australia and New Zealand.

This structure shows that research on generic medicines is connected all over the world, but most of the work comes from wealthy countries like the US and UK. Emerging countries like India are also having a bigger impact on the research landscape. The dense network links show that people from different continents are becoming more intellectually aligned and sharing research bases in the field of generic pharmaceuticals.

5.8 Bibliographic Coupling Network of Documents

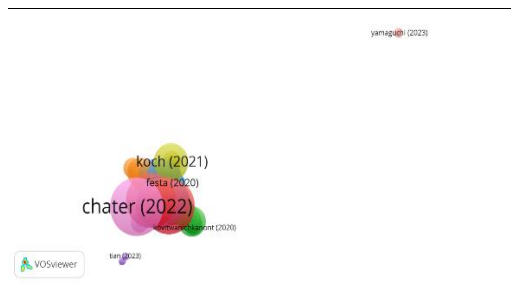


Figure : 5.8 Bibliographic Coupling Network of Documents in Generic Medicine Research (2000–2025)

The bibliographic coupling network of documents shows how different research papers in the field of generic medicine are related to one other by showing how they cite each other. The links show how similar the references are in the released documents, and each node represents one of those documents. The size of each node shows how many times it has been cited, while the color clusters show groups of publications with similar research ideas.

Chater (2022), Koch (2021), Festa (2020), and Kovitvanichkanont (2020) are all closely related, which means that they probably use a lot of the same sources and are part of the same line of research. This line of research could be about how people see generic medicines, market trends, or policy issues.

Conversely, Yamaguchi (2023) seems detached from the primary

cluster, suggesting that this study has a unique citation pattern and centers on a somewhat separate research theme or regional setting. Likewise, Tian (2023) exhibits restricted coupling strength, indicating nascent yet less-cohesive contributions within this field.

The bibliographic coupling study shows that generic medicine research is still somewhat fragmented, with a few core publications serving as the conceptual underpinning. This is because several recent studies have not yet established substantial citation ties with previous literature.

5.9 Co-citation Network of Journals

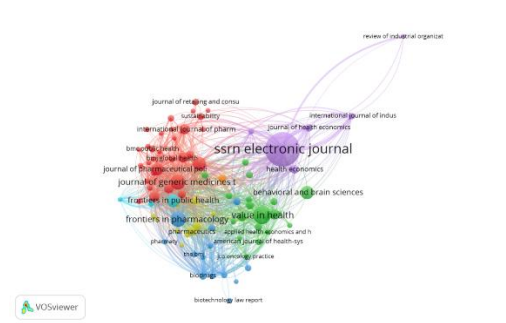


Figure 5.9 : Co-citation Network of Journals in Generic Medicine Research (2000–2025)

The co-citation network of journals shows the intellectual structure of research on generic medications by showing how often publications are mentioned together in academic writing. There is a journal at each node, and the lines between them show how often journals cite each other. The size of each node shows how many times it has been cited, and the colors show

different groups of journals that have similar themes or areas of study.

The image shows that SSRN Electronic Journal is the most important and core node. This means that it is the most often cited source and a major place to share research on health economics and pharmaceutical markets. Value in Health, Frontiers in Pharmacology, Frontiers in Public Health, and the Journal of Generic Medicines are other important journals. They are all part of interrelated groups that show how generic medicine research is multidisciplinary.

You can see separate groups:

- The red cluster is made up of journals that focus on public health, pharmaceutical policy, and regulation. Examples are the Journal of Generic Medicines, BMJ Global Health, and the International Journal of Pharmacy.
- Value in Health and Health Economics are two examples of what the green cluster is about. It is about health economics and healthcare policy.
- The blue cluster has journals that focus on clinical and pharmaceutical research, like The BMJ, Frontiers in Pharmacology, and Pharmaceutics.
- The Review of Industrial Organization and the Journal of Health Economics are the two main

journals in the purple cluster. They focus on industrial organization and economic behavior.

Overall, the co-citation network shows that research on generic medicines uses information from many fields, such as pharmacology, health economics, and public health policy. The SSRN Electronic Journal provides a vital intellectual bridge across these fields.

5.10 Co-authorship network

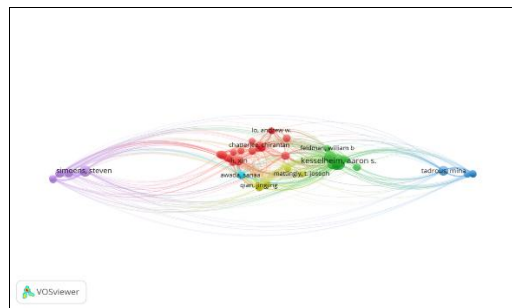


Figure 5.10 : Co-citation Network of Journals in Generic Medicine Research (2000–2025)

The co-authorship network made with VOSviewer shows how researchers work together. Each node stands for a different author, and the size of the node shows how much they have published or how strong their collaborations are. Edges show works that were written by more than one person, while color-coded clusters show research groups that are quite close to each other.

Important people include Kesselheim, Aaron S., Li, Xin, Chatterjee, Chirantan, and Feldman, William B. reveal strong connections to each other, which suggests that there is a lot of collaboration and leadership in the industry. Peripheral writers such as Simoens, Steven, and Tadrous, Mina exhibit fewer connections, suggesting restricted or niche collaboration.

This picture shows important contributors, how academic collaborations are set up, and possible topics for future interdisciplinary work.

5.11 Bibliographic Coupling Network of Organizations

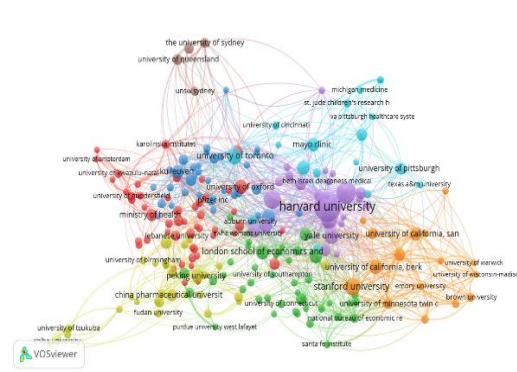


Figure 5.11 : Bibliographic Coupling Network of Organizations in Global Research on Generic Medicines (2000–2025)

Using VOSviewer, the bibliographic coupling network shows how close research institutions are to each other based on how often they cite each other's work. Each node stands for a group, and the size of the node shows how much or how important its scholarly work is. The edges between

nodes show how closely related the institutions are in terms of bibliographic coupling, which means how often they cite the same sources. This shows topic alignment and research affinity.

Harvard University, the University of Oxford, and the University of Toronto are all well-known institutions that are in the center of the field. This shows that they are very involved with extensively cited literature and that they are thematically similar to other top institutions. Clustered groupings show patterns of collaboration between regions or fields of study. The color-coded clusters show institutions that cite related works.

This picture shows how academic institutions in the field of generic drugs are related, points out key contributors, and shows where topic expertise and collaboration could happen

5.12 Co-citation Analysis

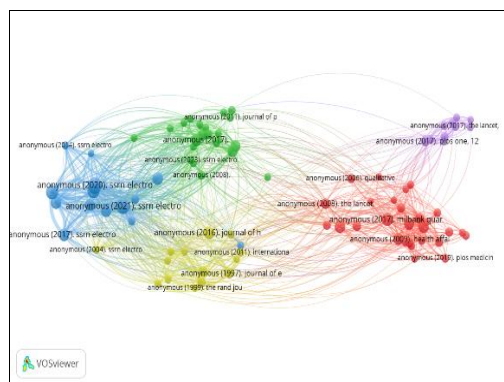


Figure 5.12 : Co-citation Network of Cited References in Global Research on Generic Medicines (2000–2025)

Interpretation : This co-citation network, which VOSviewer shows, shows the intellectual basis for global research on generic pharmaceuticals from 2000 to 2025. Each node stands for a referenced reference, and the lines connecting nodes show how often these references are cited together in the literature. The size of a node shows how often it is cited, and the color-coded clusters show how citations are grouped thematically based on shared patterns.

The network shows clear clusters, which suggests that there are important study issues. For instance, clusters could stand for areas like health economics, pharmaceutical policy, consumer behavior, and clinical outcomes. References that are often referenced together in each cluster are important works that have shaped the conversation in their fields.

This graph lets you find important articles, see how scholarly opinion has changed over time, and see how different research streams come together in the study of generic drugs.

5.13 Co-citation Network of Cited Sources

Interpretation : The co-citation network, made with VOSviewer, shows the intellectual structure of global research on generic pharmaceuticals from 2000 to 2025. The linkages show how often various sources are cited together in the literature, and each node stands for a cited source (usually a

journal). The size of a node shows how often it is cited, and the color-coded clusters show how citations are grouped by theme.

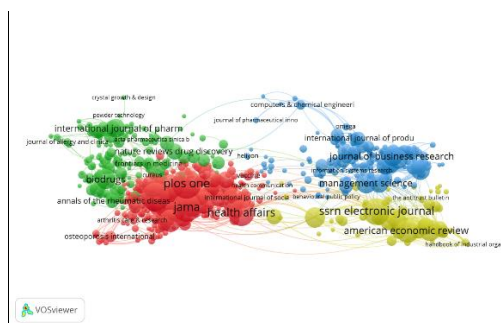


Figure 5.13 : Co-citation Network of Cited Sources in Global Research on Generic Medicines (2000–2025)

PLOS ONE, JAMA, and Health Affairs are some of the publications in the red cluster. This shows that they are very interested in health policy and clinical research. The green cluster, which includes the International Journal of Pharm, Nature Reviews Drug Discovery, and BioDrugs, shows research in the fields of medicine and pharmaceuticals. The blue cluster, which includes periodicals like the Journal of Business Research and Management Science, shows that business and management fields have made contributions. The yellow cluster, which includes the SSRN Electronic Journal and the American Economic Review, shows how economics and public policy might be seen.

This picture shows that research on generic medications is multi-

disciplinary, drawing on knowledge from health sciences, pharmaceutical innovation, corporate strategy, and economic policy. It also points out important sources that shape scholarly discourse and shows how different research areas are connected.

5.14 Co-authorship Network of Researchers

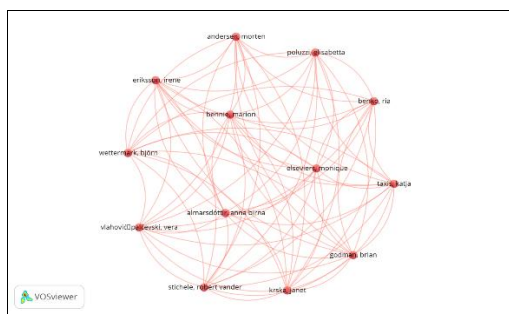


Figure 5.14 : Co-authorship Network of Researchers in Global Generic Medicines Research (2000–2025)

Interpretation : The co-authorship network made with VOSviewer shows how academics worked together on global studies of generic medications from 2000 to 2025. Each node stands for a single author, while the lines that connect them show publications that were co-authored. The size of a node shows how often or how much contributions have an effect, while the closeness and thickness of lines show how strong the collaboration is.

Notable authors like Godman, Brian, Poluzzi, Elisabetta, Taxis, Katja, and Elseviers, Monique seem to be at the center of things, which suggests that

they play an important role in creating research alliances and doing important work. Peripheral writers such as Benko, Ria, and Eriksson, Irene exhibit diminished linkages, suggesting more constrained or specialized collaboration.

The network shows several clusters, which are groups that work closely together and may be grouped by where they are located, what institution they are affiliated with, or what topic they are interested in. This structure shows how people in the area work together and names the main people who are pushing research on generic drugs.

5.15 Keyword Co-occurrence and Thematic Structure of Generic Medicine Research (RQ6)

RQ6 aims to identify the most commonly discussed topics, issues, and associated concepts in the literature related to market expansion and consumer perception of generic medicines. The keyword co-occurrence and thematic clustering analysis conducted using VOSviewer provides direct evidence to address this research question.

The analysis reveals that the most dominant research themes revolve around **affordability and cost containment, consumer perception and acceptance, trust in quality and therapeutic equivalence, regulatory and policy frameworks, and market**

competition and pricing strategies.

Frequently occurring keywords such as *generic medicines*, *market growth*, *affordability*, *consumer perception*, *trust*, *policy intervention*, and *accessibility* indicate that economic and behavioral dimensions are central to scholarly discussions on generic medicine markets.

The clustering structure further demonstrates a strong conceptual linkage between consumer perception and market expansion. Studies emphasizing positive consumer attitudes, confidence in quality, and price sensitivity are closely associated with higher adoption and penetration of generic medicines. In contrast, recurring concerns related to safety, efficacy, and quality perception emerge as key barriers that may restrict market growth, particularly in developing and emerging economies.

Overall, the findings confirm that contemporary research increasingly integrates consumer-centric perspectives with market-oriented and policy-focused discussions. This thematic convergence highlights the crucial role of consumer perception in shaping the growth trajectory of generic medicine markets and explicitly justifies the inclusion of RQ6 in the present bibliometric analysis.

6. Discussion and Conclusion

This bibliometric analysis identified a significant and increasing

body of research on generic drugs during the past twenty-five years (2000–2025). The study's research questions indicate that the journal *Frontiers in Pharmacology* has published the most publications on generic medications, followed by *PLOS ONE* and *Health Affairs*. The data shows that the most research has been done in the last four years, especially in 2024. This shows that more and more scholars are interested in making generic pharmaceuticals more affordable, available, and widely used.

The work "Artificial Intelligence in Drug Discovery and Development" by Paul et al. (2020) is the most cited. It shows how digital technology and drug discovery are coming together. Aaron S. Kesselheim and Steven Simoons are two of the most prolific authors, and they have become important contributors. Researchers from many nations are connected by large collaborative networks. The co-authorship analysis showed that prominent research clusters have emerged around leading authors and institutions including Harvard University, Brigham and Women's Hospital, and the University of California. Collaboration networks are still growing.

A country-by-country look at the data shows that the US, China, and India are the most active countries in doing research on generic drugs around the world. Harvard University has

published the most papers of any university, which shows that it is the leader in research on healthcare market policy and pharmaceuticals. The keyword co-occurrence network also showed that the most common phrases were "generic drugs," "affordability," "market growth," and "consumer perception." This suggests that current study issues are about market access, cost-effectiveness, and patient trust in generic medicines.

This study has some limitations that could be used as ideas for further research. First, it only looks at research that was published between 2000 and 2025. Future studies could look at research that was published more recently. Second, this analysis only uses the Dimensions.ai database. Future studies may use other datasets like Scopus or Web of Science to compare. Third, only documents in English were looked at, which could mean that useful contributions in other languages were missed. Finally, the study only looked at peer-reviewed journal articles and didn't look at theses, reports, or conference proceedings that would have added information.

Even with these limitations, this study adds to the increasing body of research on generic medication by methodically mapping worldwide patterns, key contributors, and new themes. The results provide a basis for policymakers, researchers, and pharmaceutical companies to gain a

deeper understanding of how research on generic medicines has changed over time. They also encourage more research that will make medicines more accessible, affordable, and innovative around the world.

Emerging Research Trends and Policy Implications (RQ8)

RQ8 seeks to identify emerging research trends and clusters of related themes that may guide future academic inquiry and policy-making in the area of generic medicines. The temporal and thematic patterns observed in this bibliometric analysis provide meaningful insights into evolving research directions.

Recent publications, particularly from 2020 onwards, indicate a growing emphasis on **healthcare affordability, price regulation mechanisms, government procurement policies, biosimilar, and equitable access to medicines**. The increasing prominence of health economics and policy-oriented journals suggests a shift in research focus from purely clinical considerations toward systemic, regulatory, and governance-related aspects of generic medicine markets.

Furthermore, the rising research contributions from emerging economies such as India and China highlight an expanding interest in policy-driven generic medicine adoption as a strategy for achieving universal health coverage. These patterns indicate that future

research is likely to concentrate on evaluating the effectiveness of pricing controls, generic substitution policies, public awareness initiatives, and regulatory transparency in influencing consumer perception and sustaining market growth.

From a policy perspective, the findings underscore the importance of strengthening consumer trust through quality assurance, transparent regulation, and educational interventions. Policymakers may leverage these insights to design evidence-based strategies that promote wider acceptance of generic medicines while ensuring affordability and long-term market sustainability. Thus, the identified bibliometric trends provide a valuable foundation for future research and informed pharmaceutical policy development.

Integration of Consumer Perception and Market Growth of Generic Medicines

Although generic medicines are widely recognized for their cost advantages, their market growth is not driven by price factors alone. The findings of this bibliometric analysis indicate that **consumer perception plays a pivotal role in shaping the adoption and expansion of generic medicine markets.** Studies emphasizing trust in quality, perceived therapeutic equivalence, safety, and efficacy are closely aligned with

research on market penetration and growth dynamics.

The thematic patterns reveal that positive consumer perception enhances acceptance and repeat usage of generic medicines, thereby accelerating market expansion. Conversely, negative perceptions—such as doubts regarding quality, effectiveness, or manufacturing standards—act as significant barriers to adoption, particularly in developing and emerging economies. This suggests that market growth is highly sensitive to behavioral and perceptual factors rather than purely economic considerations.

Furthermore, the integration of consumer perception with regulatory and policy-oriented themes highlights the mediating role of governance mechanisms. Policies related to quality assurance, transparent regulatory approval, pharmacist substitution, and consumer awareness campaigns directly influence public trust, which in turn affects market performance. Therefore, sustainable growth of generic medicine markets requires a coordinated approach that simultaneously addresses affordability, regulatory credibility, and consumer confidence.

Scope of Literature and Thematic Coverage

The bibliometric dataset analyzed in this study includes a broad range of pharmaceutical, healthcare, and clinical research articles in addition to core studies on generic medicines. This

wider thematic coverage is primarily attributed to the interdisciplinary nature of generic medicine research and the keyword-based retrieval strategy adopted from the Dimensions database. As a result, studies addressing pharmaceutical policy, healthcare economics, drug regulation, and clinical outcomes were also captured.

While this approach may have reduced the relative concentration of narrowly focused generic drug studies, it provides a comprehensive overview of the broader research ecosystem influencing the market growth and consumer perception of generic medicines. The inclusion of interdisciplinary literature enables a better understanding of systemic factors such as regulatory frameworks, healthcare affordability, and policy interventions that shape generic medicine adoption.

However, it is acknowledged that future bibliometric studies could improve thematic precision by applying more restrictive search strings or domain-specific filters to enhance the representation of core generic medicine research. Such focused analyses would further strengthen insights into consumer perception dynamics and market growth mechanisms, thereby contributing more directly to evidence-based policy formulation.

Interpretation of Bibliometric Patterns and Policy Implications

The bibliometric patterns identified in this study reflect the structural and policy-driven dynamics of the global generic medicine market. The dominance of research contributions from countries such as India, China, and the United States can be attributed to their strong generic manufacturing capacities, large domestic markets, and active regulatory environments. In particular, India's prominence aligns with its role as a global supplier of affordable generic medicines and the implementation of public initiatives aimed at expanding access to low-cost drugs.

The observed concentration of keywords related to affordability, access, regulation, and substitution policies suggests that research attention has increasingly shifted from clinical efficacy to market-oriented and policy-driven concerns. This shift is likely driven by rising healthcare costs, patent expirations of branded drugs, and the growing burden of chronic diseases, which collectively necessitate cost-effective treatment alternatives.

Collaboration patterns among authors and institutions further indicate the growing importance of interdisciplinary and cross-national research efforts in addressing generic medicine adoption. Such collaborations are often influenced by shared policy challenges, regulatory harmonization efforts, and global health priorities

promoted by international organizations.

From a policy perspective, these patterns highlight the need for integrated strategies that address not only price competitiveness but also consumer trust, regulatory transparency, and awareness-building initiatives. Policymakers can utilize these insights to design targeted interventions that promote generic substitution, strengthen quality assurance mechanisms, and enhance public confidence, thereby supporting sustainable market growth of generic medicines.

References

- Adebisi, Y. A., Nwogu, I. B., and Alrasheedy, A. A. (2022). A bibliometric review of access to medications in impoverished nations. *Health Policy and Planning*, 37(4), 520–534. <https://doi.org/10.1093/heapol/czac042>
- Ahmad, M., and Sharma, P. (2021). A review of Indian consumers' attitudes and knowledge about generic medications. *Indian Journal of Pharmaceutical Education and Research*, 55(3), 674–682.
- Ali, S., Verma, R., and Khan, M. (2023). A bibliometric viewpoint on mapping global research on healthcare innovation. *Journal of Health Research Analytics*, 18(2), 110–126.
- Alrasheedy, A. A., Hassali, M. A., Stewart, K., Kong, D. C., and Ibrahim, M. I. M. (2014). A review and update on what patients know, think, and accept about generic drugs. *Patient Preference and Adherence*, 8, 1153–1167. <https://doi.org/10.2147/PPA.S47385>
- Aria, M., and Cuccurullo, C. (2017). *Bibliometrix: An R program for a full examination of science maps*. *Journal of Informetrics*, 11(4), 959–975.
- Asongu, S., and Odhiambo, N. (2019). The enduring nature of healthcare disparity: Policy insights from Africa. *Social Science & Medicine*, 230, 78–86.
- Babar, Z. U. D., and Scahill, S. (2014). A systematic evaluation of barriers to the use of generic medicines in underdeveloped nations. *International Journal of Pharmacy Practice*, 22(1), 1–10.
- Ball, D. E., Tisocki, K., and Al-Saffar, N. (2006). The quality of medicines: Insights from the underdeveloped world. *Health Policy and Planning*, 21(6), 359–370.
- Bate, R., Mathur, A., and Lever, H. (2020). A ten-year study of global changes in the quality of generic pharmaceuticals. *Pharmacoeconomics*, 38(7), 663–678.
- Bennett, D., and Yin, W. (2019). The Indian pharmaceutical market. *Journal of Development Economics*, 139, 272–286.
- Bhatt, A. (2021). Generic drugs and healthcare policy in India: Obstacles and prospects. *Indian Journal of Public Health*, 65(3), 227–233.
- Bloom, D. E., Canning, D., & Mansfield, R. (2021). The economics of getting and paying for drugs. *Health Affairs*, 40(9), 1452–1461.
- Cha, J. & Lee, H. (2022). Evidence from OECD countries on pharmaceutical innovation and the spread of generic drugs. *Health Economics Review*, 12(1), 34–46.
- Chatterjee, C., and Feldman, W. (2018). Lessons from the U.S. and India on how to change the prices of generic drugs. *The Lancet Global Health*, 6(10), e1056–e1058.
- A. West and S. Chaudhuri (2015). Understanding the Indian generic pharmaceutical industry: The impact of policy

and regulation. *Research Policy*, 44(10), 1893–1903.

F. G. De Bakker, P. Groenewegen, and F. Den Hond (2005). A bibliometric examination of three decades of study and thought about corporate social responsibility and corporate social performance. *Business & Society*, 44(3), 283–317.

Dunne, S. S., and Dunne, C. P. (2014). What are people's thoughts on generic drugs? A thorough study and critical evaluation of material regarding stakeholder views of generic medications. *BMC Medicine*, 12(1), 173.

Dutta, R., Singh, A., & Mehta, V. (2019). Generic drugs in new markets: Prospects and challenges. *International Journal of Pharmaceutical and Healthcare Marketing*, 13(1), 25–39.

Dylst, P., & Simoens, S. (2016). Does the structure of the market affect the prices of generic drugs? A viewpoint from Europe. *Pharmacoconomics*, 34(2), 115–123.

Fischer, K. E., Heisser, T., and Stargardt, T. (2019). How reference pricing affects the use of generic drugs in Europe. *Health Policy*, 123(4), 337–345.

Gautam, C. S., and Saha, L. (2008). Fixed dose medication combinations (FDCs): A perspective on their rationality or irrationality. *British Journal of Clinical Pharmacology*, 65(5), 795–796.

B. Godman, M. Haque, and A. Kurdi (2021). Policies that make it easier for people in low- and middle-income nations to use generic drugs. *Expert Review of Pharmacoconomics & Outcomes Research*, 21(1), 1–14.

Gupta, R., & Yadav, P. (2021). A bibliometric study of pharmacovigilance research around the world. *Scientometrics*, 126(1), 433–454.

Institute IQVIA. (2024). Trends in medications around the world: a look ahead to 2028. Reports from IQVIA.

Jakovljevic, M. and Getzen, T. (2020). Health spending and how affordable medications are: Evidence from BRICS countries. *Frontiers in Public Health*, 8, 530–542.

Kaur, J., & Sharma, P. (2020). How people in India see and deal with the problems of using generic drugs. *International Journal of Pharmaceutical Studies*, 8(2), 45–52.

Kesselheim, A. S., and Avorn, J. (2013). The government's role in encouraging the usage of generic drugs. *New England Journal of Medicine*, 369(26), 2472–2475.

Kumar, R., & Singh, V. (2022). A policy review of how people in India think and know about generic drugs. *Indian Journal of Health Marketing*, 9(3), 88–102.

Kumar, S., and Gupta, R. (2022). A global look at the economic effects of using generic medicines. *Health Policy Review*, 17(1), 33–49.

Lopez, R., Silva, C., and Fernandes, M. (2021). Pharmaceutical innovation and global health: A bibliometric summary (1990–2020). *Scientometrics*, 126(4), 3129–3152.

Merigó, J. M., Cancino, C., Coronado, F., and Urbano, D. (2015). A bibliometric examination of academic research in innovation. *Scientometrics*, 102(1), 1–29.

Mishra, T., Bose, R., and Sen, A. (2020). Bibliometric examination of worldwide trends in pharmacological research. *Scientometrics*, 125(3), 987–1004.

Nguyen, T., Wang, C., and Li, Z. (2023). A bibliometric study of healthcare management research around the world from 2000 to 2022. *Health Services Research*, 58(2), 215–234.

- OECD. (2023). Trends in the pharmaceutical market: generic drugs and keeping costs down. OECD Health Policy Paper No. 150.
- Paul, D., Sanap, G., Shenoy, S., and Kalyane, D. (2020). AI in the process of finding and making new drugs. *Drug Discovery Today*, 25(10), 1–15.
- Patel, D., Singh, A., & Mehta, V. (2021). A thorough examination of doctors' and patients' views on generic drugs. *Journal of Health Marketing*, 6(3), 72–83.
- Reddy, N. K., and Thomas, J. (2019). A review of the global expansion of generic medication markets: Challenges and prospects. *International Journal of Health Economics and Policy*, 4(2), 39–49.
- Sharma, R., and Kaur, S. (2020). Comprehending customer awareness and conduct around generic medications. *Journal of Consumer Health Research*, 5(4), 210–222.
- Sharma, R., & Mehta, P. (2022). A bibliometric analysis of international research on pharmaceutical marketing (2000–2021). 148, 145–158 of the *Journal of Business Research*.
- Simoens, S. (2008). Creating long-lasting markets for generic pharmaceuticals throughout Europe. *Journal of Generic Medicines*, 5(1), 1–10.
- Simoens, S. (2019). Pricing and reimbursement of generic drugs in Europe: A bibliometric analysis. *Health Economics Policy and Law*, 14(3), 321–336.
- Tadrous, M., Martins, D., and Gomes, T. (2021). A thorough analysis of the use of generic drugs and cost savings across countries. *BMJ Global Health*, 6(11), e007483.
- Trewhitt, K. G. (2020). Harmonization of regulations and worldwide acceptance of generic drugs. *Journal of Pharmaceutical Policy and Practice*, 13(1), 88–97.
- The World Health Organization (WHO). (2020). Policy recommendations for member states to help people get generic drugs. WHO Press in Geneva.
- Yuan, J., Lu, Z. K., Xiong, X., and Jiang, B. (2020). An examination of the national volume-based procurement (NVBP) effect in China on reducing medicine prices and improving pharmaceutical affordability. *Health Policy*, 124(7), 711–718.
- Zhang, Q., and Sun, W. (2021). A bibliometric analysis of pharmaceutical policy innovations and their impact on generic medication markets. *Frontiers in Pharmacology*, 12, 755–772.

Panel of Peer Reviewers

1. **Dr. Prantik Banerjee** Professor, Dept. of English, Hislop College, Nagpur.
2. **Dr. Amol Padwad** Retd. Professor, Dr Ambedkar University, New Delhi.
3. **Dr. Kartik Pannikar** Professor & Head, Dept. of English, J.M.Patel College, Bhandara.
4. **Dr. Nikhila H.S.** Professor & Head, Dept. of Film Studies, EFLU, Hyderabad.
5. **Dr. Priyaraj Maheshkar** Professor & Head, Dept. of History, Priyadarshini Mahila Mahavidyalaya, Wardha.
6. **Dr. Purabhi Bhattacharya** Professor & Head, Dept. of History, S.F.S College, Nagpur.
7. **Dr. Sucheta Marathe** Professor & Head, Dept. of English, Smt. Binzani Mahila Mahavidyalaya, Nagpur
8. **Dr. Pranjali Kane** Associate Professor, Dept. of English, Shri. Binzani College, Nagpur.
9. **Dr. Renuka Roy** Professor, Dept. of English, Porwal College, Nagpur.
10. **Dr. Shubhashree Mukherji** Professor, Dept. of English, Kamla Nehru College, Nagpur
11. **Dr. Manish Chakravarti** Vice-Principal, Porwal College, Nagpur.
12. **Dr. Shailendra** Associate Professor & Head, Dept. of Linguistic, RTMNU, Nagpur.
13. **Dr. Madhavi Moharil** Associate Professor, Dept. of English, Rajkumar Kewalramani Mahavidyalaya, Nagpur.
14. **Dr. Sachin Dwivedi** Assistant Professor, School of Shastrik Learning. KKSU, Ramtek.
15. **Dr. Raghavendra Bhatt** Assistant Professor, School of Shastrik Learning. KKSU, Ramtek.
16. **Dr. B. Swain** Professor & Head, P.G.T.D., Sociology, RTMNU, Campus.
17. **Dr. Vijay Kumar** Associate Professor & Head, Dept. of Sociology, Hislop, Nagpur.
18. **Dr. Hariom Puniyani** Professor & Head, Department of Commerce, Hislop College, Nagpur.
19. **Dr. Rashi Arora** Associate Professor, G.S.College of Commerce & Economics, Nagpur.
20. **Dr.Alok Rai** Professor & Head, Department of Microbiology, Porwal college, Kamptee.
21. **Dr. Arti Shanware.** Professor & Head, Department of Biotechnology RGBC, LITU Nagpur.
22. **Dr.Sujata Mankar** Associate Professor & Head, Department of Microbiology, D.R.B Sindhu Mahavidyalaya Nagpur.
23. **Dr. Seema Nimbarte** Associate Professor, Department of Microbiology, Sevadal Mahila Mahavidyalaya Nagpur.
24. **Dr. Prashant Gade.** Retd. Professor PGTD of Physics RTMNU, Nagpur
25. **Dr. Abhay Deshmukh.** Professor, PGTD of Physics RTMNU, Nagpur
26. **Dr. Zeenat Kashmiri** Associate Professor, Department of Zoology, D.R.B Sindhu Mahavidyalaya Nagpur.
27. **Dr. Milind Shindkhede** Associate Professor & Head Department of Zoology, D.R.B Sindhu Mahavidyalaya Nagpur.
28. **Dr. Rahul Meshram .** Associate Professor & Head Department of Biochemistry. D.R.B Sindhu Mahavidyalaya Nagpur.
29. **Dr. Ragini Chahande** (Retd) Professor, Head Department of Biochemistry, Porwal College, Kamptee Nagpur.
30. **Dr. Aruna Kawadkar** Associate Professor & Head Department of Zoology, Institute of Science Nagpur

