M.V.MUTHIAH GOVERNMENT ARTS COLLEGE FOR WOMEN

MVM JOURNAL OF RESEARCH

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ABOUT THE JOURNAL

Research emerges through systematic process of enquiry or investigation. It aims to either find out something very new or verify the existing knowledge.

Nowadays, Research has become an important component of higher education institutions. The academic fraternity should dwell into various research activities both to rejuvenate and update them and to bring laurels to the parent institution.

To facilitate this, the institution should provide a genuine platform for both the budding researchers and the experienced academicians to bring out their research outputs in a concrete shape for societal improvement and knowledge.

MVM Journal is such a potential initiative endeavoured by the M V Muthiah Government Arts College for Women, Dindigul.

MVM Journal blossomed in the year 2014 to promote research and tab the potentialities of research excellence of the academics of the campus. The maiden issue of the journal was published in the year 2014 without the ISSN number. The second issue was published in the year 2017with the ISSN Number 2395-2962 both the first and second volumes are print journals. The journal goes digital from third issue, providing an electronic platform, to have larger readership.

Name of the Journal	: **M V M Journal of Research**
Periodicity	: Yearly
Language(s)	: English and Tamil
Year of publication (Print version)	: Since 2014
Year of Publication (Both Print & Online edition)	: Since 2018

Aim
- To provide an opportunity to the academics i.e. Students, Research Scholars and Faculty members of M V Muthiah Govt. Arts College for Women, Dindigul to publish their research findings.
- To increase the visibility and impact of research productivity of MVM academics through print and online version of the journal.
- To share knowledge in the form of high quality research works in varied domains.

Scope
- The journal is a multi-disciplinary print-cum-online journal which aims to publish high quality peer reviewed articles in all branches of knowledge.
- The journal publishes articles in all the subjects within the perimeter of Sciences (Physics, Chemistry, Zoology, Botany, Plant biotechnology, Mathematics, Geography, Computer Science) and Arts, humanities & languages (History, Tamil, English, Economics, Commerce).
- Engineering, Medicine, Pharmacy, nursing and other related subjects are not under the purview of the journal.

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An Annual Publication

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EDITORIAL

Dear Readers,

"Education is the passport to the future, for tomorrow belongs to those who prepare for it today" – Malcolm X

Ever since the dawn of civilization human beings have been inclined towards knowledge and the thirst to seek the truths in everything that is strange and new. It gives us immense pleasure to publish the ninth volume of MVM Journal of Research with grand success. Research is an unending pursuit which always requires refinement. Our Journal offers avenues for the researchers and scholars to present papers with profound persistence. This volume is enriched with research centric papers of high quality and clarity. We extend our sincere thanks to the renowned reviewers and the eminent external advisors for their sincere cooperation in moulding the articles. The editorial board is always thankful to our respected Madam Principal Dr. D. Lakshmi for her endless support and we have to be grateful to the esteemed authors and readers for their continuous effort and support which lead to the spontaneous success of the Journal.

March 2022   **CHIEF EDITOR**

Dindigul

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COVID-19 RESEARCH PRODUCTIVITY OF INDIA AS REFLECTED IN PUBMED DATABASE: A SCIENTOMETRIC ANALYSIS USING BIBLIOSHINY

Dr.K.Ramasamy

College Librarian, M V Muthiah Government Arts College for Women, Dindigul, Tamil Nadu . Email: drkramasamy@mvmwgacdgl.ac.in

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Abstract

Covid-19 has become a deadly disease that shattered the entire world in a very short period of time. People are affected not only physically but also mentally, socially, psychologically and economically. The present study examines the scientometric dimensions of Indian research output on Covid-19 during 2020-2021. The data required for the study was downloaded from PubMed database. The data was analyzed using Biblioshiny – the shiny web interface for bibliometric analysis, which is available as a part of Bibliometrix of R Software. The study reveals that : 1841 records found in the database came from 617 sources covering two a two year period (2020-2021). There is no citation for these papers. 2432 keywords were used in these records. These records were contributed by 6589 authors who appeared 11226 times, in toto. There are 151 authors of single authored documents and 6438 authors of multi-authored documents. There are 222 single authored documents. A majority of the records were journal articles (1203). Kumar S is the most productive author with 54 records followed by Kumar A with 50 records and Gupta N with 47 records. The Indian journal of Medical Research is the topper with 57 publications followed by the journal 'Diabetes and Metabolic syndrome' with 56 publications. All India Institute of Medical Sciences is the topper with 966 (872+94) papers followed by Postgraduate Institute of Medical Education and Research with 281 (201+80) papers. India is the most productive country with 9261 records followed by USA with 361 records and China with 138 records. . The most frequently used keywords include humans (903), Sars-Cov-2 (572), India/Epidemiology (568) and Covid-19 (510).

Keywords : *Covid-19, Coronovirus, PubMed, Scientometrics, Bibloshiny, India*

1 Introduction

Coronavirus disease (COVID-19) is an infectious disease caused by the SARS-CoV-2 virus. Most people infected with the virus will experience mild to moderate respiratory illness and recover without requiring special treatment. However, some will become seriously ill and require medical attention. Older people and those with underlying medical conditions like cardiovascular disease, diabetes, chronic respiratory disease, or cancer are more likely to develop serious illness. Anyone can get sick with COVID-19 and become seriously ill or die at any age.

The best way to prevent and slow down transmission is to be well informed about the disease and how the virus spreads. Protect yourself and others from infection by staying at least 1 metre apart from others, wearing a properly fitted mask, and washing your hands or using an alcohol-based rub frequently. Get vaccinated when it's your turn and follow local guidance.

The virus can spread from an infected person's mouth or nose in small liquid particles when they cough, sneeze, speak, sing or breathe. These particles range from larger respiratory droplets to smaller aerosols. It is important to practice respiratory etiquette, for example by coughing into a flexed elbow, and to stay home and self-isolate until you recover if you feel unwell ("Coronavirus", 2021).

Ii Review of Literature

Malik, Butt, Bashir and Gilani (2020) carried out a scientometric evaluation of coronaviruses related literature including COVID-19. Data related to Coronavirus research was extracted from the Web of Science (WoS). All types of publications (28,846) were included and retrieved. To measure the quantity and quality of the publications, "R-Bibliometrix" package was used for detailed analysis exploring a wide range of indicators. Generally, an increasing trend was observed over time led by the USA and China followed by the United Kingdom, Europe, and few other developed countries. The last two decades contributed around 39.5% of documents while only 06 months of 2020additionally contributed around 46.5% of total documents. Earlier shorter spikes of increased post epidemic publications followed by decreased productivity were detected in the last 2

decades and showed a lack of continuity-'a research epidemic following a disease epidemic'. Articles (53.4%) were the most common publication type. Journal of Virology, British Medical Journal (BMJ), and Virology were leading sources while BMJ, and Lancet showed increased contributions recently. Overall, similar trends of top authors were observed in terms of productivity, impact, collaborations, funding sources, and affiliations with few exceptions mainly from affected regions. Top 20 countries contributed >89% of documents suggesting a lack of global efforts. Networking was found to be mainly among developed nations with limited contributions from resource-limited countries perhaps requiring more cooperation.

Johnson, Sakya, Sakya, Onkendi and Hallan (2020) conducted a study to identify the 100 most cited publications focusing on COVID-19 to provide readers with useful historical information on current relevant research. A search of all databases and journals accessible in Elsevier's Scopus was performed on May 13th, 2020. The document search was performed using query "COVID-19," yielding 6,693 results. A similar search was performed using Thomson Reuter's Web of Science, yielding 2,593 documents and fewer citations. The top 100 most cited papers were identified, and data were extracted. All references contained within the top 100 articles were collected. Statistical analysis was performed using R-Studio and Bibliometrix. The top 100 most cited articles were published in 50 different journals from over 25 countries. The most cited article is "Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China" by Huang et al., published in The Lancet with 1184 citations. Included are a list of the top 100 most cited articles, the most cited authors, the top five journals these publications most frequently appeared in, the most contributing countries, the top institutional affiliations, and the top international collaborations of the top 100 most cited publications on COVID-19.

Ahmadian, Mokhtari, Ghafari and Saberi (2021) identified and visualized the scientometric indicators of top ten highly productive journals publishing documents on topics related to COVID-19. On April 4, 2021, using 36 COVID-19 keywords derived from MeSH, retrieved all relevant global publications indexed in Scopus. Then, all studies were limited to top 10 highly productive journals in this field. The top ranked journals in publication numbers belonged to the International Journal of Environmental Research and Public Health (N=1304, 16.2%), Plos One (N=1158, 14.4%) and BMJ (997, 12.4%),

respectively. The Lancet (N=69983), JAMA (N=42553) and the Journal of Medical Virology (19089) ranked first to third as to received citation numbers, respectively. Mahase, E (N=180, 2.23%), Lacobucci, G (N=126, 1.56%) and Rimmer, A (N=82, 1.01%) were ranked first to third as highly-productive authors, respectively. However, the highest-ranked authors in their citations/document indicator were Cheng, Z (3691), Gu, X (2736.25) and Xia, J (2269.66), respectively. First to third ranked countries in receiving citations were China (94776), United States (51621) and United Kingdom (32339), respectively. Out of top 10 contributing countries in producing documents, United States (1976; 24.5%), United Kingdom (1372; 17%) and China (894; 11.1%) ranked first to third, respectively. Keywords co-occurrence and clustering showed that clinical manifestation and dissemination of the disease as well as its epidemiology have been heavily considered.

Senthamilselvi, Surulinathi, Karthik and Jeyasuriya (2020) highlighted the publication status and growth of Hantavirus/Coronavirus research in India and make quantitative and qualitative assessment by way of analysing various features of research output based on Scopus online database during the period 1975-2020. A total of 3498 publications were published and overall H-Index is 50. The publications peaked in the year 2020 with 3218 publications and most frequently cited one is "Rodriguez-Morales, A.J., Cardona-Ospina, J.A., Gutiérrez-Ocampo, E., Ahmad, T., Sah, R.. (2020) Clinical, laboratory and imaging features of COVID-19: A systematic review and meta-analysis, Travel Medicine and Infectious Disease 34,101623 with 293 citations. The USA topped the list with highest share (374) of publications. United Kingdom with 212 share of publications followed by China with 154 share of publications, Thailand with 119 share of publications, Australia and Italy with 101 share of publications respectively in the context of international collaboration. All India Institute of Medical Sciences, New Delhi topped the list with 246 publications, followed by Postgraduate Institute of Medical Education & Research, Chandigarh with 178 publications, Dr. D.Y. Patil Vidyapeeth Deemed University, Pune with 108 publications. 160 Institutes are with minimum of 10 Publications 12 Institutes. The highly productive journals are: Diabetes And Metabolic Syndrome Clinical Research and Reviews(Elsevier) with 100 publications (CiteScore-2.6, SJR-0.672 and SNIP-0.982), Asian Journal Of Psychiatry(Elsevier) with 92(CiteScore-2.7, SJR-0.736 and SNIP-1.022); Indian Journal Of Ophthalmology(Wolters Kluwer

Health)(CieScore-1.6, SJR-0.482 and SNIP-0.931) and Journal Of Biomolecular Structure And Dynamics with 80 publications respectively.

Laksham, Surulinathi, Balasubramani and Jayasuriya (2020) examined the publications on Coronavirus from India as indexed in web of science online database. The search term "Coronavirus" or "COVID 19" with topic field has been used as keyword and limited to India. A total of 281 unique records over the year 1975–2020 have been downloaded and analyzed under various categories considered for this study. The highest numbers of articles are published in the year 2016, 2017, 2018 and 2019. Year 2015 has highest number of Citations with 531 for 17 (6.2 %) publications. The study found that 1369 authors concentrated the research in this field and 281 papers published in indexed journals. International Centre for Genet Engineering & Biotechnology stood in the first with the highest number of publications with 20 (7.3 %) and received 549 Citations followed by All India Institute of Medical Science with 12 (4.4 %) Publications and received 67 Citations, Guru Ghasidas Vishwavidyalaya with 10 (3.7%) Publications and received 482 Citations, Indian Institute of Technology with 10 (3.7 %) Publications and received 86 Citations, University of Delhi with 8(2.9 %) Publications and received 128 Citations, Indian Institute of Science with 6 (2.2%) and received 61Citations. India has collaborated with 38 countries. CSIR, DBT India, UGC, USDHHS, DST India and ICMR are most funded agencies in the field of Coronavirus.

III Objectives

The objectives of the present study are:

- To trace out the document types of Indian Covid-19 research output
- To find out the most productive authors
- To know the most relevant sources
- To explore the source dynamics
- To know the most relevant affiliating institutions
- To find out the most productive countries
- To explore the most relevant countries by corresponding authors
- To find out the most frequently used keywords

IV Research Methodology

The research output of India on covid-19 as available in PubMed database as on 17/10/2021 at 1:45 pm. The keyword ' Covid-19' was used to retrieve the records, on the condition that the words ' Covid-19 India' should occur in the title of the research papers to be retrieved. A total of 1841 records were downloaded as a PubMed file. The file was exported to and used in R Bibliometrix tool namely Biblioshiny for examining the scientometric dimensions of Indian research output on ' covid-19'.
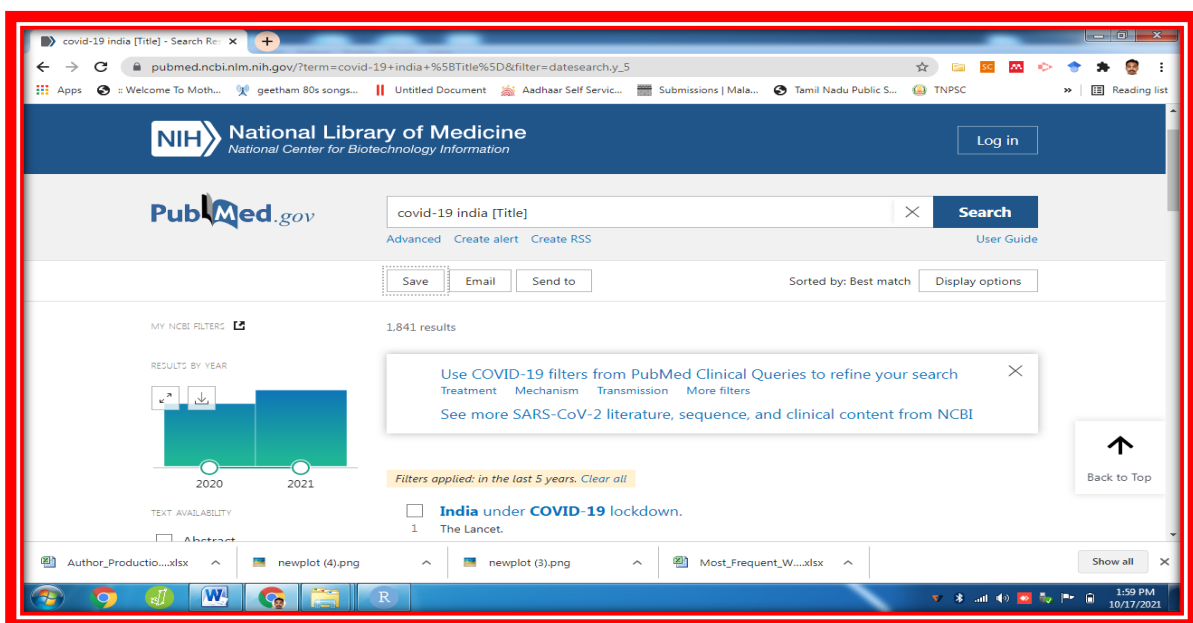
Figure 1 : Search Results

V Data Analsyis and Interpretation

Table 1 : Main Information

Description	Results
Timespan	2020:2021
Sources (Journals, Books, etc)	617
Documents	1841
Average years from publication	0.413
Average citations per documents	0
Average citations per year per doc	0

References	1
DOCUMENT CONTENTS	
Keywords Plus (ID)	2432
Author's Keywords (DE)	2432
AUTHORS	
Authors	6589
Author Appearances	11226
Authors of single-authored documents	151
Authors of multi-authored documents	6438
AUTHORS COLLABORATION	
Single-authored documents	222
Documents per Author	0.279
Authors per Document	3.58
Co-Authors per Documents	6.1
Collaboration Index	3.98

Table 1 gives main information about Indian research output on Covid-19 as available in PubMed database. 1841 records found in the database came from 617 sources covering two a two year period (2020-2021). There is no citation for these papers. 2432 keywords were used in these records. These records were contributed by 6589 authors who appeared 11226 times, in toto. There are 151 authors of single authored documents and 6438 authors of multi-authored documents. There are 222 single authored documents. There are 0.279 documents per author and there are 3.58 authors per document while there are 6.1 co-authors per document. The collaboration index is found to be at 3.98.

Table 2 : Document Types

Document Type	Count
Journal Article	1203
Letter	162
Journal Article;Review	93
Journal Article;Research Support, Non-Us Gov't	68

Editorial	62
Comment;Letter	55
Journal Article;Observational Study	34
Journal Article;Multicenter Study	18
News	16
Comment;Journal Article	14
Published Erratum	9
Case Reports	8
Case Reports;Journal Article	7
Case Reports;Letter	7
Letter;Research Support, Non-Us Gov't	7
Comparative Study;Journal Article	6
Journal Article;Practice Guideline	6
Preprint	6
Journal Article;Multicenter Study;Observational Study	4
Journal Article;Video-Audio Media	4
Journal Article;Published Erratum	3
Journal Article;Randomized Controlled Trial	3
Journal Article;Research Support, Nih, Extramural	3
Journal Article;Systematic Review	3
Case Reports;Journal Article;Review	2
Clinical Trial;Journal Article	2
Journal Article;Multicenter Study;Research Support, Non-Us Gov't	2
Journal Article;Randomized Controlled Trial;Research Support, Non-Us Gov't	2
Journal Article;Research Support, Nih, Extramural;Research Support, Non-Us Gov't	2
Journal Article;Research Support, Non-Us Gov't;Review	2
Letter;Observational Study	2
Letter;Review	2
Biography;Historical Article;News;Portrait	1
Clinical Trial Protocol;Journal Article	1

Clinical Trial, Phase Ii;Journal Article;Multicenter Study;Randomized Controlled Trial	1
Clinical Trial, Phase Iii;Journal Article;Randomized Controlled Trial;Research Support, Non-Us Gov't	1
Comment;Editorial	1
Comment;News	1
Comparative Study;Evaluation Study;Journal Article	1
Comparative Study;Journal Article;Multicenter Study	1
Comparative Study;Journal Article;Multicenter Study;Observational Study	1
Comparative Study;Journal Article;Observational Study	1
Comparative Study;Journal Article;Research Support, Non-Us Gov't	1
Comparative Study;Journal Article;Validation Study	1
Comparative Study;Letter;Multicenter Study	1
Editorial;Interview	1
Editorial;Research Support, Non-Us Gov't	1
Evaluation Study;Journal Article	1
Journal Article;Meta-Analysis	1
Journal Article;Meta-Analysis;Research Support, Non-Us Gov't	1
Journal Article;Observational Study;Research Support, Nih, Extramural;Research Support, Non-Us Gov't	1
Journal Article;Observational Study;Research Support, Non-Us Gov't	1
Journal Article;Research Support, Nih, Extramural;Research Support, Non-Us Gov't;Research Support, Us Gov't, Non-Phs	1
Journal Article;Research Support, Nih, Extramural;Research Support, Us Gov't, Phs;Review	1
Journal Article;Research Support, Nih, Intramural	1
Journal Article;Research Support, Non-Us Gov't;Research Support, Us Gov't, Non-Phs	1

Table 2 shows the document types of Indian research output on Covid-19 during 2020-2021. The pubmed database has its own classification of documents published

therein. A majority of the records were journal articles (1203) followed by letters (162), journal article reviews (93), journal article research support, non-UG Govts (68) and editorials (62). Journal articles are classified into many divisions – journal article observational study (34), journal article multicenter study (18), and journal article practice guideline (6) and so on. A good number of comparative studies were also published (7) during the study period.

Table 3: Most Relevant Authors

Authors	Articles	Articles Fractionalized
Kumar S	54	10.94
Kumar A	50	7.51
Gupta N	47	6.54
Sharma S	40	7.92
Singh S	36	5.14
Gupta S	34	5.99
Kumar R	33	8.42
Singh A	33	5.35
Gupta A	32	3.28
Sharma P	27	4.81
Sharma N	26	3.94
Sharma A	24	3.63
Ghosh A	23	4.65
Panda S	23	3.10
Gupta R	22	3.04
Das A	20	3.26
Misra S	19	2.49
Singh Ak	19	3.06
Singh R	19	2.10
Kumar M	17	2.82
Kumar P	17	3.22
Sarkar S	17	3.37

Bhatnagar S	16	1.39
Ghosh S	16	3.04
Kumar N	16	3.65
Sharma R	16	2.74
Singh K	16	1.68

Table 3 shows the most productive authors. Kumar S is the most productive author with 54 records followed by Kumar A with 50 records and Gupta N with 47 records. While Sharma S has published 40 records, Singh S and Gupta S have published 36 and 34 records respectively. Both Kumar R and Singh A have published 33 records each. These 27 authors, who have contributed more than 15 papers each, had published a total of 712 papers out of 1841.

Table 4 : Most Relevant Sources

Sources	Articles
The Indian Journal of Medical Research	57
Diabetes & Metabolic Syndrome	56
Journal of Family Medicine and Primary Care	54
Indian Journal of Ophthalmology	49
Asian Journal of Psychiatry	42
Bmj (Clinical Research Ed.)	32
The Journal of the Association of Physicians of India	22
Indian Journal of Psychological Medicine	20
Plos One	19
The Science of the Total Environment	18
Clinical Epidemiology and Global Health	17
Medical Journal Armed Forces India	17
Asia-Pacific Journal of Public Health	16
Disaster Medicine and Public Health Preparedness	15
Nature	15
Bmj Open	14

Cureus	14
Journal of Medical Virology	14
Lancet (London England)	14
Chaos Solitons and Fractals	13
Environmental Science and Pollution Research International	13
Indian Journal of Public Health	13
Scientific Reports	13
The Primary Care Companion for CNS Disorders	13
Environment Development and Sustainability	12
Frontiers in Public Health	12
Indian Journal of Critical Care Medicine : Peer-Reviewed Official Publication of Indian Society of Critical Care Medicine	12
Journal of Public Affairs	12
Postgraduate Medical Journal	12
The Lancet. Global Health	12
Epidemiology and Infection	11
Indian Journal of Otolaryngology and Head and Neck Surgery : Official Publication of the Association of Otolaryngologists of India	11
Indian Journal of Psychiatry	11

Table 4 and Fig.2 show the most productive journals of Indian research output on Covi-19 during 2020-2021. The Indian journal of Medical Research is the topper with 57 publications followed by the journal ' Diabetes and Metabolic syndrome' with 56 publications and the 'Journal of family medicine and primary care' with 54 publications. These three journals have published more than 50 publications each with a total share of 167 publications. Indian journal of ophthalmology and Asian Journal of Psychiatry have published 49 and 42 papers respectively. All other enlisted sources have published more than 10 papers. These 33 journals have published 675 papers, all together.
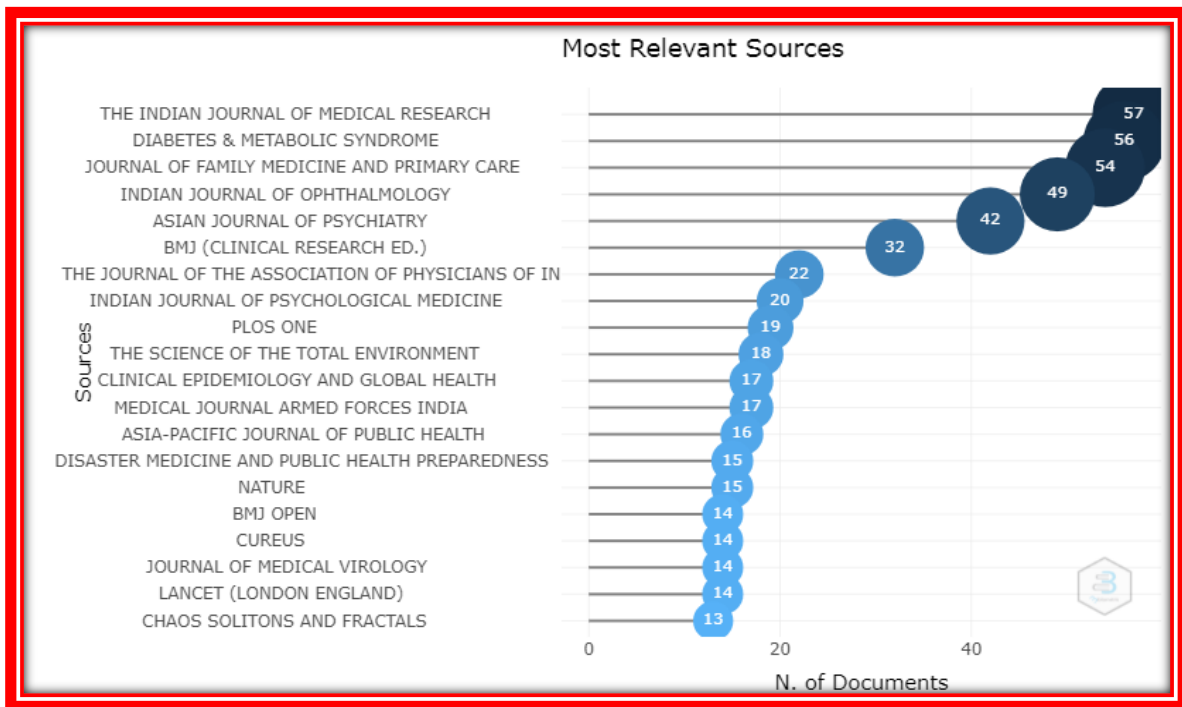
Figure 2 : Most productive Sources : Indian Covid-19 research output

Table 5: Source Dynamics

Year	2020	2021
The Indian Journal of Medical Research	36	21
Diabetes & Metabolic Syndrome	32	24
Journal of Family Medicine and Primary Care	24	30
Indian Journal of Ophthalmology	26	23
Asian Journal of Psychiatry	26	16
Bmj (Clinical Research Ed.)	11	21
The Journal of the Association of Physicians of India	10	12
Indian Journal of Psychological Medicine	16	4
Plos One	9	10
The Science of the Total Environment	15	3

Table 5 gives the year-wise publications of top 10 most productive sources in Indian Covid-19 research output during 2020-2021. The Indian Journal of Medical Research has published 36 papers in 2020 and 21 papers in 2021 followed by the journal

'Diabetes & Metabolic Syndrome' with 32 papers in 2020 and 24 papers in 2021. Journal of Family medicine and primary care published 24 papers in 2020 and 30 papers in 2021, the highest by a journal in 2021. Indian Journal of Ophthalmology had 26 and 23 papers while Asian Journal of Psychiatry had 26 and 16 papers respectively in 2020 and 2021. PLOS one, the popular open access journal has published 9 paper sin 2020 and 10 papers in 2021.

Table 6 : Most Relevant Affiliations

Affiliations	Articles
All India Institute of Medical Sciences	872
Postgraduate Institute of Medical Education and Research	201
ICMR-National Institute of Virology	127
Government Medical College	115
Indian Council of Medical Research	103
All India Institute of Medical Sciences (Aiims)	94
Post Graduate Institute of Medical Education and Research	80
National Institute of Mental Health and Neurosciences	76
King George's Medical University	71
Banaras Hindu University	67
Kasturba Medical College	66
Homi Bhabha National Institute	63
Chandigarh	59
L V Prasad Eye Institute	55
National Centre for Disease Control	54
Christian Medical College	52
Vardhman Mahavir Medical College and Safdarjung Hospital	52
Topiwala National Medical College and Byl Nair Charitable Hospital	51
Postgraduate Institute of Medical Education and Research (PGIMER)	50
Jodhpur	44
Government Medical College Srinagar	42
Armed Forces Medical College	41

CSIR -Institute of Genomics and Integrative Biology	41
Tata Medical Center	40

Table 6 and Fig. 3 show the institutional that have contributed at least 40 papers on covid-19 research output in India. All India Institute of Medical Sciences is the topper with 966 (872+94)   papers followed by Postgraduate Institute of Medical Education and Research with 281 (201+80) papers and ICMR-National Institute of Virology with 127 papers. The other two institutions with more than 100 papers are : Government medical college (115) and Indian Council of Medical Research (103). National Institute of Mental Health and Neurosciences and King George's Medical university have published 76 and 71 papers respectively. Three institutions have 63-67 papers while 7 institutions have 50-59 papers and 5 institutions have 40-44 papers on covid-19 during 2020-2021.
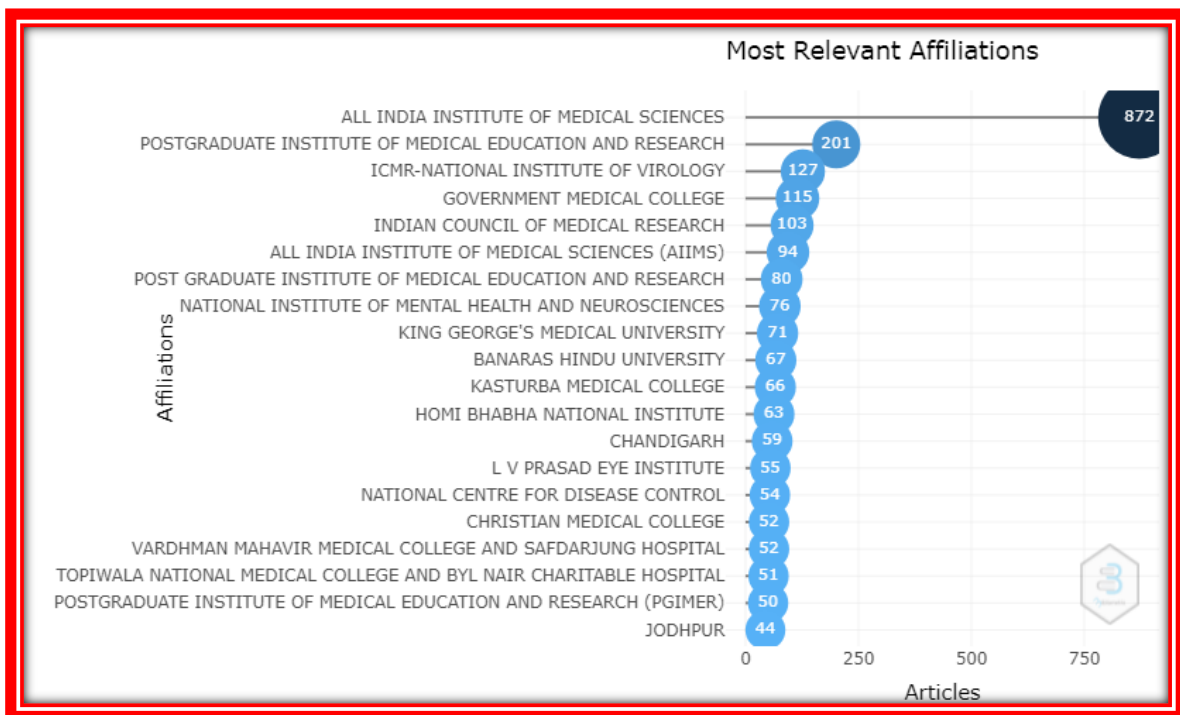
Figure 3: Most Relevant Affiliations

Table 7: Most Relevant Countries

Country	Frequency
India	9261

USA	361
China	138
Canada	51
Bangladesh	49
Australia	44
Saudi Arabia	44
UK	38
Pakistan	33
Singapore	30
Brazil	28
Japan	21
France	17
Italy	17
Germany	14
Norway	14
South Korea	13
Portugal	11
South Africa	11
Switzerland	11
Netherlands	10

Table 7 and Fig. 4 show the most productive countries of Indian Covid-19 research output 2020-2021. India is the most productive country with 9261 records followed by USA with 361 records and China with 138 records. Canada has published 51 records while Bangladesh has published 49 records. Both Australia and Saudi Arabia have 44 publications each. UK, Pakistan and Singapore have 30-38 publications while Brazil and Japan have 28 and 21 publications respectively. Other nine countries have contributed 10-17 papers on Covid-19 research.
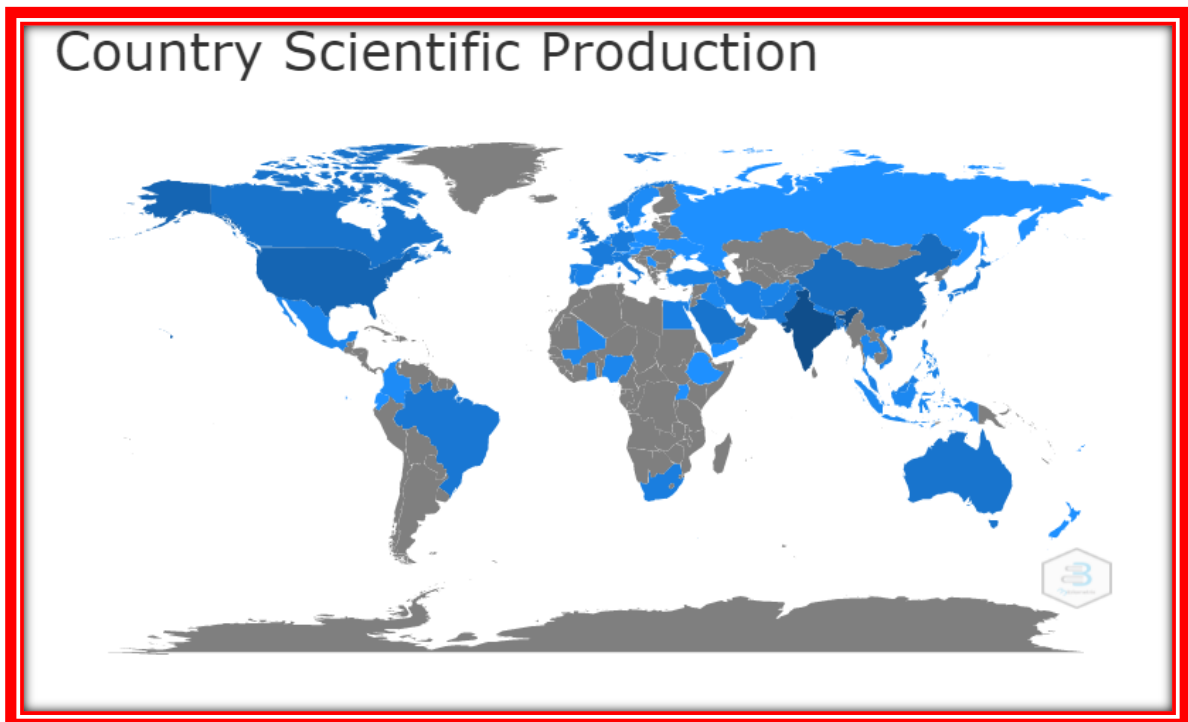
Figure 4 : Country Scientific Production

Table 8 : Most relevant countries by corresponding authors

Country	Articles	Freq	SCP	MCP	MCP_Ratio
India	1330	0.897436	1161	169	0.127
USA	60	0.040486	24	36	0.6
China	21	0.01417	13	8	0.381
Australia	7	0.004723	2	5	0.714
Canada	6	0.004049	2	4	0.667
Saudi Arabia	6	0.004049	2	4	0.667
Bangladesh	5	0.003374	5	0	0
United Kingdom	5	0.003374	4	1	0.2
France	4	0.002699	3	1	0.25
Pakistan	4	0.002699	1	3	0.75
Netherlands	3	0.002024	1	2	0.667
Singapore	3	0.002024	1	2	0.667
Italy	2	0.00135	2	0	0
Japan	2	0.00135	0	2	1

Malaysia	2	0.00135	0	2	1
Philippines	2	0.00135	0	2	1
Qatar	2	0.00135	0	2	1
Switzerland	2	0.00135	2	0	0

Table 8 shows the most productive countries in terms of corresponding authors of research papers. Indian authors served as the corresponding authors in 1330 articles of which 1161 papers are single county collaborative papers and 169 are multi country collaborative papers. Authors of USA were the corresponding authors in 60 papers of which 24 are single country and 36 are multi country collaborative papers. Countries like Bangladesh, Italy and Switzerland had only single country collaborative papers while such countries as Japan, Malaysia, Philippines and Qatar have only multi country collaborative papers. Only 1.2% of Indian contributions were out of multi-country origin while 60% of USA contributions were out of multi-country origin.

Table 9 : Most Relevant Keywords (Keyword Plus)

Words	Occurrences
Humans	903
Sars-Cov-2	572
India/Epidemiology	568
Covid-19	510
Pandemics	399
India	310
Female	293
Male	272
Adult	231
Middle Aged	207
Betacoronavirus	189
Young Adult	110
Aged	100
Cross-Sectional Studies	99

Adolescent	93
Child	85
Pandemics/Prevention & Control	84
Communicable Disease Control	76
Retrospective Studies	65
Surveys And Questionnaires	65
Covid-19/Epidemiology	60
Pneumonia Viral	60

Table 9 and Fig.5 show the most frequently used keywords of Indian Covid-19 research output during 2020-2021. The most frequently used keywords include humans (903), Sars-Cov-2 (572), India/Epidemiology (568) and Covid-19 (510). The second order of frequently used words includes pandemics (399), India (310), Female (293), male (272), adult (231) and middle aged (207). The third order includes three words namely betacoronovirus (189), young adult (110) and aged (100). Other 9 keywords appeared in 60-99 times.
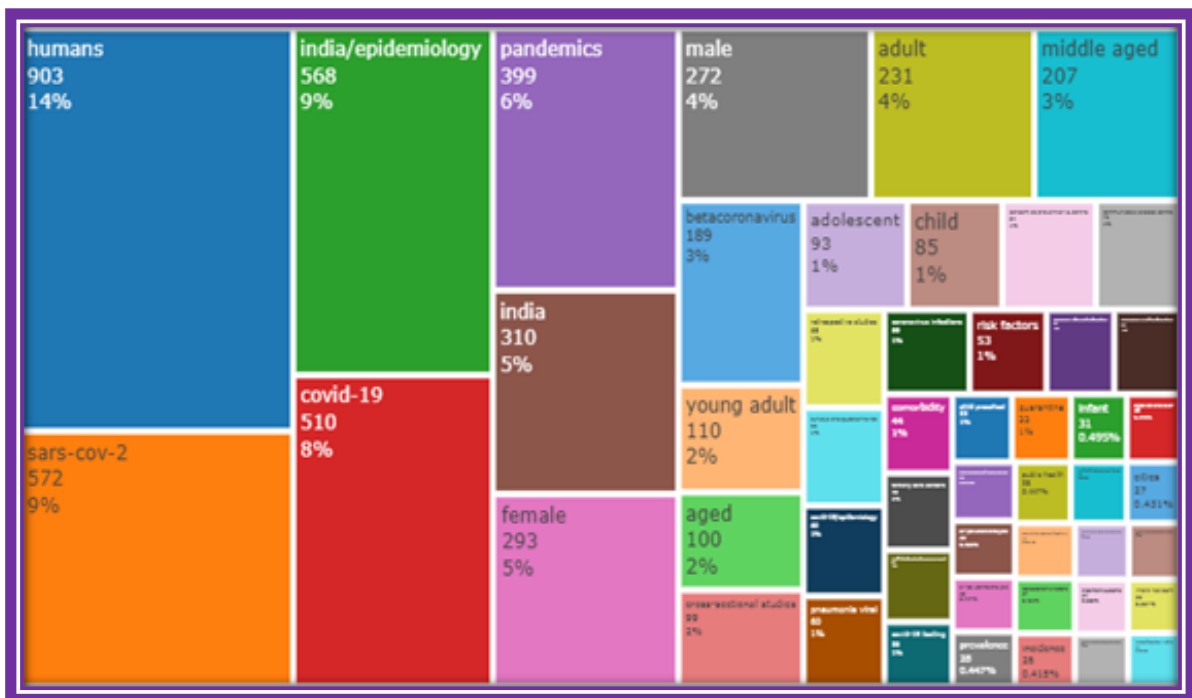

Figure 5 : Word Tree : Covid-10 Research Output of India

VI Conclusion

The Indian research on covid-19 is significant and impactful. More covid-19 related research publications should be made available in the open access platforms. Both the government and non-governmental organizations and research institutions should earmark a good amount of funds for sponsoring research projects on covid-19 and related issues. A holistic approach is required in the research activities. It is the time when the scientists of various disciplines come together and undertake collaborative research works to bring out better findings to ameliorate the present post-covid 19 era.

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SINGLE INVENTORY MODEL UNDER FUZZY ENVIRONMENT WITH DEMAND AND SHORTAGE LEVEL

K. Kalaiarasi[1] , M.Sumathi[2] and S.Daisy[3]*

[1]Department of Mathematics, Cauvery college for women (Autonomous), Affiliated to Bharathidasan University, Trichy-2, Email : kalaishruthi12@gmail.com
[2]Department of Mathematics, Khadhir Mohideen College, Affiliated to Bharathidasan University, Adhirampattinam Email sunsumi2010@gmail.com
[3]Department of Mathematics, M.V.Muthiah Government Arts College for Women, Dindigul Email daisy61285@gmail.com (**Corresponding author**)

Abstract

In this paper, the inventory model was considered to be deficient in fuzzy environments using new pentagonal fuzzy numbers. Our goal is to determine fuzzy production volume and fuzzy minimum total cos by using Pascal triangle greaded mean defuzzification for the proposed inventory model. Shortage level , production cost and total demand quantity are taken based on pentagonal fuzzy numbers.A relevant numerical analysis is also included,to justify the notion**.**

Keywords : *Pentagonal Fuzzy Numbers, Fuzzy Production Quantity, Fuzzy Minimum Total cost , Pascal triangle greaded mean.*

1.Introduction

In 1915, Harris developed the first inventory model [3]. Then in 1965, for the first time comment.Zadeh introduced fuzzy sets [11]. Theory collections have attracted the attention of many researchers. In 1983,Urgeletti Tinarelli [9] proposed inventory control models and issues. In 1987, Park [5] proposed Model of the theoretical explanation of the vague set of economic order quantity inventory problem. In 2002, Hsieh [4] proposed an approach to improving fuzzy production inventory models. In 2012, Dutta and Pawan Kumar [2] delivered a fuzzy inventory Defect-free model using trapezoidal fuzzy number with sensitivity analysis. In 2000, Der-Chen Lynn and Jing-Shing Yao [1] proposed fuzzy economic production for production inventory models.In 2015, Stephen and Rajesh [7] were formed Fuzzy inventory model with allowable deficit using hex agonal fuzzy

numbers. In this article, In Section 2, we briefly describe the concepts and assumptions used in developed fuzzy Inventory model. In Section 3, the proposed inventory model in crisp and fuzzy sense. In section 4, algorithm presented in Crisp and fuzzy Sense. In Section 5, a numerical example is given to justify the proposed ideas. In Section 6, The Conclusions are also included.

2. Mathematical model

2.1 Notations

d =demand per unit item

h=holding cost per unit item

s=shortage level

L=lot size

c=set-up cost per cycle

v=shortage cost per item

2.2 Assumptions

1) Replenishment is instantaneous

2) Lead time is zero

3) Unit price is related to the demand as $p = \gamma e^{-kd} d$ where $\gamma>0, k>0$ are real constants.

3.Proposed inventory model under crisp and fuzzy sense

Let us consider the proposed inventory crisp model total cost is,

$$TIC(L,s) = \gamma e^{-kd} d + \frac{h(L-s)^2}{2L} + \frac{vs^2}{2L} + \frac{cd}{L}$$

For the crisp order quantity

$$L = \sqrt{\frac{2cd + s^2(h+v)}{h}}$$

Here d,h and v are taken as fuzzy environments.

We suppose $d = (d_1, d_2, d_3, d_4, d_5), h = (h_1, h_2, h_3, h_4, h_5), v = (v_1, v_2, v_3, v_4, v_5)$ are non negative pentagonal fuzzy numbers. Our goal is to obtain fuzzy total and order quantity in terms of pentagonal fuzzy numbers.

Then the inventory crisp model total cost becomes,

$$T I \tilde{C}(L) = \gamma e^{-k\tilde{d}} \tilde{d} + \frac{\tilde{h}(L-s)^2}{2L} + \frac{\tilde{v}s^2}{2L} + \frac{c\tilde{d}}{L}$$

By applying arithmetic function and simplifying we get,

$$T I \tilde{C}(L) = \begin{bmatrix} \gamma e^{-kd_1} d_1 - h_1 s + \dfrac{h_1 L}{2} + \dfrac{1}{2L}(2cd_1 + s^2(h_1 + v_1)), \\[2ex] \gamma e^{-kd_2} d_2 - h_2 s + \dfrac{h_2 L}{2} + \dfrac{1}{2L}(2cd_2 + s^2(h_2 + v_2)), \\[2ex] \gamma e^{-kd_3} d_3 - h_3 s + \dfrac{h_3 L}{2} + \dfrac{1}{2L}(2cd_3 + s^2(h_3 + v_3)), \\[2ex] \gamma e^{-kd_4} d_4 - h_4 s + \dfrac{h_4 L}{2} + \dfrac{1}{2L}(2cd_4 + s^2(h_4 + v_4)), \\[2ex] \gamma e^{-kd_5} d_5 - h_5 s + \dfrac{h_5 L}{2} + \dfrac{1}{2L}(2cd_5 + s^2(h_5 + v_5)) \end{bmatrix}$$

$$= F(\tilde{L}).$$

Pascal triangle graded mean defuzzification for pentagonal fuzzy numbers

Let $A = (a_1, a_2, a_3, a_4, a_5)$ be pentagonal fuzzy numbers then we can take the coefficient of fuzzy numbers from pascal's triangles and apply the basic likelihood approach then we get the accompanying formula $P(A) = \dfrac{a_1 + 4a_2 + 6a_3 + 4a_4 + a_5}{16}$. The coefficients of $a_1; a_2; a_3; a_4; a_5$ are 1, 4, 6, 4, 1.

Now ,we defuzzifying the total cost using Pascal triangle greaded mean method, we get

$$TI\tilde{C}(L) = \frac{1}{16}\begin{bmatrix} \gamma e^{-kd_1}d_1 - h_1 s + \dfrac{h_1 L}{2} + \dfrac{1}{2L}(2cd_1 + s^2(h_1 + v_1)) + \\[2mm] \gamma e^{-k4d_2}4d_2 - 4h_2 s + \dfrac{4h_2 L}{2} + \dfrac{1}{2L}(2c4d_2 + s^2(4h_2 + 4v_2)) + \\[2mm] \gamma e^{-k6d_3}6d_3 - 6h_3 s + \dfrac{6h_3 L}{2} + \dfrac{1}{2L}(2c6d_3 + s^2(6h_3 + 6v_3)) + \\[2mm] \gamma e^{-k4d_4}4d_4 - 4h_4 s + \dfrac{4h_4 L}{2} + \dfrac{1}{2L}(2c4d_4 + s^2(4h_4 + 4v_4)) + \\[2mm] \gamma e^{-kd_5}d_5 - h_5 s + \dfrac{h_5 L}{2} + \dfrac{1}{2L}(2cd_5 + s^2(h_5 + v_5)) \end{bmatrix}$$

Differentiating partially w.r.t L and equating it to zero.

$$\frac{\partial TI\tilde{C}(L)}{\partial L} = 0 .$$

Therefore ,

$$\tilde{L}^* = \sqrt{\frac{2c(d_1 + 4d_2 + 6d_3 + 4d_4 + d_5) + s^2\left[(h_1 + 4h_2 + 6h_3 + 4h_4 + h_5) + (v_1 + 4v_2 + 6v_3 + 4v_4 + v_5)\right]}{(h_1 + 4h_2 + 6h_3 + 4h_4 + h_5)}}$$

Also $\tilde{L} = \tilde{L}^*$ we have $\dfrac{\partial^2 TI\tilde{C}(L)}{\partial L^2} > 0$; this show that $TI\tilde{C}(L)$ is minimum at $\tilde{L} = \tilde{L}^*$

4.Algorithm

Algorithm for detecting fuzzy total cost and fuzzy optimal quantity.

Step 1: Calculate the sample fuzzy total cost for fuzzy values of d,h and v.

Step 2: Now New Arithmetic Functions Determine the fuzzy total cost using fuzzy demand, shortage level cost and fuzzy shortage Cost taken in terms of pentagonal fuzzy numbers.

Step 3 : Find the fuzzy optimal order quantity which can be obtain by putting the first derivative of TIC(L) equal to zeroand second derivative is positive at $\tilde{L} = \tilde{L}^*$

5. Numerical example

5.1 Crisp model

Let $\gamma =2$,k =0.1 , d=500 /unit ,s=3 ,c=80 ,v=10 /unit , h=0.7/unit.

The solution of crisp model is

L=338.2651 , TIC(L)=234.6855.

5.2 Fuzzy model

Let d=(300,400,500,600,700) ,h=(0.5,0.6,0.7,0.8,0.9) ,v=(8,9,10,11,12)

The solution of fuzzy mode can be determined by Pascal triangle greaded mean method.

L=338.2651 , TIC(L)=234.6855.

5.3 Sensitivity Analysis

A sensitivity analysis is performed to study the effects of change in parameters d and v.

Table 1. d vs total cost and v vs total cost

d	TIC(L)	v	TIC(L)
600	257.2596	11	234.6989
700	278.0203	12	234.7122
800	297.3452	13	234.7255
900	315.4963	14	234.7388
1000	332.6647	15	234.7521

From the above observation we concluded as follows:

* Total cost increases as the demand rate increases.

* Total cost increases as the shortage cost increases.

* Total cost obtained by Pascal triangle greaded mean metho is equal to the crisp total cost.

6.Conclusion

In this paper, we read about fuzzy economic production in the commodity model with the help of pentagonal fuzzy numbers. Various fuzzy optimal sizes, demand, shortage cost and shortage level cost pentagonal fuzzy numbers are estimated. To find the fuzzy total cost Pascal triangle greaded mean method has been used. A sensitivity analysis is also conducted to know the behavior of changes in parameters.

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A PRODUCTION-FUZZY INVENTORY MODEL WITH DETERIORATION

K. Kalaiarasi[1] , M. Sumathi [2] and M. Sabina Begum [3]

[1]Department of Mathematics, Cauvery college for women (Autonomous), Affiliated to Bharathidasan University, Trichy-2, Email : kalaishruthi12@gmail.com
[2]Department of Mathematics, Khadhir Mohideen College, Affiliated to Bharathidasan University,Adhirampattinam, Email sunsumi2010@gmail.com
[3]Department of Mathematics, M.V.Muthiah Government Arts College for Women,Dindigul,Email : sabinasharifmsc@gmail.com (**Corresponding author**)

Abstract

This study explores the effect of learning on fuzzy considering the fuzzy demand in the EOQ model for deteriorating materials. The crisp equivalent form of the fuzzy objective function is obtained by using the graded mean method. The number of fillers that optimizes the fuzzy objective function is obtained. The model is extended by using learning in a fuzzy and an algorithm has been developed to determine the minimize the total cost. Numerical charts are provided for the sample under a crisp, and fuzzy environment.

Keywords*: EOQ Inventory model, graded mean method, Trapezoidal Numbers*

1.Introduction

The deterioration of an object is considered to be the loss of a part or all of its value over time. Materials such as electronics and style materials suddenly become obsolete, detergents, chemicals, prescription drugs and blood have a fixed shelf life, but their usefulness does not diminish in shelf life. Radioactive materials are subject to high-rate decay. Items like new products lose their usefulness in their lifetime. It is very difficult for all manufacturing industries to store highly volatile substances such as liquids and blood, which can spoil over time. Therefore, it is important to discuss the behaviour of these types of articles.

In this direction, Carey and Schrader [1] were the first authors to consider the effect of article spoilage on the inventory model. They discussed the general EOQ (economic order scale) model with direct deterioration and exponential deterioration. Goyal and Giri [2] provide a comprehensive overview of the deterioration of inventory literature. Manna et al. [3] Provided EOQ model for non-degradable materials with variable demand over time and partial delay. Montal et al. [4] Inspected inventory models for defective products, including marketing results with varying production costs. Goyal [5,6], on the other hand, followed the policy of economic discipline of articles that deteriorated indefinitely.

Maihami and Karimi [7] improved the price and top-up policy for non-immediate goods with random demand and incentive measures. Maihami & Kamalapadi [8] is considered a freight control model for goods that do not have instant decay with partial delay and demand depending on time and price. Dye [9] examined the effect of investing in security technology in an inventory model without immediate decay. Gorishit al. [10] Developed an optimal pricing and ordering policy for goods that are not immediately deterioration under inflation and customer revenue.

In 1965, Jadeh [11] put forward a remarkable concept of ambiguous compilation theory, which has been used successfully and consistently in various fields of science and technology. Another researcher according to the work of Chang and Jade [12] and Chen et al. [13,14] Large-scale analysis to enrich fuzzy numbers around the world and to make assumptions of uncertainty theory, which eventually led to many interesting conclusions in this area. Then, in the further course of the investigation, the notion of ambiguity is extended to sets of fuzzy intervals.

Fuzzy numbers that play a useful and important role in the problem of mathematical modelling and statistical calculation. Fuzzy numbers can be viewed from two different perspectives: their membership function or their-cuts. The two ways of looking at fuzzy numbers are similar, and depending on the details we want to explore, one may be better than the other. Of all the types of fuzzy numbers, triangular and trapezoidal numbers are the most commonly used, and their names are derived from the form derived by representing their membership function in the Cartesian plane. However, if we look at the fuzzy number in terms of its α-cuts, we get a really spaced view of the fuzzy number

Also, trapezoidal number is used, After that, we consider the inventory management model in fuzzy context, where we used the proposed defuzzification methods. Finally we modified the sensitivity analysis Parameters of the model. Finally, we noticed because of that fuzzy existence, it will give us good result rather than the crisp one.The article is structured as follows: preliminaries of the proposed work is given in Section 2 , Provides notation and assumptions. Model formulation is discussed in Section 3. Numerical examples, comparisons between models and sensitivity analysis are presented to illustrate the model in Section 4. Finally, the conclusion of the model have been made in section 5.

2.Methodology

2.1 Fuzzy Set

A fuzzy set $\tilde{A}$ on the given universal set X is a set of ordered pairs $\tilde{A} = \{ (x, \mu_{\tilde{A}}(x)) : x \, \varepsilon \, X \}$ where $\mu_{\tilde{A}} : x \rightarrow [0,1]$ is called membership function or grade membership. The membership function is also a degree of compatibility or a degree of truth of x in $\tilde{A}$.

2.2 Generalized Fuzzy Number

Any fuzzy subset of the real line R, whose membership function satisfies the following conditions, is a generalised fuzzy number.

i. $\mu_{\tilde{A}}(x)$ is a continuous mapping from R to the closed interval [0, 1].

ii. $\mu_{\tilde{A}}(x) = 0$, $-\infty \leq x \leq a_1$

iii. $\mu_{\tilde{A}}(x) = L(x)$ is strictly increasing on $[a_1 , a_2]$

iv. $\mu_{\tilde{A}}(x) = 1$, $a_2 \leq x \leq a_3$

v. $\mu_{\tilde{A}}(x) = R(x)$ is strictly decreasing on $[a_3 , a_4]$

vi. $\mu_{\tilde{A}}(x) = 0$, $a_4 \leq x \leq \infty$ where a_1 , a_2 , a_3 and a_4 are real numbers.

2.3 Trapezoidal Fuzzy number

The fuzzy number $\tilde{A} = (a_1 , a_2 , a_3 , a_4)$ where $a_1 < a_2 < a_3 < a_4$ are defined on R is called the trapezoidal fuzzy number , if the membership function $\tilde{A}$ is given by ,

$$\mu_{\tilde{A}}(x) = \begin{cases} 0, & if \quad x < a_1 \ or \ x > a_4 \\ \dfrac{x-a_1}{a_2-a_1}, & if \quad a_1 \leq x \leq a_2 \\ 1, & if \quad a_2 \leq x \leq a_3 \\ \dfrac{x-a_4}{a_3-a_4} & if \quad a_3 \leq x \leq a_4 \end{cases}$$
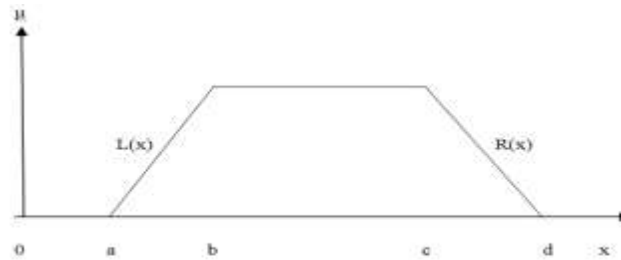
Fig.1: Trapezoidal Fuzzy Number

2.4.Graded mean integration representation method.

Chen and Hsieh [1999] introduced Graded mean Integration Representation Method based on the integralvalue of graded mean h-level of generalized fuzzy number for defuzzifying generalized fuzzy number. Here, we first define generalized fuzzy number as follows:

Suppose $\tilde{A}$ is a generalized fuzzy number as shown in Figure 2.

It is described as any fuzzy subset of the real line R, whose membership function

$\mu_{\tilde{A}}$ satisfies the following conditions.

1$\mu_{\tilde{A}}$ (x) is a continuous mapping from R to [0, 1],

2. $\mu_{\tilde{A}}$ (x) = 0, $-\infty < x \leq a_1$

3. $\mu_{\tilde{A}}$ (x) = L(x) is strictly increasing on [a_1, a_2],

4. $\mu_{\tilde{A}}$ (x) = W_A, $a_2 \leq x \leq a_3$,

5$\mu_{\tilde{A}}$ x) = R(x) is strictly decreasing on [a_3, a_4],

6. $\mu_{\tilde{A}}$ (x) = 0, $a_4 \leq x < \infty$,

where $0 < W_A \leq 1$ and a_1, a_2, a_3 and a_4 are real numbers. This type of generalized fuzzy numbers are denoted as $\tilde{A} = (a_1, a_2, a_3, a_4; w_A)LR$. When $w_A = 1$, it can be formed as $A^{\sim} = (a_1, a_2, a_3, a_4)LR$. Second, by Graded Mean Integration Representation Method, L^{-1} and R^{-1} are the inverse functions of L and R respectively and the graded mean h-level value of generalized fuzzy number
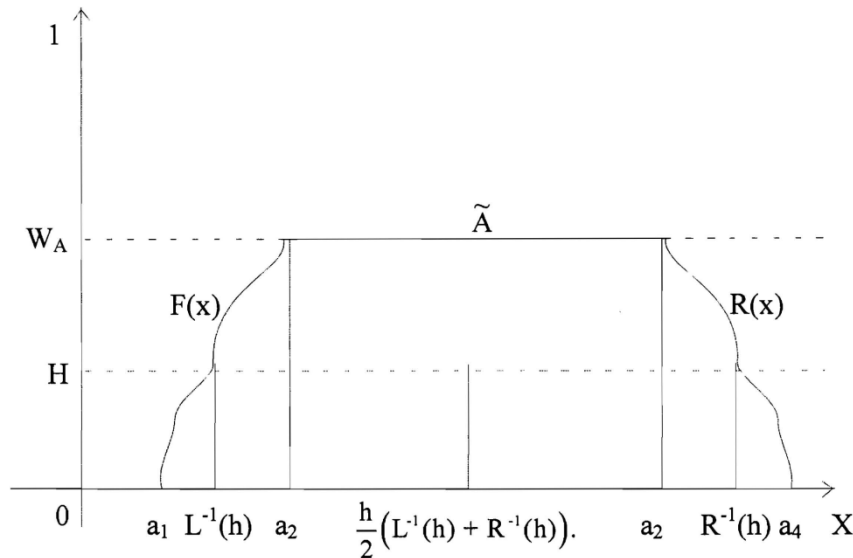
Figure 1.The graded mean h-level value of generalized fuzzy number $\tilde{A} = (a_1, a_2, a_3, a_4; w_A)LR$

$\tilde{A} = (a_1, a_2, a_3, a_4; w_A)LR$. is given by $\frac{h}{2}(L^{-1}(h) + R^{-1}(h))$ (see Figure 2). Then the graded Mean Integration Representation of $P(\tilde{A})$ with grade w_A, where

$$P(\tilde{A}) = \frac{\int_0^{w_Ah} \frac{h}{2}(L^{-1}(h) + R^{-1}(h))dh}{\int_0^{w_ah} h\,dh}$$

$$= \frac{a_1 + 2a_2 + 2a_3 + a_4}{6} \qquad (2.4.1)$$

3.Mathematical Model

3.1 Notations and Assumption

The following notation and assumptions are thought of to develop the model:

Notation:

To develop the model we tend to use the virtually similar notation as on Yan et al. [15].

P production rate

C setup cost for a production batch

H_s holding cost for the supplier

O ordering cost for the buyer

D constant demand

H_b holding cost for the buyer

Db area under the buyer's inventory level

F constant transportation cost per delivery

P_d deterioration rate

C_b deterioration cost for the buyer

C_s deterioration cost for the supplier

n numbers of deliveries per production batch,

Q production lot size per batch cycle

V the unit variable cost for order handling and receiving

ITC the total cost of the system

Assumptions:

1. The production inventory system only produces one type of item.

2. The demand is considered constant and deterministic.

3. The buyer's inventory and demand information is provided to the supplier.

4. Assume the supplier's production rate is constant and P> D.

5. Amounts and discounts for immediate payment are not taken into account.

6. The buyer bears the shipping and other handling charges.

3.2. Proposed Inventory Model in Crisp Sense

In this model, the integrated total cost consists of buyer and vendor ordering cost, inventory holding cost, Deterioration cost , Setup cost, Transportation cost and handling cost.

The joint integrated total cost per unit time derived in Yan et al. [15] is the sum of the following elements, The different types of cost are as follows:
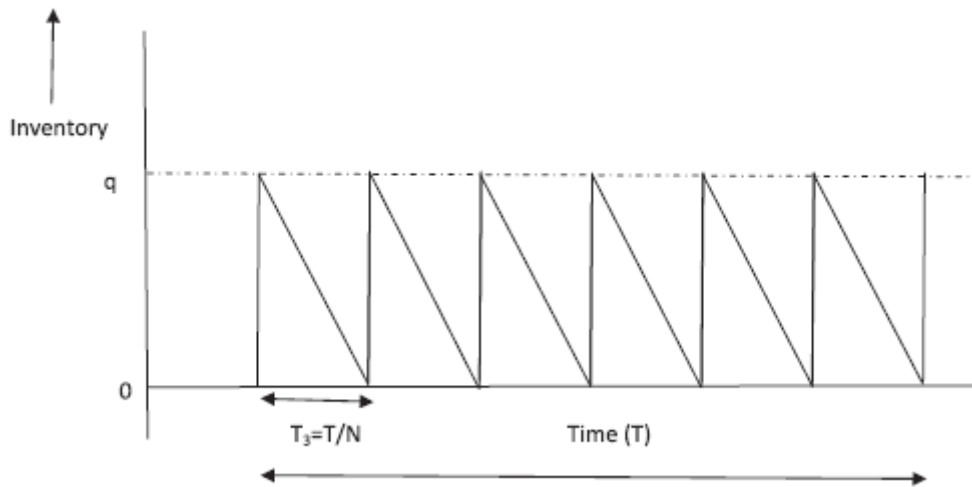
Fig. 1. Inventory model for the buyer's: inventory versus time
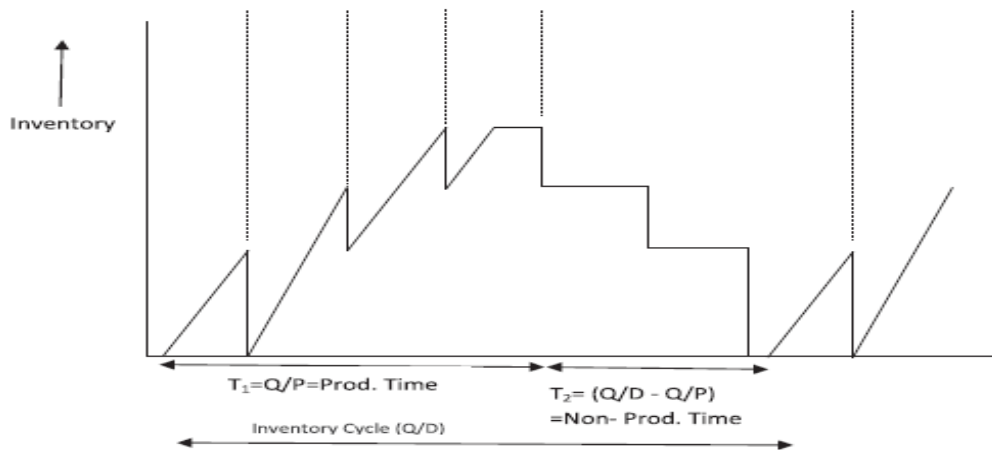
Fig 2.Inventory model for the supplier's: inventory versus time

1. Ordering cost per unit time = $\mathrm{O}\left(\dfrac{D}{nQ}+\dfrac{D}{2n}\right)$.

2. Buyer Holding cost per unit time = $\mathrm{H_b}\ \dfrac{Q}{2}$.

3. Supplier's Holding cost per unit time = $\mathrm{H_s}\ \dfrac{Q}{2}\left(\dfrac{(2-n)D}{P}+n-1\right)$

4. Buyer Deterioration cost per unit time = $\mathrm{C_b}\ \mathrm{P_d}\ \dfrac{Q}{2}$.

5. Supplier's Deterioration cost per unit time $= C_s P_d \dfrac{Q}{2}\left(\dfrac{(2-n)D}{P}+n-1\right)$

6. Transportation cost and handling cost per unit time $= (nF+VnQ)\left(\dfrac{D}{nQ}+\dfrac{D}{2n}\right)$

7. Setup cost per unit time $= C\left(\dfrac{D}{nQ}+\dfrac{D}{2n}\right)$.

The average total cost of the production inventory model for the entire system is

ITC(Q,n) =

$$\left\{\left(\dfrac{D}{nQ}+\dfrac{P_d}{2n}\right)(O+C+nF+VnQ)+\dfrac{Q}{2}(H_b+C_bP_d)+\left[\left(\dfrac{Q}{2}\left(\dfrac{(2-n)D}{P}+n-1\right)\right)(H_s+C_sP_d)\right]\right\}$$

$$ITC(Q,n)\ =\begin{cases}\dfrac{D(O+C+nF)}{nQ}+DV+\dfrac{P_d}{2n}(O+C+nF)\\[2mm]+\dfrac{Q}{2}\left\{(H_b+C_bP_d+VP_d)+\left[\left(\dfrac{(2-n)D}{P}+n-1\right)(H_s+C_sP_d)\right]\right\}\end{cases}\ \text{----(1)}$$

Theorem : For fixed n ITC(Q, n) is convex in Q.

Proof :

Taking the first and second partial derivatives of ITC(Q, n) with respect to Q, we have

$$\dfrac{\partial ITC(Q,n)}{\partial Q}=-\dfrac{D(O+C+nF)}{nQ^2}+\dfrac{\left\{(H_b+C_bP_d+VP_d)+\left[\left(\dfrac{(2-n)D}{P}+n-1\right)(H_s+C_sP_d)\right]\right\}}{2}$$

-(2)

Hence, for fixed n ITC(Q, n) is convex in Q, since

$$\dfrac{\partial^2 ITC(Q,n)}{\partial Q^2}=\dfrac{D(O+C+nF)}{nQ^3}>0$$

we obtain optimal order quantity Q by setting Eq. (2)to zero as

$$\dfrac{\partial ITC(Q,n)}{\partial Q}=0$$

$$Q = \sqrt{\dfrac{2D(O+C+nF)}{n\left\{(H_b+C_bP_d+VP_d)+\left[\left(\dfrac{(2-n)D}{P}+n-1\right)(H_s+C_sP_d)\right]\right\}}}\ \ \text{-------------(3)}$$

3.3. Proposed Inventory Model in Fuzzy Sense

We consider the model in fuzzy environment. Since the Demand is fuzzy in nature, we represent them by trapezoidal fuzzy numbers. Let D : fuzzy Demand per unit time . Now we fuzzify total cost given in (1), the fuzzy total cost is given by:

$$I\tilde{T}C(Q,n) = \left\{ \begin{array}{l} \dfrac{\tilde{D}(O+C+nF)}{nQ}+\tilde{D}V+\dfrac{P_d}{2n}(O+C+nF) \\[4mm] +\dfrac{Q}{2}\left\{(H_b+C_bP_d+VP_d)+\left[\left(\dfrac{(2-n)\tilde{D}}{P}+n-1\right)(H_s+C_sP_d)\right]\right\} \end{array} \right\} \quad \text{------(4)}$$

Our aim is to apply graded mean method to defuzzify the fuzzy total cost, and then obtain the optimal order quantity Q^* by using simple calculus technique. Suppose D = (D_1, D_2, D_3, D_4), is a fuzzy trapezoidal numbers,

$$I\tilde{T}C(Q,n) = \left\{ \begin{array}{l} \dfrac{(D_1+2D_2+2D_3+D_4)(O+C+nF)}{6nQ}+\dfrac{(D_1+2D_2+2D_3+D_4)}{6}V+\dfrac{P_d}{2n}(O+C+nF) \\[4mm] +\dfrac{Q}{2}\left\{(H_b+C_bP_d+VP_d)+\left[\left(\dfrac{(2-n)(D_1+2D_2+2D_3+D_4)}{6P}+n-1\right)(H_s+C_sP_d)\right]\right\} \end{array} \right.$$
$$\text{--(5)}$$

$$\frac{\partial ITC(Q,n)}{\partial Q}=0$$

We get,

$$Q^* = \sqrt{\dfrac{(D_1+2D_2+2D_3+D_4)(O+C+nF)}{3n\left\{(H_b+C_bP_d+VP_d)+\left[\left(\dfrac{(2-n)(D_1+2D_2+2D_3+D_4)}{6P}+n-1\right)(H_s+C_sP_d)\right]\right\}}}$$

Algorithm for Finding Fuzzy Total Cost and Fuzzy Optimal Order Quantity:

Step 1: Calculate total cost I*TC(Q, n)* for the crisp model as given in eq.(1) for the given crisp values .

Step 2: Now, determine fuzzy total cost $I\tilde{T}C(Q,n)$ using fuzzy arithmetic operations on fuzzy Demand , taken as fuzzy trapezoidal numbers.

Step 3: Use graded mean method for defuzzification of $I\tilde{T}C(Q,n)$. Then, find fuzzy optimal order quantity Q^*, which can be obtained by putting the first derivative of $ITC(Q,n)$ equal to zero and where second derivative of $ITC(Q,n)$ is positive at $Q = Q^*$.

4. Numerical Example
Example:
Crisp Model:
Following parameters are to be taken in appropriate units:

P=10000units/ year , C=800/batch , H_b = \$7 /unit / year , H_s = \$6/unit / year D=4800 units/ year , O =\$25/order , F =\$50 /delivery,V=\$1/unit ,C_b=50/unit, P_d =164.547,n=6 / production batch cycle. The total cost ITC(Q,n)= **15757.9**, Q= **164.547**

Fuzzy Model:

Let demand per unit time be a trapezoidal number. D=(4500,4600,4900,5300)

P=10000units/ year , C=800/batch , H_b = \$7 /unit / year , H_s = \$6/unit / year , O =\$25/order , F =\$50 /delivery,V=\$1/unit ,C_b=50/unit, P_d =164.547,n=6 / production batch cycle. The total cost ITC(Q,n)= **15757.9**, $Q^* = $ **164.547**

S.NO	Change of parameter in %	Parameter D	Q	ITC(Q,n)	Parameter n	Q	ITC(Q,n)
1	75	8400	269.284	20116.4	11	108.983	16138.4
2	50	7200	229.819	18967.1	9	121.956	15965.8
3	25	6000	195.615	17520.9	8	139.474	15828.8
4	0	4800	**164.547**	**15757.9**	**6**	**164.547**	**15757.9**
5	-25	3600	134.922	13624.5	5	203.67	15821.5
6	-50	2400	104.867	11001.1	3	274.125	16214.2
7	-75	1200	70.9	7565.72	2	445.362	17793.3

Table 1, **The total cost and order quantity with respect to D and n**
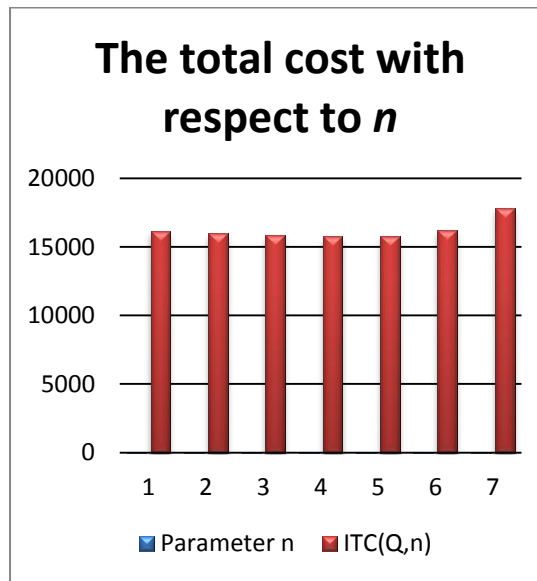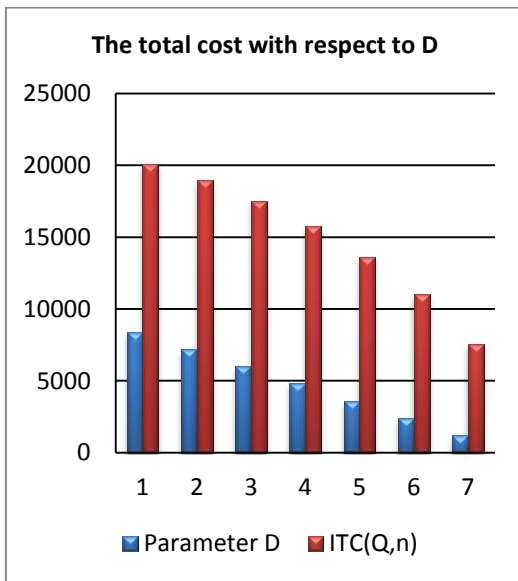
Fig.1.**The total cost with respect to *D***   Fig.2.**The total cost with respect to n**

5.Conclusion

This document presents a fuzzy inventory EPQ model to be calculated during the production and storage of a product. The proposed model is developed in both fuzzy and crisp environments. In the fuzzy environment, the demand of the inventory parameters is assumed to be trapezoidal fuzzy numbers. For classified defuzzification, the graded method is used to evaluate the optimal total cost and the optimal quantity. From a digital example, this fuzzy and crispy pattern was tested.

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தொல்காப்பியரின் கணிதவியல் சிந்தனைகள்

முனைவர்.லொ.ஆ.உமாமஹேஸ்வரி

உதவிப்பேராசிரியர், தமிழ்த்துறை, எம்.வி.முத்தையா அரசு மகளிர் கலைக் கல்லூரி, திண்டுக்கல்

முன்னுரை

பழந்தமிழரின் அறிவியல் சிந்தனைகளை வெளிப்படுத்தும் கருவூலமாகத் தொல்காப்பியம் ஒளிர்கின்றது. தொல்காப்பியரின் பல்வேறு சிந்தனைகளில் 'கணித முறைகளை' நோக்குவதாகக் கட்டுரை அமைகின்றது.

கலைஞானம் அறுபத்து நான்கில் ஒன்றாகக் கருதப்படும் கணிதம் சங்கலிதம் (கூட்டல்), விபகலிதம் (கழித்தல்), குணனம் (பெருக்கல்), பாகாரம் (வகுத்தல்), வர்க்கம், வர்க்கமூலம், கனம், கனமூலம், இயக்கம், எண்ணம் இவற்றைக் கொண்டதாகத் திகழ்கின்றது. கணிதம் என்பதற்கு ஆநவாழனள ழக யுசிவாஅநவிஉயட ஊயடஉஉரடயவழைn; Pசழஉநளள ழக உழஅpரவயயவழைn என்றும், கணித சாஸ்திரம் என்பது சோதிடத்தையும், அளவுகளையும், எல்லைகளையும் கொண்டது என்றும் தமிழ் லெக்சிகன் பொருள் தருகிறது. (பகுதி.1 ப.705) வானியல் அறிவும் கணிதத்துடன் இணைந்ததே, 'தமிழருடைய வானநூற் கணிதமுறையே வழக்கிலுள்ள எல்லாக் கணிதங்களிலும் நிதானமானது' எனும் அறிஞர் சிலேட்டரின் கருத்து இவண் குறிப்பிடத்தக்கது. கணித முறைகளுள் ஒன்றான 'அளவை' முறைகளை தொல்காப்பியர் பல்வேறு நூற்பாக்களில் சுட்டிச் செல்கின்றார். கால அளவையும், அளவை முறைகளும் இன்றியமையாதது. ஆகையால் கால அளவை, எண்ணல் அளவை, நிறுத்தல், முகத்தல், நீட்டல் அளவை குறித்த தொல்காப்பியரின் சிந்தனைகள் கட்டுரையில் விளக்கம் பெறுகின்றன.

கால அளவை

அந்தி, அயனம், ஆண்டு, இளவேனில், எற்பாடு, ஓரை, காலை, கூதிர், கைநொடி, திங்கள், நடுப்பகல், நாழிகை, நொடி, பனை, பின்பனி, பொழுது, மாத்திரை, முழுத்தம், முதுவேனில், முன்பனி, யாமம், விநாடி, வைகறை ஆகியவை 'கால அளவைகளாகக் கொள்ளப்படுகின்றன.

எழுத்துக்கு அளவு கூறும்பொழுது தொல்காப்பியர்,

கண்ணிமை நொடியென வவ்வே மாத்திரை

நுண்ணிதி னுணர்ந்தோர் கண்டவாறே　　　　　　**(நூன் மரபு - 7)**

என்று கூறுகின்றார். இன்றைய அறிவியல் அறிஞர்கள் கண்ணிமைக்கும் காலம் அரைக்கால் மாத்திரையே என்று தெளிவுபடுத்தியுள்ளனர். 'இமையென்றது இமைத்தற் தொழிலை, நொடியென்றது நொடியிற் பிறந்த ஓசையை, தன்குறிப்பு இன்றி நிகழ்தலின் இமை முன் கூறப்பட்டது. நிறுத்தளத்தல், பெய்தளத்தல், நீட்டியளத்தல், நெறித்தளத்தல், தேங்க முகந்தளத்தல், சார்த்தியளத்தல் என்கிறார் உரையாசிரியர் இளம்பூரணர். 'அரையளபு குறுகன் மகரமுடைத்தே' (நூன்-12), அரையளவிற் குறுகல்-கால் என மாத்திரைச் சுருக்க அளவையும் எடுத்தோதுகிறார்ʼ. 'நாள் முன் தோன்றும்ʼ (உயிர்-45), 'திங்கள் முன்வரின்ʼ (உயிர்-46), 'ஞாயிறு, திங்கள்ʼ (கிளவி-57) எனவும், தனது பொருளதிகாரப் பகுதியில் காலம் குறித்து நிலம் பொழுது முதற்பொருள் எனக் கூறும் தொல்காப்பியர், பொழுதின் உட்பிரிவுகளாக கார் முதலிய பெரும் பொழுது ஆறினையும், மாலை முதலிய சிறுபொழுது ஆறினையும், குறிப்பிடுவது கருதத்தக்கது (அகம் 6-12).

எண்ணல் அளவை

ஒன்று, இரண்டு, மூன்று என எண்ணங்களாகவோ, வீசம், அரைக்கால், கால் என இலக்கமாகவோ அல்லது பதாதி, சேனாமுகம், குமுதம் எனத் தொகையாகவோ எண்ணிக் கணக்கிடுவது எண்ணல் அளவையாகும் (ப-8 தமிழர் அளவைகள்) ஒன்று

முதல் கோடி வரை உள்ள எண்கள் இன்றைய நிலையில் எண்ணப்படுகின்றன. அன்றைய தமிழர் ஒன்றுக்குக் கீழ் உள்ள பின்ன எண்களையும் கணித முறையில் பயன்படுத்தியுள்ளனர்.

'உயிரும் புள்ளியும் இறுதி யாகி

அளவும் நிறையும் எண்ணும் சுட்டி

உளனப் பட்ட எல்லாச் சொல்லும்

தத்தம் கிளவி தம்மகப் பட்ட

முத்தை வரூஉம் காலம் தோன்றின்

ஒத்த தென்ப ஏஎன் சாரியை   (தொல்.1164)

இந்நூற்பாவிற்கு இளம்பூரணர் காணியே முந்திரிகை, காலே காணி என எடுத்துக்காட்டு காட்டுவார். 'அரை என வரூஉம் (தொல்-105) எனும் நூற்பாவிற்கு உழக்கரை, கொடியரை, ஒன்றறை என எடுத்துக்காட்டுவார். இதன் மூலம் ஒன்றிற்குக் குறைந்த எண்களும் கருதப்பட்டவை புலனாகும்.

எண்ணி னிறுதியன்னோடு சிவனும் (தொல்.உருபு-198) எண்ணுப் பெயர்களினது குற்றுகரவீறு அன் சாரியையொடு பொருந்தும் எனவும், ஒன்று முதல் பத்துவரை உள்ள எல்லா எண்ணுப் பெயர்களும் வழங்கப்படும் முறையினை (ஒரு பானை, இருபஃதிணை, இருபதினொடு, தொல்-199) எனவும், ஒரு, இரு என எண்ணப்படும் முறையினையும் (தொல்-438) எடுத்துக்காட்டுவார். அத்துடன் பத்து என்ற எண்ணுப்பெயர் முன் ஒன்று முதல் எட்டுவரை, இரண்டு என்ற எண் தவிர, வரும்பொழுது 'து' என்;ற குற்றியலுகரம் மெய்யோடு கெட்ட 'இன்' சாரியை பெற்று பதின் ஒன்று, பதின் மூன்று எனவரும் முறை (தொல்-433), பத்து முன் இரண்டு வந்தால் பன்னிரண்டு என வருதல் (தொல்-434) பத்து முன் ஆயிரம் வந்தால் 'பதினாயிரம்' என வருதல் (தொல்-435) நிறுத்தலளவை. முகத்தலளவைப் பெயர் முன் இன் சாரியை பெற்று பதின்கழஞ்சு, பதின்கலம் என வருதல் (தொல்-436) எனக் குற்றியலுகரப் புணரியல் முழுவதும் கிட்டதட்ட 13 - நூற்பாக்களில் எண்கள் வழக்கு

மாற்றையும், அளவைப்பெயர்கள் முன் எண்கள் பெறும் மாறுபாட்டினை 14 - நூற்பாக்களிலும் விதந்தோதுகிறார் தொல்காப்பியர்.

ஒரு நூறு, முந்நூறு, நானூறு, ஐந்நூறு, தொள்ளாயிரம் ஆகிய எண்களுக்கும் விதியினைக் கூறும் தொல்காப்பியர் (தொல்-460-462)ஒராயிரம், ஒராயிரம், மூவ்வாயிரம், ஒன்பதினாயிரம், நூறாயிரம் இவற்றிற்கும், நூற்றிருபஃது, நூற்றுக்கலம், ஒருபதினாயிரம் முதலான எண்களைக் குறித்த சிந்தனைகளையும் தருகின்றார் (தொல்-465-476). புள்ளி மயங்கியலில் ஏழன் கணக்கு (தொல்-388) எழுநூறு (389) எழுஃபது (390)இ ஆயிரம் (391), ஏழ்நூறாயிரம் (392) என 'ஏழு' என்னும் எண்ணிற்கு விதியினைக் கூறிச் செல்லும் தொல்காப்பியர்.

> ஐ ஆம் பல் என வருஉம் இறுதி
> ஆல்பெயர் எனுறும் ஆயியல் நிலையும்   (தொல்:393)

எனும் நூற்பாவில் தாமரை, வெள்ளம், ஆம்பல் என்னும் பேரெண்கள் குறித்த கருத்தினையும் தருகிறார். இதன் மூலம் ஒன்றுக்குக் கீழும், கோடிக்குப் பின்னும் குறித்த 'எண்கள்' பற்றிய சிந்தனையும், அவ்வெண்கள் அளவு முறைகளில் பின்பற்றப்பட்டதும் தெளிவாகப் புலனாகின்றன.

நிறுத்தல் அளவை

பொருட்களை நிறுத்து அளவிடல் நிறுத்தல் அளவை எனப்படும். இவ்அளவை குறித்து 'தொகை மரபு' வாயிலாக அறிய இயல்கின்றது.

> புனைஎய எளவுங் காவெ னிறையும்
> நினையுங் காலை யின்னோடு இவணும்
> (தொல்-169)

பனையென்னும் அளவுப் பெயரும், கா என்னும் நிறைப்பெயரும், எனச் சுட்டுகிறார். கா- என்பதற்கு 'துலாக்கோல்' என்றும் 100-பலம் கொண்டது 'கா' என்றும் விளக்கம் தருகின்றது, தமிழ் லெக்சிகன் (ப-840).

அளவிற்கு நிறையிற்கு மொழிமுத லாகி

உளவெனப் பட்ட வொன்பதிற் றெழுத்தே

அவை தாம்

க ச ப வென்றா ந ம வ வென்றா

அகர உகரமோ டவையென மொழிப   (தொல்-170)

எனும் நூற்பாவில் முகத்தலளவைப் பெயர்களுக்கும், நிறுத்தலளவைப் பெயர்களுக்கும் மொழி முதலில் வரும் எழுத்துக்கள் ஒன்பது எனக் காட்டுகின்றனர். இந்நூற்பாவிற்கு உரை எழுதியுள்ள இளம்பூரணர் கழஞ்சு, சீரகம், தொடி, பலம், நிறை, மா, வரை, அந்தை, இம்பி முதலான நிறுத்தல் அளவைகளைக் குறிப்பிடுகின்றார். இம்பி, முதலான தானியங்கள் அளவைகளாகப் பயன்படுத்தியிருப்பது நோக்கத்தக்கது, 'கழஞ்சு' எனும் அளவை இன்றுவரை எவ்வித மாற்றமுமின்றித் தமிழரால் பயன்படுத்தப்படும் அளவையாகும் (ப-40இதமிழர் அளவைகள்). அண்மைக்காலம் வரை புளி, சர்க்கரை, வெல்லம் போன்றவற்றை அளவிடுவதற்குப் 'பலம்' எனும் எடை பயனில் இருந்து வந்துள்ளது. தொல்காப்பியர் காலத்தில் மிக நுண்ணிய எடையளவினையும் பயன்படுத்தி உள்ளனர் என்பது மேற்காணும் நூற்பா வழி புலனாகிறது.

முகத்தல் அளவை

பொருட்களை முகந்து அளக்கும் அளவை முகத்தல் அளவையாகும். பிற அளவுப் பெயர்களைவிட, இந்த அளவு குறித்த தகவல்களை அதிகமாகத் தருகின்றார் எனலாம். கலம், (தொல்-168) பனை (தொல்-169). பதக்கு, தூணி, உரி, நாழி, (தொல்-239-240)இ உழக்கு (தொல்-457) போன்ற அளவைகளை வெளிப்படையாகத் தருகின்றார் தொல்காப்பியர். உரையாசிரியர் கலம், தூதை, பானை, நாழி, மண்டை, வட்டி, அகல், உழக்கு ஆகிய அளவைகளைக் குறிப்பிடுகிறார். பிற்காலத்தில் 'உண்கலன்களாக' ப் பயன்பட்டவை தொல்காப்பியர் காலத்தில் அளவைகளாகவும் பயன்பட்டிருக்கக்கூடும்.

நீட்டல் அளவை

பொருட்களின் நீளம், உயரம், அகலம், பருமன் போன்றவற்றை நீட்டல், அளவுக் கருவிகள் கொண்டு அளத்தல், நீட்டல் அளவை எனப்படும் (ப-51,தமிழர் அளவைகள்)இ மா எனும் நீட்டல் அளவினைத் தொல்காப்பியர் குறிப்பிடுவார் (தொல்:480). நீட்டம் வேண்டின் அவ்வளவு உடைய (தொல்.6) எனும் நூற்பாவும் இவண் சிந்திக்கத்தக்கது. உரியியலில் உரிச்சொல் குறித்துக் குறிப்பிடுகையில் 'நானவே களனும் அகலமும் செய்யும்' எனும் நூற்பாவினைத் தருகின்றார். உரையாசிரியர் சேனாவரையர் நனவு- அகலத்தைக் குறிக்கும் எனக் குறிப்பிடுகின்றார். இவை தவிர தொல்காப்பியர் அக்காலத்தில் பயன்படுத்தப்பட்ட 'நீட்டல் அளவு' கருவியினைக் குறித்து வேறெந்தத் தகவலும் அளிக்கவில்லை.

தொகுப்புரை

தொகைமரபு, புள்ளி மயங்கியல், உருபியல், குற்றியலுகரப் புணரியல், பொருளதிகாரம் உள்ளிட்ட பல்வேறு இடங்களில் தொல்காப்பியரின் 'கணித முறை' குறித்த சிந்தனைகள் விரவிக் கிடக்கக் காணலாம். தொல்காப்பியர் தரும் 'பனை' எனும் அளவு ஆழ்ந்து சிந்திக்கத் தக்கது. தொல்காப்பியரின் நூற்பாக்களினின்றும் அக்கால மக்கள் கணிதத்தில் தேர்ந்து விளங்கினர் என்பதும், நுண்ணிய அளவைகளையும் பயன்படுத்தத் தேர்ந்தவர் என்பதும் புலனாகின்றது.

AN EVALUATION OF GROUNDWATER QUALITY FOR IRRIGATION PURPOSE IN REDDIYARCHATRAM BLOCK OF DINDIGUL DISTRICT, TAMIL NADU

Dr.C.Florence Annal

Assistant Professor, Department of Geography, M.V.Muthiah Government Arts Collegefor Women, Dindigul

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Abstract

Groundwater samples were collected from 24 sample locations and analyzed for hydrochemistry of groundwater in the study area. The hydro chemical parameters selected for the present study namely Alkalinity, PH, EC, TDS, CL, SO_2-, Na, Ca, Mg using Arc GIS to show the variations in the distribution of each ion in the study area. SAR ratio, SSP Ratio, Kelly's ratio , RSC ratio and USSL ratio also calculated to demarcate the groundwater samples locations for irrigation purpose.

Keywords: Ground water, hydro chemical parameters, irrigation spatial distribution,GIS.

Introduction

Water quality, soil types and cropping practices play an important role for a suitable irrigation practice. Irrigation water quality varies greatly upon the types and quantity of dissolved salts. Thus, water for irrigation Suitability is determined not only by the total amount of salt present but also by the kind of salt. Excessive amounts of dissolved ions in irrigation water affect plants and agricultural soil physically and Chemically, thus reducing productivity. The physical effects of these ions are to lower the osmotic pressure in the plant structural cells, thus preventing water from reaching the branches and leaves. The chemical effects disrupt plant metabolism. Water quality problems in irrigation include indices for salinity, Chlorinity, Sodicity and alkalinity. EC and Na+ play a vital role in suitability of water for irrigation. Higher EC in water creates a saline soil. Harmful effects of irrigation water increases with the total salt concentration, irrespective of the ionic composition. The salts apart from affecting the growth of plants also affect the soil structure, Permeability and aeration which indirectly affect plant growth. SAR is the most commonly used for evaluating groundwater suitability for irrigation purposes Ayers and . It

is normally expressed as Na content or alkali hazard which is normally expressed in Sodium adsorption ratio SAR .The irrigation water quality is judged by the four most applied criteria. These are: (I) total dissolved solids (TDS) i.e. the total salt concentration measured by EC (II) relative proportion of Sodium to other cations, expresses by Sodium Adsorption Ratio (SAR) (III) concentration of certain specific elements and (IV) residual Sodium Carbonate (RSC). Good irrigation water is the one which will not retard the plant growth. The quality of irrigation water depends upon various types of impurities present in water are Concentration of sediments in water, Total Concentration of soluble salts (known as TDS), Proportion of Sodium ions to other cations, Concentration of toxic elements such as boron Concentration, Concentration of bicarbonate in relation to the concentration of calcium andmagnesium.

Study Area

Reddiarchtram is one of the revenue block in Dindigul district of Tamilnadu. Reddiarchatram block is located between 10^0 $36^{'}$ N latitude and 77^0 $98^{'}$ E longitude. It occupies an area of 279.25 sq.km. It is bounded by Oddanchatram in the north, Dindigul in the east, Author in the south and Kodaikanal in the west. The block is divided into 24 revenue villages , 138 hamlets and 2 town panchayats. Geologically the block is covered by crystalline metamorphic rock. Geomorphologically the block is divided into western mountainous terrain and pediment composite plain. The vast pediplain areas of the block have undergone different pediment modification. Reddiarchatram block consists of the dark brown to dark reddish brown and calcareous soils. Dark brown to reddish soils are found in various parts of 18 villages , dak brown soil is found in some parts of 8villages and calcareous soils are distributed in gentle slope of the block. Average annual rainfall to the place is an important factor that could be considered for selection of crop. The highest rainfall 1255.6mm is received during north east monsoon and 40.45mm rainfall is the maximum during south west monsoon season. There are 115 tanks, 6 dams and 9583 wells both open and bore wells, 7 large and 55 small tank are used for irrigation. the total irrigated area is more than 50% of the cultivated land. According to 2011 census the density of population of the Reddiarchatram is 267 per sq. km. . The sex ratio is 998 per 1000 males. The percent of literate population to the total population of Reddiarchatram is 64.8%. Cultivators are the major working groups in this block. Agricultural workers who

do not own land but work for wages are dominant in the block. House hold workers dominant in surrounding areas.
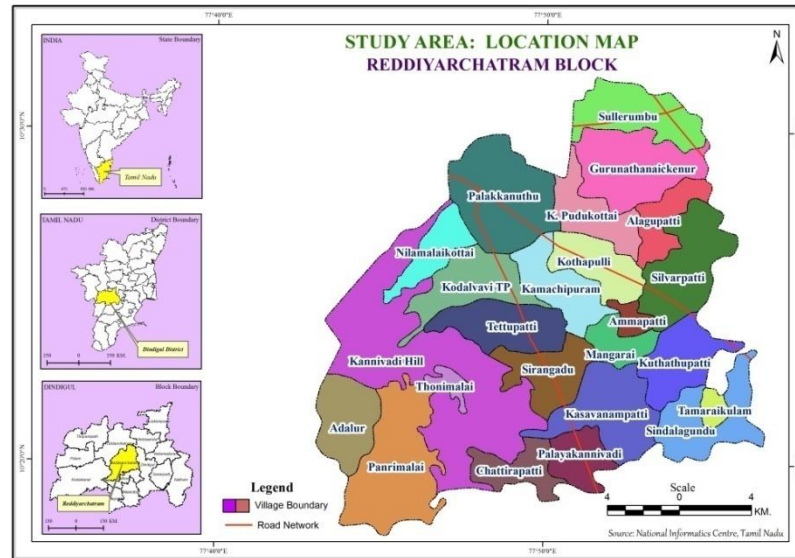
Fig-1

Aims and Objectives

The study aims to assess the groundwater quality through chemical analysis for irrigation purpose in the study area; the objectives of the study are to

- To identify and analyses the Physio – chemical parameters which make water unfit for irrigation and
- To delineate the area into suitable and unsuitable for irrigation based on the quality of ground water using GIS thematic mapping.

Materials and Methods

Ground Water sample were collected from 24 wells and bore wells water analysis of chemical parameters. Sample bottles were cleaned by rinsing them with distilled water followed by their treatment with 1M solution of the preservative acid. In the case of bore wells (hand pumps) the water samples were collected after pumping for 10- 15 minutes in order to remove stagnant groundwater. There are four basic criteria for evaluating water quality for irrigational purposes, viz. salinity hazard, sodium hazard, excessive concentration of toxic elements and excessive presence of other miscellaneous elements.

Various tests were conducted according to the Standard Methods forexamination of water. Water quality parameters which were studied are as follows: total dissolved solids (TDS), electrical conductivity (EC), PH, Calcium (Ca), Magnesium (Mg), Sodium (Na), Potassium (K), Carbonate (CO$_3$), Bicarbonate (HCO$_3$), Nitrate (NO$_3$), Sulphate (SO$_4$) and Chloride (Cl). These parameters mainly consist of certain physical and chemical characteristics of water that are used in the evaluation of agricultural water quality. Numerous water quality guidelines have been developed by many researchers for using water in irrigation under different condition. However, the classification of US Salinity Laboratory (USSL) is most commonly used .Parameters such as EC, TDS, pH, Sodium Adsorption Ratio (SAR), Soluble Sodium Percentage (SSP) and Residual Sodium Carbonate (RSC) were used to assess the suitability of water for irrigation purposes.

Result and Discussion

Sodium Adsorption Ratio (SAR)

A high salt concentration in water leads to formation of a saline soil and high sodium leads to development of an alkali soil. The sodium or alkali hazard in the use of water for irrigation is determined by the absolute and relative concentration of cations and is expressed in terms of Sodium Adsorption Ratio(SAR). If the proportion of sodium is high, the alkali hazard is high; and conversely, if calcium and magnesium predominate, the hazard is less. Thereis a significant relationship between SAR values of irrigation water and the extent to which sodium is absorbed by the soil. If water used for irrigation is high in sodium and low in calcium, the cation-exchange complex may become saturated with sodium. This can destroy the soil structure owing to dispersion of the clay particles. A simple method of evaluating the danger of high-sodium water is the sodium adsorption ratio, SAR. Where all ionic concentrations are expressed in milliequivalent per liter. Calculation of SAR for given water provides a useful index of the sodium hazard of that water for soils and crops. A low SAR (2 to 10) indicates little danger from sodium; medium hazards are between 7 and 18, high hazards between 11 and 26, and very high hazards above that. It indicates the degree to which irrigation water tends to enter into cation-exchange reactions in soil. The excess sodium or limited calcium and magnesium content are evaluated by SAR computed as:

$$SAR = Na+ / \sqrt{Ca} + Mg / 2$$

The average values of SAR in the study area is ranged 0- 6.3. about 100% of the SAR for groundwater sample of the study area are less then 10 indicates excellent (SI) category while no SAR for groundwater sample of the study area within the range of 10-18 indicates good quality for irrigation.The figure 2   shows that the entire study area are having suitable water for irrigation based on sodium Absorption Ratio.
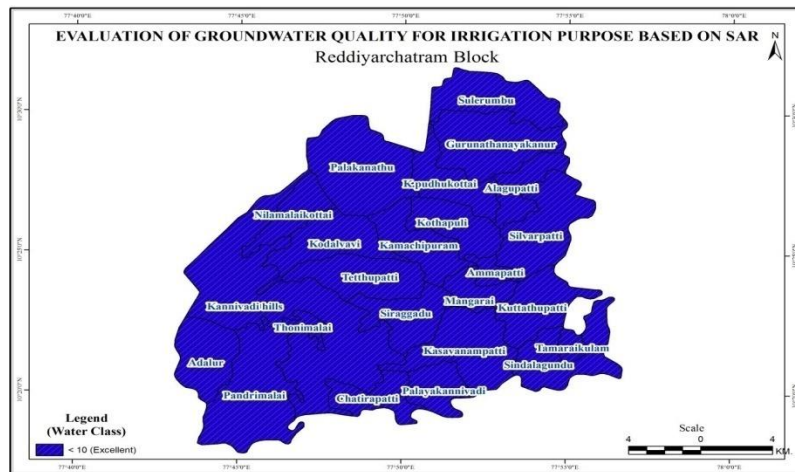
Fig-2

U.S. Salinity Laboratory Classification

U.S. Salinity Laboratory classification (Wilcox, 1955) is used to study the suitability of ground water for irrigation purposes. In classification of irrigation waters, it is assumed that the water will be used under average conditions with respect to soil texture, infiltration rate, drainage, quantity of water used, climate and salt tolerance of crop. The US Salinity Laboratory's diagram is widely used for rating the irrigation waters, where SAR is plotted against EC. The plots of chemical data of the groundwater samples in the US Salinity Laboratory's diagram are illustrated in the total concentrations of soluble salts in irrigation water can be classified into low (C1), medium (C2), high (C3) and very high (C4) salinity zonesSodium concentration is an important criterion in irrigation-water classification because sodium reacts with the soil to create sodium hazards by replacing other cations. The extent ofthis replacement is estimated by Sodium Adsorption Ratio (SAR). A diagram

for use in studying the suitability of ground water for irrigation purposes is based on the sodium adsorption ratio (SAR) and electrical conductivity of water expressed in μS/cm.

Evaluation of ground water quality for irrigation purpose based on EC values is present in figure 3. It reveals that excellent and good quality water for irrigation was found in 4 villages and in 11 villages the water comes under permissible for irrigation category. About 6 villages show the water is suitable for irrigation and the remaining 2 villages have unsuitable water for irrigation.
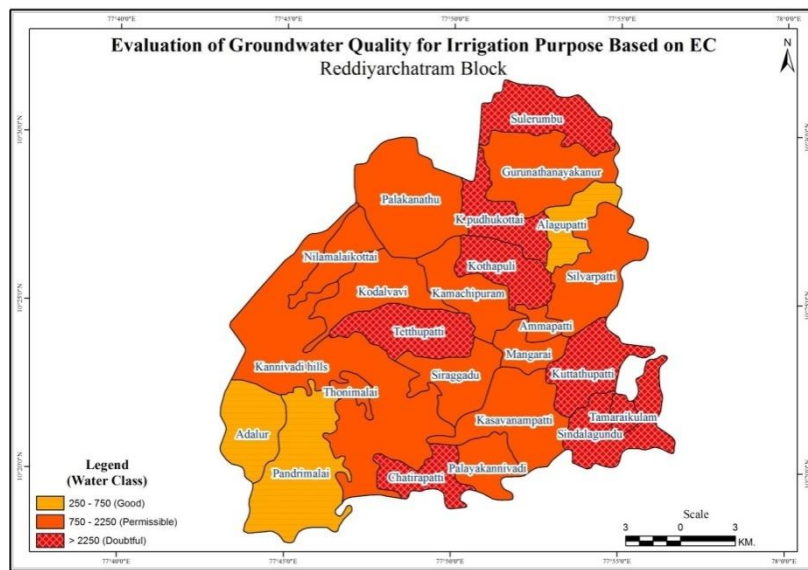
Fig- 3

Sodium Percentage

The suitability of the groundwater for irrigation depends on the mineralization in water and its effect on plants and soil. The concentration of sodium is high in irrigation water, the sodium ions tend to be absorbed by clay particles, displacing Mg^{2+} and Ca^{2+} ions. This exchange process of Na^+ in water for Ca^{2+} and Mg^{2+} in soil reduces the permeability and eventually results in soil with poor internal drainage. Groundwater was grouped based on average percent sodium as excellent (<20%), good (20-40%), permissible (40-60%), doubtful (60-80%) and unsuitable (>80%). Out of the selected wells, 10% had excellent irrigation water quality, 60% had good irrigation water quality, 25% had permissible irrigation water quality and 5% had doubtful irrigation water quality .Percent sodium can be determined using the following formula:

Na% = {(Na+ + K+)/ (Ca2+ + Mg2+ + Na+ + K+)} 100

Where all ionic concentrations are expressed in millieqivalent per litre.

The sodium percentage in the study area varies from $0 - 67.6$ (table 1). As per the world health organization ,2011 standards, the sodium percentage of 60 is the maximum recommended limit for irrigation water. Figure 4 shows the evaluation of ground water quality for irrigation purpose based on sodium percentage. It is observed from the figure that entire study area having excellent, good, and permissible water for irrigation. Only 4 villages having unsuitable water for irrigation. Irrigation water with high sodium percentage may cause sodium accumulation and calcium deficiency in the soil and hence breakdown of its physical properties.
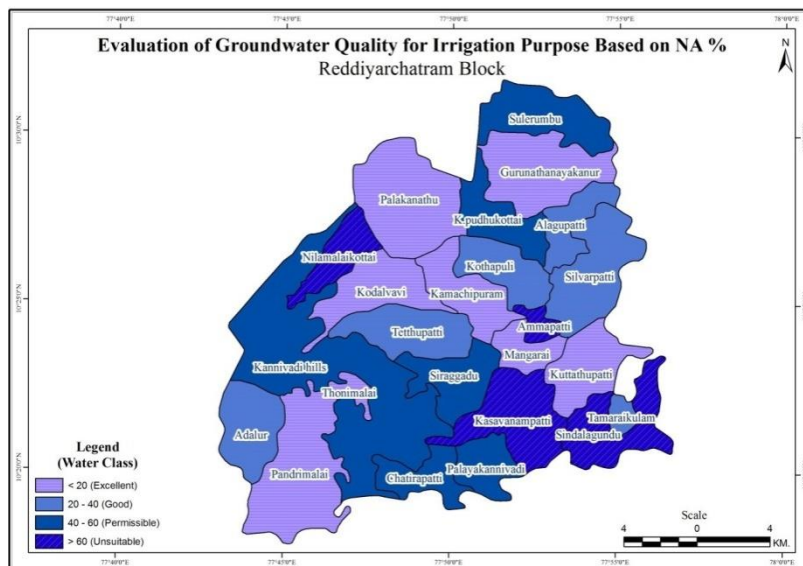
Fig - 4

Magnesium Hazard

Although calcium and magnesium ions are essential for plant growth but they may be associated with soil aggregation and friability. Magnesium is washed from rocks and subsequently ends up in water. High concentration of calcium and magnesium in irrigation water can increase soil pH, resulting in reducing availability of phosphorus. Water contains calcium and magnesium concentration higher than 10 meq/l (200mg/l) cannot be used in agriculture. Magnesium ion concentration also plays an important role in productivity of soil. A large number of minerals contain Magnesium. Chemical industries add magnesium

to plastics and other materials as a fire protection measure or as filter. Magnesium content is considered as one important criterion in determining the quality of surface water for irrigation. It also ends up in the environment from fertilizer application and from cattle feed . If the Magnesium Ratio is greater than 50 percentage it is considered as unsuitable for irrigation purpose . It has been noted that if magnesium hazard is less than 50, the water is safe and suitable for irrigation. It can be calculated by this formula:

$$Mg \text{ content} = \{Mg / (Mg + Ca2)\} \, 100$$

The magnesium ratio in ground water samples varies from 5.88 – 39.5 epm (table 1). In the study area about 100% of the groundwater sample shows less than 50% of magnesium ratio and indicates suitable water for irrigation.

Potential Salinity

Potential salinity pointed out that the suitability of water for irrigation is not dependent on the concentration of soluble salts. The opinion that low solubility salts precipitate in the soil and accumulate with each successive, whereas the concentration of highly soluble salts increases the salinity of the soil. Potential salinity is defined as the chloride concentration plus half of the sulphate concentration. "Potential salinity" was introduced for assessing the suitability of water for irrigation uses which may be defined as the chloride concentration plus half of the sulfate concentration .

$$Potential \, Salinity = Cl + \tfrac{1}{2} SO4 .$$

In the study area the potential salinity varies from 1.2 – 41.9. about 4.1% of the ground water sample location shows less then 3 potential salinity values and indicates excellent to good water for irrigation. Nearly 12.5% of the sample location have the potential salinity values of 3- 5 and comes under good to injurious water category for irrigation. The remaining 83.3% have above 5 of potential salinity values and shows injurious to unsuitable water class for irrigation Figure 5 classify the study area based on potential salinity. Excellent water category for irrigation found in only one village of the study area. Good injurious water category for irrigation found in 3 villages and 83.3% unsuitable water found in 20 villages of the study areas.
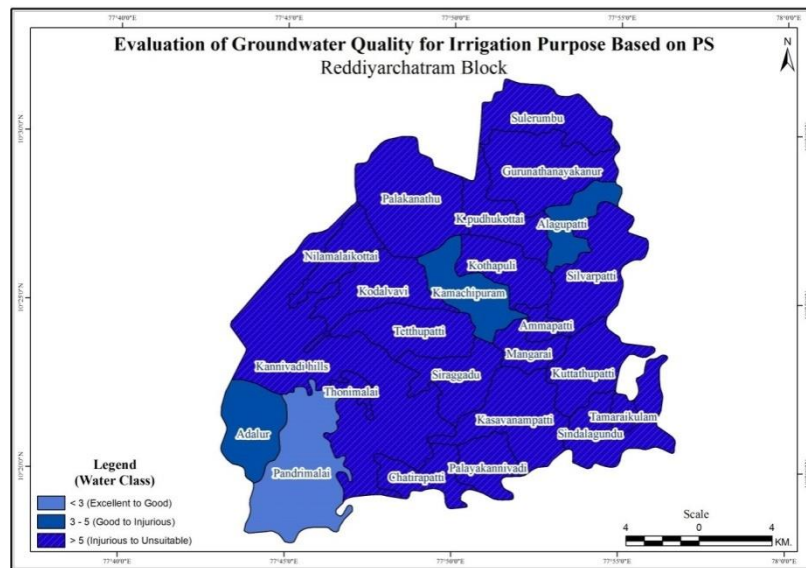
Fig - 5

Residual Sodium Carbonate

The concentration of bicarbonate and carbonate also play a vital role forclassification of irrigation waters. The relative abundance of sodium with respect to excess of carbonate and bicarbonate over alkaline earth affects the suitability of water for irrigation purpose and this excess is donated by residual sodiumcarbonate (RSC) and is determine by the formula(Richards, 1954) as given below.

$$RSC = (CO_3 + HCO_3) - (Ca + Na)$$

Where the concentration of ions is expressed in meq/1.

In general the high concentration of CO_3 and HCO_3 represents alkaline nature. Bicarbonate and carbonate: bicarbonate occur in low salinity waters and their concentration usually decrease with increase in EC. The proportion of bicarbonates ions is higher then calcium ions and has been considered to be undesirable because after evaporation of irrigation water, bicarbonate ions tend to precipitate calcium ions. The values of RSC in the study area ranges from 0.9 – 37.1. ground water having less then 1.25 or equal to 1.25 epm of RSC is marginally suitable for irrigation purpose where as water having more than 2.5 epm of RSC is not suitable for irrigation purpose. Based on the RSC values 12.5% of sample location have safe water and 87.5% have unsuitable water for irrigation in the study

area. (table 1).From the figure 6 It was analyzed that the safe water for irrigation based on RSC values spreads in south western ,part ,marginally suitable water found in west and north western part. Unsuitable water found in central and surrounding villages of the study area.
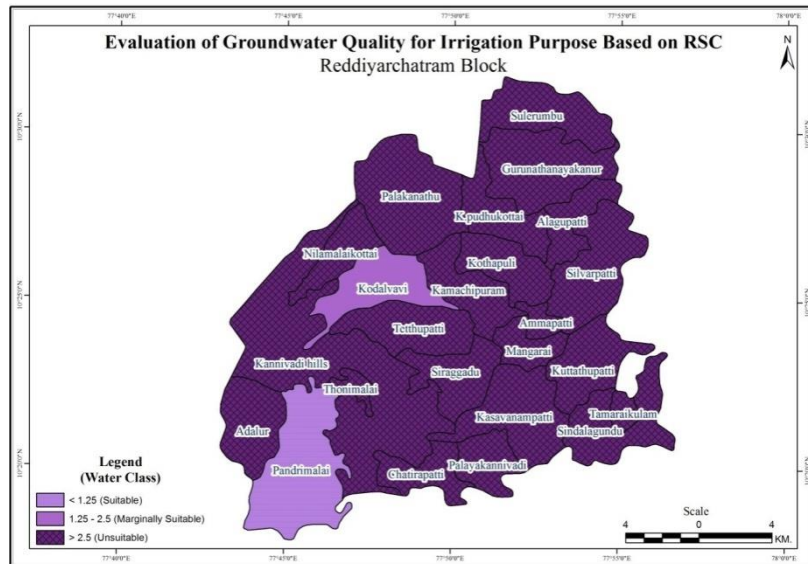
Fig- 6

Kelly's Index

Sodium measured against Ca2+ and Mg2+ is used to calculate Kelley's ratio. SAR is a better measure for sodium, and this particular ration is not in common use, but this study also presents a review of all the quality criteria of classification to evaluate the obtained dataset. A Kelly's index of more than 1 indicates an excess level of sodium in waters. Hence, waters with a Kelly's index less than 1 are suitable for irrigation, while those with a ratio more than 1 are unsuitable. the sodium problem in irrigational water could very conveniently be worked out on the basis of the values of Kelley's ratio.'Permeability Index' after conducting a series of experiments for which he has used a large number of irrigation waters varying in ionic relationships and concentration. The following in the formula

Kelly ratio = NA/Ca+Mg

The Kelly's ratio has been calculated for all the water sample of the study area.It varies from 0 – 1.63 epm (table 1). About 87.5% of the Kelly's ratio values for the groundwater of the study area are less than 1 and indicates good quality water for irrigation purpose

while remaining 12.5% is more than and indicates the unsuitable water quality for irrigation (table 1). Evaluation of groundwater for irrigation purpose based on Kelly's ratio is presented in (figure 7). Except 3 villages all other villages comes under good water category for irrigation based on Kelly's ratio.
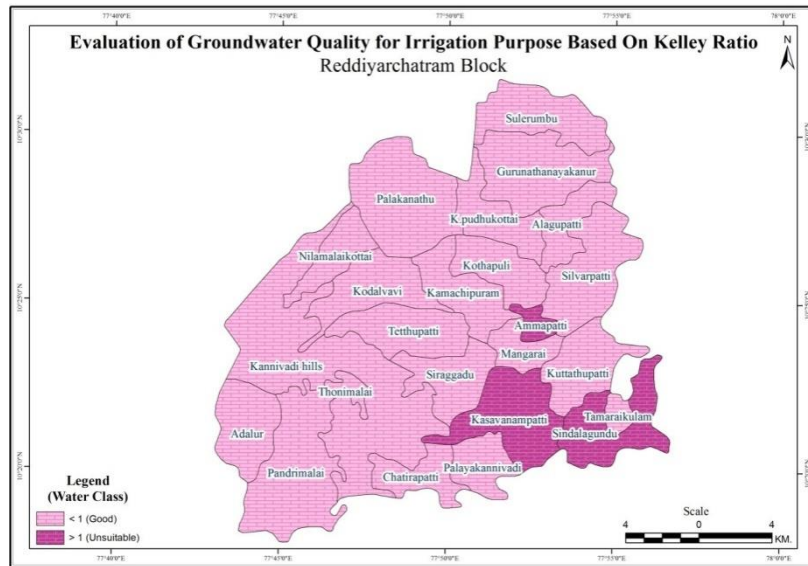
Fig - 7

Soluble Sodium Percentage (SSP)

Soluble Sodium Percentage (SSP) is used to evaluate sodium hazard. The concentrations of Ca+2, Mg+2and Na+ are expresses in milliequivalents per liter (epm). Water with a SSP greater than 60% may result in sodium accumulations that will cause a breakdown in the soil's physical properties. The ratio of the exchangeable Na+ to total exchangeable cations (Exchangeable Sodium Percentage, ESP) is a good indicator for soil structure deterioration. High value of ESP means high sodium ion concentration in the water , and high sodium concentration means dispersing soils by replacing the calcium and partly of the magnesium ions from soil exchange complex. The sodium in irrigation waters is also expressed as percent sodium or soluble sodium percentage SSP and can be determined using the following equation :

$$\textbf{SSP} = [Na + / (Ca + Mg + Na\,]xl00$$

The soluble sodium percent values less than 50 or equal to 50 indicates good quality water and if it is more than 50 indicates unsuitable water quality for irrigation. The values of soluble sodium percent range from 0 – 63.5. Nearly 83% of the SSP values for the groundwater locations of the study area are less than 50 and indicates good quality water for irrigation purpose while remaining 17% is more than 50 and indicates the unsuitable water quality for irrigation. The figure 8 Shown the evaluation of groundwater quality for irrigation based on sodium soluble percentage. The analysis shows that 4 villages have unsuitable water for irrigation based on SSP. The remaining entire study areas have good water quality for irrigation.
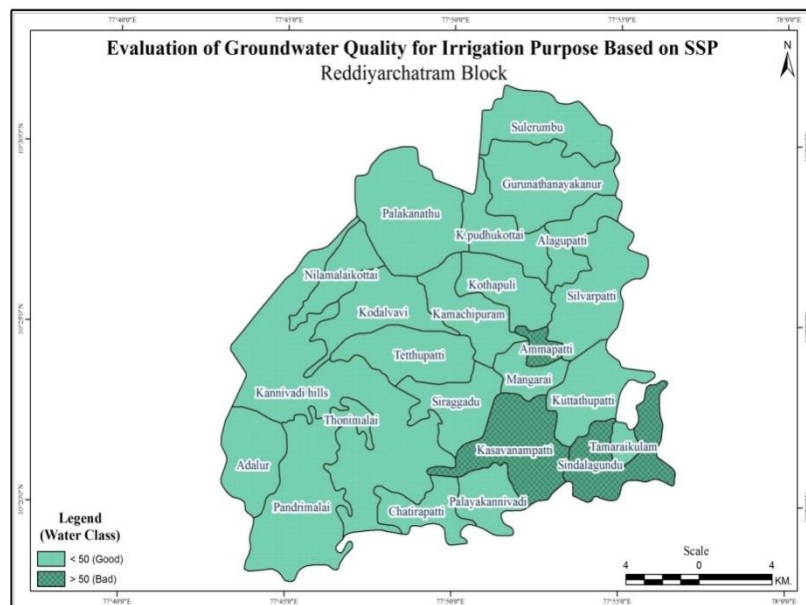
Fig-8

Conclusion

Groundwater samples from the study area were analyzed for chemical parameters and the data was interpreted to found the groundwater quality for irrigation purpose in the study area. Based on SAR ratio all the sample locations came under suitable water for irrigation purpose. According to EC values nearly 15 percent of the water samples comes under good quality water for irrigation and the remaining water samples comes under permissible and unsuitable categories for irrigation. The analysis revealed that entire study area having excellent, good, and permissible water for irrigation sodium. The evaluation of ground water quality for irrigation purpose based on MG ratio revealed that entire study area having suitable water quality for irrigation purpose. Potential salinity

values and indicates excellent to good quality water for irrigation is found in the study area. Based on the RSC values the safe water for irrigation spread in south western part ,marginally suitable water found in west and north western part and unsuitable water found in central part of the study area. Evaluation of groundwater for irrigation purpose based on Kelly's ratio presented that except 3 villages all other villages shown good quality water for irrigation. Nearly 83.3% of the SSP values for the groundwater locations of the study area are less than 50 and indicates good quality water for irrigation purpose while remaining 16.7% is more than 50 and indicates the unsuitable water quality for irrigation. The analysis shown that 4 villages shows unsuitable water for irrigation based on SSP and the remaining study area have good water quality for irrigation.

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Annexure – 1

Table – 1- Chemical Parameters

Sl.No	Name of the Panchayat	SAR	NA%	MR	PS	KR	SSP	PH	EC	TDS	RSC
1	Adalur	1.45	37.3	16.6	3.3	0.5	33.3	7.6	0.67	0.42	-3.9
2	Alagupatti	0.52	22.9	38.2	3.15	0.17	14.5	7.6	0.61	0.39	-2.6
3	Ammapatti	6.3	64.2	28.5	11.7	1.62	63.5	8.2	2.10	1.34	-15
4	Chattirapatti	0.52	47.9	13.8	10.5	0.10	9.2	7.4	2.44	1.56	-10.1
5	Gurunathanaickanur	1.1	12.8	18.8	7.15	0.65	20.7	7.5	1.15	0.73	-8.3
6	K.Pudukottai	3.76	49.1	17.6	14.4	0.75	42.9	6.8	2.46	1.57	-4.4
7	Kamachipuram	0.21	11.6	20	4.45	0.05	5.06	7.3	0.85	0.54	-5
8	Kannivadi kills	2.96	55.4	24.3	10.5	0.73	42.2	7.7	1.84	1.17	-10.5
9	Kasavanampatti	5.43	71.7	27.2	10.6	1.63	62.0	7.8	1.95	1.24	-9.85
10	Kodalvavi	0.32	9.41	20.7	9.4	0.05	5.5	7.4	1.70	1.08	-2
11	Kothapuli	1.96	25.5	30.3	16.5	0.30	23.5	8.0	2.70	1.72	-18.7
12	Kulaththupatti	0.46	8.78	19.9	10.9	0.05	5.6	7.9	3.30	1.11	-23.7
13	Magarai	1.84	19.1	39.5	11.5	0.22	18.2	7.5	1.94	1.24	-19.7
14	Nilamalaikottai	1.66	61.1	23.8	5.45	0.57	36.3	7.7	1.08	0.69	-4
15	Palakkanuthu	0.19	8.6	16.0	7.65	0.06	3.52	7.9	1.50	0.96	-8.6
16	Palayakannivadi	3.26	46.5	15.5	8.45	0.83	45.3	6.9	1.44	0.92	-11.9
17	Pandrimalai	0	0	34.4	1.2	0.0	0.0	7.9	0.29	0.18	-0.9
18	Silvarpatti	1.96	29.6	15.6	6.4	0.34	25.8	8.2	1.18	0.75	-7.9
19	Sirggadu	2.83	60	25.	5.65	1.0	50.0	8.0	1.0	0.64	-5.8
20	Sindalakundu	4.82	67.6	19.7	15.4	1.23	55.2	7.5	2.35	1.50	-14.5
21	Sullerumbu	3.08	41.8	14.8	41.9	0.39	28.2	7.2	5.30	3.39	-37.1
22	Tamaraikulam	2.97	33.5	12.5	24.9	0.47	31.9	7.4	3.01	1.92	-24
23	Tettupatti	2.53	32.0	35.8	17.7	0.40	28.8	7.8	2.87	1.83	-19.1
24	Thonimalai	1.08	17.0	5.88	12.5	0.18	15.8	7.4	2.05	1.31	-18

Source: Primary data Collected from the study area

STUDIES ON IDENTIFYING VARIOUS DISEAESES AFFECTING THE SILKWORM *BOMBYX MORI* UNDER REARING

Dr. M. Eathel Poline

Assistant Professor of Zoology, PG Department of Zoology, M.V. Muthiah Govt Arts

College for Women, Dindigul – 624 001. Email: eathelpoline@gmail.com

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Abstract

India is the highest producer of silk in the world as well as the largest consumer. Although there is so much demand both in production and supply, the farmers are facing lots of problems because the silkworms are easily susceptible to various kinds of diseases. Hence the present study was mainly focused on assessment of diseases in silkworm *Bombyx mori* in the sericulture unit situated at Kannivadi in Dindigul. The study period was carried out from the 2nd of January to 31st, 2021. There were two kinds of diseases such as White muscardine and Flacherei have been identified and recorded in the sericulture unit from II instar to V instar stage. The date wise data of infected number of worms with such kind of disease in each day were tabulated and interpreted with relevant literature.

Introduction

In integrated farming system sericulture is an important component; which is an agro based rural industry, with tremendous potential for employment generation in rural areas. It is the biggest village industry after handloom and khadi providing full or partial employment to about *6.5* million people in India (Pankajet al., 2005).

In the world, India ranks second in raw silk production next to China. Karnataka state alone produces bulk of Indian raw silk (Govindan and Devaiah, 1995). Diseases in silkworm mulberry plants caused by pathogens reduce the quantity and quality of silk production which in turn affects national economy and farmers' income. Although there are several commercial species of silkworms, *Bombyx mori* is the most widely used and intensity studied (Goldsmith, et al., 2005). The silkworm is the larva or caterpillar of the *Bombyx mori* moth. The major diseases of silkworm are Flacherie (Bacterial), Nuclear

cytoplamic polyherosis (Viral), Pebrine (Microsporidian), Muscardine (Fungal). The prime objectives of this study are to visit the sericulture unit for examining the intensity of the diseases and the percentage of prevalence at different instar levels have to be elucidated.

Materials and Methods

Collection and Identification of Diseased silkworm

The sericulture unit situated was visited at Kuttathauavarampatti in kannivadi near Dindigul, Tamil Nadu, during the month of January from 2nd to 31st. Based on the appearance of symptoms, changes found over its body surface, sluggishness, poor feeding the infected larvae were identified from the healthy individuals and it was subjected for screening to identify the type of infection affecting the worms. Productive bivoltine silkworm is obtained and used as a study material. The silkworm, *Bombyx mori* is a native of China but has long been domesticated throughout the world largely in the temperate and sub-tropical regions for its fine cocoon filaments. This study was carried out to find out the diseases of silkworm. The mulberry silkworm is prone to infection of various pathogenic organisms.

The pathogen infected individuals were isolated. Diseased and dead silkworms, their faecal matter, contaminated mulberry leaves and rearing appliances act as sources of infection. Wide fluctuation in temperature and humidity with poor quality mulberry Leaves are the major predisposing factors for flacherie. The diseased larvae showed symptoms such as cessation of feeding, flaccidity, loss of body lustre, sluggishness and dysentery. During the initial stages of infection the larva becomes lethargic and stops eating. At an advanced stage of infection the larva exhibits retarded growth, vomits gut juices and excretes semisolid faeces. The larva becomes soft and translucent. These insects were kept frozen until analyzed. Finally the larvae ferments and the inner content turns into a black coloured liquid, which emits foul odour.

Though the rearing site was carefully maintained the occurrence of diseases were normally seen which had implied that the environmental factor also caused some detrimental effect on the rearing individuals. The pathogenicity was examined from the period between 2nd January 2021 to 31st January 2021 and the rate of susceptibility to diseases had been noted down at different instar levels under rearing. The rate of

infestation were investigated at different instar level had been reported in the present study.

Results

The sericulture farm has been maintained with supplying the disinfectant vejitha in a scheduled manner. The temperature and humidity had also been maintained properly. Though the farm is maintained with proper physiological parameters the silkworms are commonly susceptible to various kinds of pathogens. The pathogenicity was examined from the period between 2nd January 2021 to 31st January 2021 and the rate of susceptibility to diseases had been noted down at different instar levels under rearing. Two types of diseases were identified in the sericulture unit during the study period. 1. Bacterial disease – Flacherie, 2. Fungal disease – White Muscardine. Bacterial flacherie were caused primarily by *Serretia marcesens. Streptococcus sp, and Staphylococcus sp* of bacteria.

Table-1 shows the percentage of prevalence of fungal disease ***White muscardine*** in silkworm larvae infected from II instar to V Instar larval Stage.

S. No	Date	Stages of Instar	No.of Sikworms Infected	Range of Silkorm (Infected in Numbers)	No.of Silk worm infected	% of disease prevalence
1	10.01.2021 11.01.2021 12.01.2021 13.01.2021	II	30 36 42 53	30 to53	161	7.4%
2	14.01.2021 15.01.2021 16.01.2021 17.01.2021 18.01.2021 19.01.2021	III	60 63 69 75 80 90	60 to 90	427	19.7%
3	20.01.2021 21.01.2021 22.01.2021 23.01.2021 24.01.2021 25.01.2021	IV	103 111 116 120 126 129	103-129	705	32.6%
4	26.01.2021 27.01.2021 28.01.2021 29.01.2021 30.01.2021 31.01.2021	V	132 137 140 145 149 154	132-154	857	39.6%

Table – 1 shows the Comparative analysis between the rate of prevalence and number of worms affected from II instar to V instar stage. The study report revealed that from 10th to 13th January the number of infected worms increased every day from 30 to 53 at the stage of II instar and 161 silkworms were totally affected by white muscardine diseases. The estimated rate of percentage of disease prevalence was 7.4%. The rate of infestation gradually increased to 19.7%, 32.6% and 39.6% in the III, IV and V instar stage respectively. The report portrayed that the number of infected silkworms found 30 on the first day of study later it raised to 90, 129 and 154 from II to V instar and the total number increased in each instar was 161, 427, 705 and 857 respectively. It clearly stated that the adult worms were easily susceptible to the pathogenicity rather than that of young worms. The young worms were able to sustain against the disease.

Table-2 Shows the percentage of prevalence of diseases in silkworm infected by Flacherie Disease in the IV th Instar.

Date	Instar	Flacherie Infected silkworm	% of prevalence
1 Jan 2021	IV Instar	7	70%
24 Jan 2021	IV Instar	3	30%

Table – 2 portrayed that the number of silkworms infected by another disease known as Flacherie caused by bacteria such as *Serretia marcesens, Streptococcus sp, and Staphylococcus sp* during IV instar stage. Compared with the white muscardine disease the rate of infestation caused by the flacherie was much less. When the larva entered into IV instar stage a least number of worms infected with flacherie. The investigated report revealed that 7 worms were infected with the rate of infestation was estimated about 70% on 21st January. But 2 days later the infestation rate was reduced only to 30% on 24th of January. This was the contradictory report against white muscardine which showed increasing trend of infestation from earlier period to adult stage.

Table 3 shows the larval weight, cocoon weight, Shell weight and Shell ratio in control as well as infected silkworm.

Parameters Group	Matured larval weight(g)	Cocoon weight (g)	Shell weight (g)	Shell ratio%
Control	2.55	1.77	0.35	17.04
Infected silkworm	2.07	0.75	0.1	13.01

In the sericulture farm the overall parameters such as matured larval weight (g) ,cocoon weight (g), shell weight(%) and shell ratio between controlled and disease silkworms had been taken and portrayed in table-3.

In the control group the weight of matured larvae was 2.55 g , the cocoon weight was 1.77 g and shell weight was 0.35g, and the overall shell ratio is 17.04%, but the diseased silkworm group the larval weight reduced to 2.07g cocoon weight 0.75g, shell weight 0.1 and the shell ratio reduced as much as to 13.01%. Thus the parameter clearly showed that if any larval forms would have severely affected by various kinds of infection and diseases that would cause prompt effect on the individual worm. Moreover the quality and weight of the cocoon, shell and shell ratio also reduced.

Discussion

There are several silk worm species are cultured for the production of silk. Among which the *Bombyx mori* is the most widely and intensively used for studying. The mulberry silkworm is easily susceptible to various diseases and is affected by parasites and pests. Various types of silkworm diseases are identified from the larval forms to the adult moth stage are caused by virus, bacteria, fungus and protozoa. When the larvae are infected with such a kinds of pathogens, the mortality rate is increased which ultimately reduce the quality and quantity of cocoon that would cause a great economic loss. In view of this the silkworm diseases are to be treated seriously otherwise it can create epidemic.

Many researchers worked on the control and prevention of silkworm diseases caused by microbes is flacherie, grasserie, muscardine and pebrine during rearing helps to increase the silk productivity by preventing the mortality to a great extent. The report was stated by Das and Shamsuddin, (2006) that temperature played a vital role on the growth of the silkworms. As silkworms are cold-blooded animals, temperature have a direct effect on various physiological activities. The temperature had a direct correlation with the growth of

silkworm; wide fluctuation of temperature was harmful to the development of silkworm.

Rahmathulla, (2014) stated that water is an essential requirement for metabolic activity and optimum growth. At higher temperature probably evapo-transpiration at body surfaces and respiratory epithelium of tracheal system significantly increases. The problem of water balance in silkworm at ambient temperature is further complicated by poor moisture content of the leaf, which finally affects the growth and productivity of Silk yield. Silkworms are greatly affected by White muscardine disease due to *B. bassiana* causesa which cause the cocoon yield loss upto 30 percent almost throughout the year (Lakshmi *et al.,* 2013).

In the present study the silkworm was heavily infected by white muscardine disease. This report was similar to the report stated by Chandrasekaran and Nataraju, (2008) who revealed that silkworm showed symptoms of white muscardine caused by fungus *Beauveria bassiana* the most common one in India.

In the present study the bacterial disease flacherie was infecting the IV and V instar in their later part of their life cycle. The result of the present study was similar to the study of Nataraju *et al*., (2005) who stated that the major fact responsible for bacterial flacherie was the rearing conditions. The rise in temperature and humidity in rearing place leads to dysfunction of alimentary canal which encourages flacherie.

The mummified stage of fungal disease was seen in the present study which was considered as highly contagious and dreadful. The whole body covered with white powdery mycelium and produces millions of conidia except the chitinous parts of the head region. It was proved by the report of Ishikawa & Miyajima, (1964). They portrayed that mummified larva remains hard, do not decay, spoil or smell.

The present study of fungal diseases was evidenced from the report of Bulmer & Formtling, (1983). Their report showed that infected survival larvae were spun the cocoons and unable to emerge as silk moth due to secondary infection was found in pupal stage. The Muscardine infection was due to body contamination by fungus and direct penetration by germ tube. This disease was acute with young worms and chronic with adult worms.

Many studies were carried out in India and other sericulture countries on white muscardine infecting the silkworms. Among different types of muscardine, white muscardine was the most common, caused by *Beauveria bassiana* (Bals.)

In the present study reported that muscardine was common and highly infected the

silkworm under rearing condition. According to the report of Samson et al.,(1990) and Anon, (1992), the muscardine of *B. bassiana* was a well known entomopathogen of worldwide distribution (Low temperature and relatively high humidity) played a great role for spread and development of muscardine disease in the rearing bed. Highest rate of infection and mortality was found during rearing, similarly there was a possibility for larvae to get infected either through food or other sources of contamination. Sometimes few worms are infected, it spreads within the host and affected worms release pathogens either through excreta or by direct contact leading to the secondary infection. This may ultimately lead to the spread of diseases in the rearing bed.

The incidence of muscardine disease was caused by high humidity and low temperature. The present study report was proved from the study of Samson et al., (1990). His investigation report stated that fungus infect primarily the third and fourth instars silkworm but the disease symptoms appear at late stage of infection and affected all stages of life cycle of silkworm. In Several reports from farmer of different Sericultural areas in India exhibit the cocoon crop loss due to silkworm diseases.

The present study was carried out between the 10th January and 31st January. Since it was the winter season, the incidence rate of infection was high. It was evidenced from the report of Dasgupta,(1961). He reported that major silkworm diseases caused by Grasserie (virus), Flacherie (bacteria), Muscardine (fungi) and Pebrine (protozoan /microspordian). Among the fungal diseases of silkworm, white muscardine and green muscardine possess a major threat to silk cocoon production during rainy and winter seasons as these two seasons were congenial for the spread of these diseases (Sengupta *et al.,* 1990).

Mummified larva looks like white chalky piece, different stages of diseased, healthy and dead larvae have been seen. The mummified stage considered as highly contagious and dreadful. The whole body covered with white powdery mycelium and produces millions of conidia except the chitinous parts of the head region. Mummified larva remains hard, do not decay, spoil or smell, unlike other diseased larvae of grasserie, flacherie and pebrine. Infected survival larvae were spun the cocoons and unable to emerge as silk moth due to secondary infection was found in pupal stage. These infectious microbes cause secondary infection and spread diseases stated by (Ishikawa & Miyajima, 1964).

According to the report of Ishikawa and Miyajima, (1964) no conspicuous

symptoms were noticed immediately after inoculation of fungal pathogen *Beauveria bassiana*. This has been proved in the present study which revealed that the infected silkworm became inactive, sluggish, stopped the feed underneath the mulberry leaves. After 48hours, the infected worms started to vomit digestive and remained juice and later, the worms gradually became stiff and the movement of the worms was very much restricted and colour of the body changed to brown colour with oily specks. Initially the oily specks are in small in size with the advancement of the age, the size and number of the oil specks was enhanced. Then the silkworm body became soft, pliable and later stiff and hard. Nearly on 7th or 8th day of the infection white efflorescence noticed near intersegment region, spiracles, and then complete body was covered with the white mycelia and finally conidia developed on the body. The mummified cadaver became brittle and breaks into pieces when dropped from a certain height.

Infected worms fail to spin the cocoons but those which spin produces flimsy cocoons. Cocoons formed by these infected worms were smaller and lighter in weight and the worms not emerged as moths, (Seema et al., 2019). The matured larval, cocoon and shell weight significantly reduced in the heavily infected silkworms. It was proved from the report of Seema et al.,(2018) who stated that the overt changes observed in the economical traits of cocoon in *Beauveria bassiana* infected silkworm. Appropriate matured larval weights are an indicator to measure the health of silkworm and in turn to obtain good quality of cocoon. Cocoon weight is an important commercial character used to determine the amount of raw silk that can be obtained, (Seema et al., 2018).

The fineness of cocoon filament is expressed by size i.e. denier. Reduction in the matured larval weight may be due to the consequence of fungal infection that leads to the decrease in food consumption, digestion, relative consumption rate, efficiency of conversion of ingested food in fifth instar of *Bombyx mori*, (Raj *et al* (2002). The shell weight is more important than the cocoon weight since the shell yields the silk for reeling. Thus, higher the weight of the shell, greater will be the silk yield with the references cited in the discussion, it was concluded that the silkworm larvae might have been affected by physical parameters such as temperature and humidity. It might have severely been affected by the pathogens such as protozoan, bacteria and fungi. Utmost care must be given to rearing silkworm and their various levels of instar from II to V stage in the sericulture farm that would prevent the culturist from economic loss.

Conclusion

When periodically the sericulture farm was visited to observe incidence of pathogenecity of silkworm *Bombyx mori* in the sericulture unit, various kinds of silkworm diseases such as White muscardine and Flacherie were identified. The form of white sporulation, vomiting and colour changes also noticed in at the rearing unit. The infected silkworms were collected from random sampling method. The percentage of prevalence rate of infection was identified at different instars were recorded.

It was concluded that the number infected silkworm was measured totally 2160 among which the larvae infected with White muscardine during II Instar were161, III Instar 427, IV instar 705 and V instar 857. The silkworm infected with flacherie disease was seen in the IV instar, totally 10 silkworms were reported to have flacherie. White muscardine was found from 2nd to 5th instar stage and it affected the total number of 2160 silkworm. Flacherie diseases were found only in 4th instar laeval stage and it affected the total number of 10 silkworms. The results achieved were discussed with the relevant literature.

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வைரமுத்துவின் புதினங்கள் பழமொழி எனும் படைப்பாக்க உத்திப்பயன்பாடு

முனைவர் சோ.தண்டபாணி

உதவிப் பேராசிரியர், தமிழ்த்துறை, எம்.வி.முத்தையா அரசு மகளிர் கலைக்கல்லூரி, திண்டுக்கல்

முன்னுரை

செவிவழியாகத் தொடங்கி எழுத்திலக்கியமாகத் தோற்றம் பெற்ற இலக்கிய வடிவம் என்றால், அது கதைகூறும் இலக்கிய வடிவமான புதின இலக்கிய வகையே ஆகும். இவ்விலக்கிய வடிவம் மனித வாழ்வோடு பன்னெடுங்காலமாகத் தொடர்பிலிருக்கும் ஒரு கலைக்கூறாகும். சங்க இலக்கிய அகப்பாடல்கள் சிறு சிறு கதை நிகழ்வுகளாக அமைந்து படிப்பவர் உள்ளத்தில் பலவிதமான உணர்வுகளை எழுப்பி இன்பமுறச் செய்தன. அதனால் அவை இன்றும் நிலைத்து நிற்கின்றன. அவ்வாறு படிப்பவர் உள்ளத்தில் தாம் சொல்ல வரும் கருத்து நிலைத்து நிற்பதற்கும், தெளிவாக உணர்ந்து கொள்வதற்கும் சங்கப் புலவர்கள் தொடங்கி இன்றுள்ள படைப்பாளர்கள் வரை பல்வேறு உத்திகளைக் கையாளுகின்றனர். அவ்வுத்திகளில் பழமொழியும் ஒன்று. கவிஞர் வைரமுத்து தன்னுடைய புதினங்களில் பழமொழி என்னும் உத்தியைப் பயன்படுத்தியுள்ளதைப் பற்றி இக்கட்டுரை எடுத்துக்கூறுகின்றது.

உத்தி - விளக்கம்

தமிழ் இலக்கிய மரபில் ஒவ்வொரு காலக்கட்டத்திலும் தோன்றிய படைப்புகள் தாம் கூற வந்த செய்தியை வெளியிட்ட ஒரு குறிப்பிட்ட உத்தியையோ அல்லது பல்வேறு உத்திகளையோ பயன்படுத்துவதுண்டு. இவ்வுத்திகள் படைப்பின் தரத்தை உயர்த்துவதாக அமைதல் வேண்டும். அத்தகைய உத்திகளைப் பற்றி நன்னூலார்,

> "நுதலிப் புகுதல் ஒத்து முறை வைப்பே
> தொடுத்துச் சுட்டல் வகுத்துக் காட்டல்
> முடித்துக் காட்டல் முடிவு இடம் கூறல்
> ....
> ....
> ஒன்றினம் முடித்தல் தன்னினம் முடித்தல்
> உய்த்து உணர வைப்பு என உத்தி என் நான்கே"[1]

என்ற நூற்பாவின் மூலம் 32 உத்திகள் நூலில் பயன்படுத்தப்படுவதைப் பற்றிக் குறிப்பிட்டுள்ளார்.

'ஒத்த காட்சி உத்தி வகை விரிப்பின்' என்பது தொல்காப்பியம். இதற்கு இளம்பூரணர் **"உத்தியை அது சூத்திரத்தின் பாற் கிடப்போர் பொருள் வேறுபாடு காட்டுவது"**[2] என விளக்குகிறார்.

ஒரு படைப்பாளனின் படைப்பு சிறப்பதற்கும், வாசகர் மனதில் நீங்கா இடம் பெறுவதற்கும் இவ்வுத்திகள் மிகவும் இன்றியமையாததாகின்றன.

பழமொழிகள்

'பழமொழி என்ற சொல்லே நமக்கு அதன் பொருளை உணர்த்தி நிற்கின்றது. பழமொழி என்பது வாய்மொழி இலக்கியமான நாட்டுப்புற இலக்கியத்தின் ஒரு பகுதியாகும். இது நாட்டுப்புற மக்களின் அனுபவ மொழியாக விளங்குகின்றது. பழமொழிகள் தாம் கூற வந்த அழுத்தமான கருத்துக்களால் அவர்களின் மனக்குறிப்பை நமக்குச் சுருங்கச் சொல்லி விளங்க வைக்கின்றது.

> **"நுண்மையும் சுருக்கமும் ஒளியும் உடைமையும்**
> **நுண்மையும் என்றிவை விளங்கத் தோன்றிக்**
> **குறித்த பொருளை முடித்தற்கு வரூஉம்**
> **ஏது நுதலிய முதுமொழி"**[3]

என்ற தொல்காப்பிய நூற்பாவின் வழி அவர் காலத்திலேயே பழமொழிகள் வழக்கத்திலிருந்தது தெரியவருகின்றது.

கவிஞரின் புதினங்கள் தேனி மாவட்டத்தையும் அதனைச் சுற்றியுள்ள கிராமப்புறங்களையுமே கதைக் களமாகக் கொண்டுள்ளதால் அப்பகுதி மக்களிடையே வழக்கத்திலுள்ள பழமொழிகள் புதினங்களில் அதிகமாகக் கவிஞரால் பயன்படுத்தப்பட்டுள்ளது.

இப்பழமொழிகள் புதினங்களில்
1. விவசாயம் சார்ந்தது
2. சமூகம் சார்ந்தது

என இரண்டு வகையாகப் பாகுபடுத்தப்படுகிறது.

1. விவசாயம் சார்ந்தது

வேட்டைச் சமூகமாகத் தன் வாழ்க்கையைத் தொடங்கிய மனித சமூகம் பின் வேட்டைக்குப் பயன்படுத்திய விலங்குகளை வைத்து விவசாயச் சமூகமாக அவர்கள்

வாழ்க்கை பரிணமிக்கத் தொடங்கியது. அதன்பின் தான் நாகரீகம் வளர்ந்தது. பண்டமாற்று முறை வளர்ந்தது. அதன் விளைவே இன்று ஏற்றுமதி, இறக்குமதி என்ற நிலையில் மையம் கொண்டது.

"தை ஒழவு அய்யாட்டுக் கெடைடா"

<div align="right">(க.கா.இ.ப. 18)</div>

தாவரங்களுக்கு எவ்வளவு தான் உரம் போட்டாலும் நிலத்திற்கு ஆட்டுப்புழுக்கையும், கோமியமும் சேர்ந்தா பொட்டல்காடு கூட பொன் விளையும் பூமியாக மாறிவிடும். அவ்வாறு ஐந்து ஆட்டுக்கெடா வச்சா என்ன ஊட்டமோ அப்படியொரு ஊட்டம்தான் தைமாதம் உழுகும் உழவுக்கு என்பது பழமொழியின் பொருள்.

"நண்டுர நெல்லு
நரியோடக் கரும்பு
வண்டியோட வா(ழை)ழ
தேரோடத் தென்ன"

<div align="right">(க.கா.இ.ப. 7)</div>

விவசாயம் தெரிந்திருந்தாலும், விவசாயம் செய்தாலும் மட்டும் பத்தாது. ஒரு செடியை எந்த அளவிற்கு இடைவெளிவிட்டு நட வேண்டும் என்பதையும் விவசாயப் பெருங்குடிகள் அறிந்திருந்தனர். அந்த அனுபவத்தையும் அவர்கள் பழமொழியாக்கிப் பத்திரப்படுத்திக் கொண்டனர். நெல்லு நட்டால் இரண்டு நாற்றுக்கும் மத்தியில் நண்டோடனும். கரும்பு நட்டா இரண்டு கரும்புக்கும் இடையில் நரி ஓட வேண்டும். வாழை நட்டால் இரண்டு வாழைக்கும் இடையில் வண்டியோட வேண்டும். தென்னை நட்டால் இரண்டு தென்னைக்கும் இடையில் தேரோட வேண்டும் என்பதே நாற்றுக்காண இடைவெளிக் கணக்கு.

"தென வெதைச்சாத் தென அறுக்கணும் வென வெதைச்சா வென அறுக்கணுமில்ல"

<div align="right">(க.கா.இ.ப. 154)</div>

நாம் எப்பொழுதும் மனதில் நல்ல எண்ணங்களையே கொண்டிருக்க வேண்டும். நாம் பிறருக்கு என்ன செய்ய எண்ணுகின்றமோ அச்செயலே நமக்கும் நடக்கும் என்பதே இப்பழமொழியின் பொருள்.

"பனமரம் வச்சவன் பாத்துகிட்டே சாவானாம்; தென்னமரம் வச்சவன் தின்னுட்டுச் சாவானாம்"

<div align="right">(க.கா.இ.ப. 256)</div>

தென்னை மரம் நட்டு வைத்து இரண்டு அல்லது மூன்று ஆண்டுகளில் காய்ப்புக்கு வந்து விடும். அதனால் அதன் பயனை இரண்டு அல்லது மூன்று ஆண்டுகளில் நாம் பெற முடியும். ஆனால் பனைமரம் 30m உயரம் வரை வளரக் கூடியது. பனை மரம் நட்டு வைத்துப் பத்து ஆண்டுகள் ஆனபின் தான் 15m வரை வளரும். அது காய்ப்புக்கு வருவதற்கு எப்படியும் 15 அல்லது 20 ஆண்டுகள் ஆகும். அதன் பயனை மரம் நட்டவர்கள் அனுபவிப்பார்களா என்பது சந்தேகமே. அதனைப் பார்க்க மட்டுமே முடியும் நட்டு வைத்தவன். இந்த அனுபவத்தின் அடிப்படையிலேயே இப்பழமொழி இன்று வரை பயன்படுத்தப்பட்டு வருகிறது.

2. சமூகம் சார்ந்தது

தமிழில் பழமொழிகள் பல பெயர்களில் வழங்கப்படுகிறது. பழஞ்சொல், முதுமொழி, முதுசொல், வசனம், சொலவம், சொலவடை என்னும் பெயர்களில் மக்களிடம் வழக்கத்திலுள்ளது. இதில் வழங்கப்படும் ஒவ்வொரு பெயரும் ஒரு காரணப் பெயரே. இப்பெயரிலே அதற்கான காரணமும் தெரிகின்றது. மொத்தத்தில் பழமொழி என்பது ஒருவரின் அனுபவமொழி.

"பழமொழிகளின் அமைப்புகள் பலவாக உள்ளன. வெறுமனே கூற்றாகவும், மறுப்பாகவும், வினாவாகவும், உரையாடலாகவும் அமைகின்றன."[4]

கவிஞர் வைரமுத்துவின் "கள்ளிக்காட்டு இதிகாசம்" புதினத்தில் ஒருவருக்கு அறிவுரை கூறும்போதும் இப்பழமொழிகள் பயன்படுத்தப்பட்டுள்ளன.

"உள்ளதும் போச்சுடா நொள்ளக்கண்ணான்னு ஒக்காந்திருக்கயே"

(க.கா.இ.ப. 21)

கள்ளிக்காட்டு இதிகாசம் புதினத்தில் முருகாயி, பேயத்தேவருக்கும் மொக்கராசுவிற்கும் மறுமாத்தத்தைத் தூக்குச் சட்டியின் மூடியின் அடிப்பாகத்தில் தடவிவிட்டிருக்க அது கஞ்சியின் அலையில் பட்டுக் கரைந்து விடுகிறது. மூடியின் மேல்பாகத்தில் இருந்தாலும் பறவைகள் உண்டது போக மிச்சமிருக்கும். ஆனால் இன்று கஞ்சியில் விழுந்து கரைந்தே போய்விட்டது. அப்பொழுது பேயத்தேவர் மொக்கராசுவிடம் இப்பழமொழியைக் கூறுகிறார்.

"ஒரு மாடு குடும்பங்காக்கும்; ஒன்பது மாடு குலங்காக்கும்"

(க.கா.இ.பக். 27-28)

இது விவசாய வாழ்வில் வேரோடிய ஒரு நம்பிக்கையான பழமொழியாகும். ஒரு விவசாயி ஒரு மாடு வைத்திருந்தால் அம்மாடு அவன் குடும்பத்தைக் காப்பாற்றும். ஆனால் அவனிடம் ஒன்பது மாடு இருந்தால் அம்மாடுகள் அவன் பரம்பரையையே காப்பாற்றும் என்பது மாட்டின் மீது மனிதன் கொண்ட நம்பிக்கை.

"அவனை நெருப்பென்று தள்ளவும் முடியாது இனிப்பென்று கொள்ளவும் முடியாது"

(க.கா.இ.ப. 33)

சிலரிடம் கோபமும் அன்பும் சேர்ந்து காணப்படும். அவர்கள் எப்ப எந்த குணத்தோடு இருப்பார்கள் என்று தெரிந்து கொள்ளமுடியாது. அதற்காக இப்பழமொழி பயன்படுத்தப்படுகின்றது.

"மூடி மூடி வச்சாலும் முட்டக்குள்ளயிருந்து மொசலா வரப்போகுது"

(க.கா.இ.ப. 46)

"கள்ளிக்காட்டு இதிகாசம்" புதினத்தில் பேயத்தேவரின் மகளான செல்லத்தாயிக்கு இரண்டாவது திருமணத்திற்கு அவளை அலங்காரம் செய்கின்றனர். எவ்வளவு தான் அலங்காரம் செய்தாலும் இருக்கின்ற அழகு தான் இருக்கும் என்ற பொருளில் இப்பழமொழி பயன்படுத்தப்படுகிறது.

"ஓலப்பாயில ஒண்ணுக்கிருந்தவன் மாதிரி"

(க.கா.இ.ப. 53)

தொணதொணவென்று பேசிக் கொண்டிருப்பவனைப் பார்த்துப் பயன்படுத்தும் பழமொழி இது. செல்லத்தாயின் இரண்டாவது கணவனான ஒச்சுக்காளை திருமணத்திற்குப் பேயத்தேவர் போடுகிறேன் என்று கூறிய நகையைப் பற்றியே ஒச்சுக்காளை பேசிக் கொண்டிருக்கும் போது கூட்டத்தில் இருப்பவர்கள் இப்பழமொழியைப் பயன்படுத்துகிறார்கள்.

"ஒத்துவாழவும் முடியல. ரெண்டாம் பொழப்பும் இப்படியாச்சேன்னு ஊரு வையுமே..... அதனால அத்துவாழவும் முடியல" (க.கா.இ.ப. 59)

கணவன் செய்யும் கொடுமைகளால் செல்லத்தாயிக்கு அவனுடன் சேர்ந்து வாழவும் முடியவில்லை. இரண்டாம் திருமண வாழ்க்கையும் இப்படி ஆகிவிட்டதே என்று ஊர் மக்கள் பேசும் பேச்சிற்குப் பயந்து அவனை அத்து வாழவும் முடியவில்லை.

"ஒழச்சா தானப்பா ஒழக்கு நிறையும்"

"கழுத பேஞ்சா கம்மா நெறையப் போகுது"

(க.கா.இ.ப. 75)

பேயத்தேவரின் மகனான சின்னு சட்டை கசங்காமல் சம்பாதிக்க ஆசைப்பட்டுக் கஞ்சா விற்கத் தொடங்கினான். அப்பொழுது பேயத்தேவர் உழைத்த காசுதான் உடம்பில் ஒட்டும் என்று கூற அதற்கு அவன் என்னைக்கு விவசாயம் செய்து அதிகப் பணம் சம்பாதிப்பது என்று கூற இப்பழமொழி பயன்படுத்தப்படுகிறது.

　　　　"உப்புத் தின்னா தண்ணி குடி"　　　　　　(க.கா.இ.ப. 124)

பேயத்தேவரின் மகன் ஒரே மரத்தை இருவர்க்கு விற்றுவிட அவர்கள் அவனைத் தண்டிக்கும் போது இப்பழமொழியைப் பேயத்தேவர் பயன்படுத்துகிறார்.

　　　　"நெல்லு சிந்தினா அள்ளலாம். சொல்லு சிந்தினா அள்ள முடியாது"

　　　　　　　　　　　　　　　　　　　　(க.கா.இ.ப. 139)

அதாவது கோபத்தில் பேசும் போது வார்த்தைகளைப் பார்த்துப் பயன்படுத்த வேண்டும். அப்படிப் பேசிய சொற்களைத் திரும்பப் பெற்றுக் கொள்ள இயலாது. அந்தச் சொல் பாதிக்கப்பட்டவரின் மனதைச் சுட்டுக் கொண்டேயிருக்கும். இப்பழமொழி வள்ளுவரின்,

　　　　"தீயினால் சுட்டபுண் உள்ளாறும் ஆறாதே
　　　　நாவினால் சுட்ட வடு"[5]

　　　　"செத்தும் கொடுத்தாளே சீலக்காரி"
　　　　"குடுக்கிற தெய்வம் கோழிக் கூட்டப் பிரிச்சுக் குடுத்திருக்கப்பா"

　　　　　　　　　　　　　　　　　　　　(க.கா.இ.ப. 141)

பேயத்தேவரின் மகன் பட்ட கடனை எப்படி அடைப்பது என்று மனமொடிந்து நின்ற பேயத்தேவரிடம் அழகம்மாள் சேர்த்து வைத்தப் பணம் என்று உடைந்த கோழிக்கூட்டில் இருந்த பணத்தை முருகாயி பேயத்தேவரிடம் கொடுக்கும் போது இப்பழமொழி பயன்படுத்தப்படுகின்றது.

　　　　"பால் திரியத் தொடங்கும் நேரம் பாத்திரத்துக்குத் தெரியாது என்பது போல பிள்ளைகள் கெடத் தொடங்கும் நேரமும் பெற்றவர்களுக்குத் தெரிவதில்லை" (க.கா.இ.ப. 155)

பால் திரிவதை எவ்வாறு பாத்திரம் அறியாதோ அதுபோல் பிள்ளைகள் கெடத் தொடங்கும் நேரமும் பெற்றவர்களுக்குத் தெரிவதில்லை. பேயத்தேவரின் மகன் சின்னு கெட்டுப் போனதும் ஆரம்பத்தில் பேயத்தேவருக்குத் தெரியவில்லை.

"மூங்கில் பட்டைய வச்சு முக்கி முக்கிக் கட்டிப்பாத்தாலும் நிமிரவா போகுது நாய்வாலு"　　(க.கா.இ.ப. 236)

பேயத்தேவர் - முருகாயி இவர்களின் காதலை சாதியைக் காரணம் காட்டி இச்சமூகம் ஏற்க மறுக்கின்றது. ஆனால் எவ்வளவு தான் மனதிற்குக் கட்டுப்பாடுகள் போட்டாலும் அவரின் மனம் முருகாயியை நினைத்துக் கொண்டேயிருக்கிறது. அப்பொழுது இப்பழமொழி பயன்படுத்தப்படுகிறது.

"ஈறைப் பேனாக்கி பேனைப் பெருமாளாக்குகிற கிராமம்"

(க.கா.இ.ப. 245)

இப்பழமொழி சங்க இலக்கியங்களில் இடம்பெறும் அம்பல், அலர் போன்றது.

"சிலரும் பலரும் கடைக்கண் நோக்கி
மூக்கின் உச்சிச் சுட்டுவிரல் சேர்த்தி
மறுகில் பெண்டிர் அம்பல் தூற்ற
....
....
அலர் சுமந்து ஒழிக இவ் அழுங்கல் ஊரே"[6]

சங்க இலக்கியங்களில் எவ்வாறு சிலரும் பலரும் கூடித் தலைவன் தலைவியையப் பற்றி எவ்வாறு பேசினார்களோ அதுபோலவே பேயத்தேவர் முருகாயி இவர்களின் காதலை அம்பலக்கல்லிலும் வயல்வெளியிலும் ஆண்களும் பெண்களுமாய்க் கூடிக் கூடிப் பேசுகின்றனர். அப்படி அவர்கள் பேசும் போது இப்பழமொழி பயன்படுத்தப்படுகிறது.

தொகுப்புரை

பழமொழிகள் மக்களின் வாழ்வைப் படம்பிடித்துக் காட்டும் காலக் கண்ணாடிகள். இப்பழமொழிகள் அம்மக்களின் அனுபவ மொழிகள். சுருங்கச் சொல்லி விளங்க வைக்கும் கருத்துப் பெட்டகங்கள். புதினங்களில் இப்பழமொழிகள் பயன்படுத்தப்படும் போது ஆசிரியர் கூற வந்த கருத்து வாசகர்களுக்குத் தெள்ளத் தெளிவாகப் புரியவைக்க முடிகின்றது. பழமொழிகள் என்ற சொல்லே அதன் பொருளை நமக்குப் புரிய வைக்கின்றது. ஒவ்வொரு பழமொழிக்குப் பின்னும் அவர்களின் அனுபவம் என்னும் ஒரு கதை பொதிந்திருப்பதை உணர முடிகின்றது. இப்பழமொழிகளைப் புதினங்களில் பயன்படுத்துவதன் மூலம் வாசிக்கும் வாசகர்களின் கவனத்தைப் புதினங்கள் ஈர்க்கின்றன.

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GOPAL NAICKER – A FREEDOM FIGHTER IN DINDUGUL

Dr. J. Dhanasekaran

Assistant Professor in History, M.V.Muthaiah Govt. Arts College for Women, Dindigul

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Gopal Naicker was born on 14th January 1728. His original name was Thirumalai Kupala Chinnapa Naicker. His Father name was Tirumalai Dhasari Chinnapa Naicker. His wife is Pappammal. He had two sons namely Muthuvel Naicker and Ponappanaicker. Thirumalai Kupala Chinnapa Naicker was hailed as Kupalabatch Prime warrior of freedom struggle from Tamil Nadu by Tippu Sultan and as Gopal Naicker by people. He reined Virupaatchi for 40 years. He was the principal architect of the coalition of the Poligars. In 1795 they deposed the Setupati of Ramanathapuram\, but failed to win the allegiance of the inhabitants. The proceedings of the Madras Government, Military Consultations during the period 1789 and 1799-1801 also indicate the earlier relations of the company with Palayakkarars[1]. The Poligar Rebellion which culminated during the period 1799-1801 was a great event in the history of Tamil Nadu[2]. They made deep inroads into the liberties of the poligars and nattamakars[3] too and offended their sentiments[4]. Further the changes introduced by the company threw a large section of the people out of employment and created insecurity in the villages[5]. The company not only waged a series of wars and stringent measures against these traditional chieftains for default of payments or defiance to its authority, but overthrew and at times executed them.

Thus the Madras Council deposed Cambia Nayak, Poligar of Sapatore for his failure to pay tribute. The chief turned rebel was caught and executed poojari Nayak of Deodanapetty met with the same fate. In 1799 Kattabomman and other poligars were suppressed[6]. This was followed by the abolition of the Poligar system further, the replacement of one branch of the ruling house of a pollam by another was reduced to an accepted practice. This policy excited mutual jealousies and created an animosity towards the English and raised the banner of revolt[7]. The axe of coercion fell heavily upon the poligars of Dindigul[8].

In 1784, after an agreement between the Mysore province and British army, Dindigul was restored by Mysore province.In 1788, Tipu Sultan, the Son of Haider Ali, was crowned as King of Dindigul. In 1790, James Stewart of the British army gained control over Dindigul by invading it in the second war of Mysore. In a pact made in 1792, Tipu ceded Dindigul along with the fort to the English. Dindigul is the first region to come under English rule in the Madurai District. In 1798, the British army strengthened the hill fort with cannons and built sentinel rooms in every corner.

The South India Rebellion of 1800-1801 represented a violent reaction against the growing influence of the English.The Rebellion of 1800-1801 was organised with a pre-determined motive of destroying British imperialism[9]. It spread over an extensive region and assumed the proportions of a mass movement.The horrors that attended the growth of imperialism spread a wave of revulsion and led the inhabitants to united action.The common people of South India to liberate the 'peninsula of Jamba Dwipa' from British yoke. This was more because of the support extended by the local princes to the alien ruler[10].

In the beginning the rebellion broke out in Tirunveli and Dindigul, but the other parts of Tamilnadu remained quiet. It was only when these rebellions were suppressed that fresh rising broke out in the Marava country, Madurai and Thanjavur. Hence the company found it no impossible a task to crush the insurrection still certain trends in the rebellion tend to establish that it assumed the proportions of a popular rebellion. The proclamations of the rebels indicate that they believed in a mass movement against the British.

The English accords of the period refer to the inhabitants of different territories flocking to the rebel ranks quite voluntarily. In addition to these, the kuravai which was the war cry of the rebels and the killah-a leaf pierced with the nail-when sent to the villages served the purpose of summons to bring the inhabitants to the battle fields[11]. In response men sent from Plani, Ayacudi, Kannivadi, Veeramalai and soon jointed them in strength[12]. Hence it might not be improper to consider that the insurrection assumed the proportions of a popular outbreak particularly in 1801. Still defeat was inevitable because of the military strength of the Company, the support of its allies and command of vast resources. The British people formulated divide and Rule strategy and gamed over the Palayakaras.

Palayakarars rebelled against the huge amount of tax levied by the British.The people reached a stage where they have to sell all their properties and crop yields to pay the tax. The Palayakaras decided to fight against the British to protect the cause of the peoplemuch more vigor and vehemence. Among the polygarsGopalaNayak of Dindigul Who spearheaded the movement and organised a formidable confederacy for overthrow of the British rule.They held a conspiracy in Dindigul and rose in arms with an attack on Coimbatore on the June 3rd, 1800[13]. The insurrection spread over an extensive region, to Sholapur in the north and Nanguneri in the far South. In this great struggle the Tamils played the most remarkable role. The proclamation and letters of the rebel's clues to the causes of the insurrection[14]. Their grievances were that the English reduced the hereditary rulers to the humiliating states of "a window" , treated the sons of soil like 'dogs', showed no honour to the customs of the land, denied the peasants due share of the crops, and made the rice 'vellum' or water.

The Dindugulfort played a major role during the Polygar wars, between the Palayakarars and the British. The Polygar of Virupachi, Gopal Nayak formed a revolutimary Alliance organing the Palayakaras of Dindigul and commanded the Dindugul division of Polygar, and during the wars aided the Sivaganga queen QueenVelu Nachiyar and her commanders Maruthu Pandiyar Brothers to stay the fort after permission from Hyder Ali.The king of Sivaganga Muthuvaduga Nathar[15] was shot to dead inkalaiyakavil war. Queen Velu Nachiyar, who escaped from the deadly attack of the British, came to the palace of Gopal Naicker along with her daughter Vellacci, Minister Thandavarayanpillai and Maruthu Brothers. Velu Nachiyar sweared on to redeem the country from the British and Gopal Naicker assured to support her. Gopal Naickers Guidance was the major reason behind the success of Velu Nachiyar.

After hanging Veerapandiya Kattabomman to death in Kayastha, the British imprisoned his brother Oomaithurai in Palayankottai prison Gopal Naicker and Maruthu devised a plan to redeem Oomaithurai. They entered the prison tactically by preparing and army dressed like people carrying 'Karadi' to Tiruchendur after the battle redeemed Oomadurai. Oomadurai, who was out from the prison, executed the heads of the British who came to attack him swood urging swirl Gopal Naicker made him king of Panchalankurichi again Granting and award and 6,000 soldiers.The Collector of Dindigul

B. Hardis who came to know through his spy's that Gopal Naicker was the reason for Gorilla attack all over the country, Summoned him with charges against him but Gopal Naicker did not respond. The second summon threatened him to surrender in November 1799. Gopal Naicker, even at the age of 72, did not fear about the threatering and started to chalk out a plan for the final attack.

A large Army under the leadership of Gopal Naicker and Keralavarma drove out the British army in Dindigul Rockfort and captured the exphosives guns in the weapon warehouse. The British were not able to withstand the Gorilla war strategy. The army of GopalNaicker destroyed the Military equipment's in the Dindigul fort after streneous efforts. The army of Tippu sultan under the leadership of GopalNaicker fought with the British army in Dindigul fort. The British who came to knew about the final phase of war counter attracted with canons around Coimbatore in 03.06.1800. Lieufinent cornel Ennas seiged Virupatchi with a large army in 12.10.1800. The rebellion broke out in Virupakshi and spread over most of Dindigul. Hence the rebellion remained centred to the Dindigul area. He attacked the surroundings, Chatrapatti and Nangoanchi till 14th. They sieged the British palace. The people of periyakottai actively involved in the war demanding their lives for the sake of Gopal Naicker. The fort of Periakotai the residence of GopalNayak was reconstructed[16]. Trees were field with across the roads for obstructing communications of THE British. After completing these preperations the rebels announced to the villages of their decision to send an expedition to Virupakshi, Chattrapatty and Palani[17] and attacked the revenue establishments of the company.

The people belonging to Vellore fought along with the people of Periyakottai against the British in Chatrapatti. The people gathered in front of the Jamin Palace of Chatrapati and fought against the British and lost their lives. The people of Periyakottai, Chatrapati and Vellore fought against the British Army but were not able to withstand the modern war weapons of the British and lost their lives[18]. They fought valiantly till their last breath.The struggle was attended with bitter ferocity and immense slaughter. The rebels paid more dearly then the English as they were neither disciplined nor adequately armed, the rebels had a well concerted plan of action but it did not work up to expectations. Gopal Naicker escaped without being caught by the enemies. The palace of Virupatchi was crushed to ground by the furious enemies. Who were not able to trap Gopal

Naicker? The British could not find out Gopal Naicker after Virupatchi war, even after a rigorous search for a span of 2 months.

So they fired an amount of Rs.20, 000 for his head. GopalNaicker was betrayed of for the sake of money. The British imprisoned him on 04.05.1801 and he was tortured in the prison.In the year 1801, Gopal Naicker was hanged to death in Virupatchi Fort by the British. Gopal Naicker sweared during his death that Millions of people would gather and will bring an end to the British Rule.A Manimandam for Gopal Naicker was constructed in Dindigul district at a cost of Rs.69 lakhs and inaugurated by The Hon'ble Chief Minister of Tamilnadu Selvi J Jayalalithaa on 20th February 2013.   Thenpandi Singam is a Tamil historical novel written by kalaignar M.Karunanidhi. The British army, under statten stayed at Dindigul fort from 1798 to 1859. Dindigul was under the rule of the British Until India got our Independence on 15 August 1947.

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EXPERIENCES AND ENCOUNTERS IN THE NOVELS OF IMMIGRANT WRITERS

Ms.H.Surya Prabha[1] and Dr.K.M.Sumathi[2]

[1]Assistant Professor of English, M.V.Muthiah Govt. Arts College for Women, Dindigul.
Email: suryasri1909@gmail.com
[2]Assistant Professor of English, M.V.Muthiah Govt. Arts College for Women, Dindigul,
sumaangel@yahoo.com

Abstract

Perspectives that emerge from at least two cultures, identities and in some cases, languages, forge the recent literature of emigration and exile. The themes in migrant literature, however, vary depending not only on country of origin but also on the pattern of migration itself. The main focus of migrant literature is often directed at the act of migration to another land, issues of ruthlessness and racism, nostalgia and longing. Recently, there is recognition that global uprootedness is a global phenomenon and the focus, in an odd way, is not on the country of origin or of arrival but on the community that that does not fully belong either. The paper aims at conventions and customs discussed in the novels of the two immigrant writers, Bapsi Sidhwa and Chitra Banerjee Divakaruni.

Keywords: Biculturalism, marginalization, fundamentalism, authoritarianism.

For the immigrants, the process of fitting into their new home country involves the loosening of ties with the country of their origin, a strong sense of dislocation within the family where traditional gender roles are newly defined under the pressure of the surrounding society in the newly acquired community. They are in between the more traditional expectation on one hand and their own practical choice for the acquiring of a new identity on the other. They undergo the plight of identity crisis, cultural dilemmas and displacement.

Biculturalism has impinged upon the consciousness of a number of South Asian writers who have been uprooted from their soil sometimes for the glamour and sometimes for greener fodder or the no-hold-barred sort of lifestyle. The writers feel an archetypal urge to scrutinize their colonial existence and the lure of the western world. They explore

the sub-continental expatriate sensibility in the backdrop of intense political environment with its impact on their personal life.

Bapsi Sidhwa, a Pakistani novelist and Chitra Banerjee Divakaruni, an Indian novelist are immigrants to the United States of America. They have tried to explore transformations in one's life and subsequent consequences in the wake of Americanization and globalization. The project the political background and biographical details through their novels. The gender marginalization and exploitation has jeopardised their existence first as immigrants and then as women, despite the change in locale and culture. As the Asian women expatriates in the USA, they use their novels as the socio-political commentary of both the Asian and the Western societies.

Bapsi Sidhwa's *An American Brat* is a tale of a young Parsi girl Feroza, set in the late 1970s Lahore, a testing time for Pakistan when Zulfikar Ali Bhutto, pakistan's popular Prime Minister has been overthrown by the army dictator, Zia-Ul-Hag. In Pakistan, there is general descent into authoritarianism in the name of religion and the non-Islamic communities, like the Parsi's are affected by the increasing fundamentalism. To the Parsi community, Bhutto comes across as a hero, the embodiment of liberalism, progress of rigid thinking and the champion of women's rights, Bapsi Sidhwa, born in Lahore in undivided India, belongs to the Parsi community in Pakistan. During the time of British Colonialism, the Parsi community enjoyed an exclusive status on par with the ruling English. After the partition, like many other Parsis, in Lahore and Karachi, Sidhwa's family decided to stay in the newly, created state of Pakistan and later has settled in the USA. She feels that she is a Parsi first, then a Pakistani specifically a Punjabi and a woman simply by gender. Her novels are fictional expansion of the varied experience of life and society in Pakistan and America. In *An American Brat,* she chronicles the adventures of a young Pakistani Parci girl Feroza Ginwalla in America.

The novel exhibits three phases of Feroza's life: the first phase in her hometown, very timid, tensed and complex-written, the second phase, the process of learning through experience and the third phase, the climax of expansion and transformation. Feroza represents the expatriate youngsters who are trying to strike a balance between tradition and modernity, past and present dependence and freedom. Sidhwa contrast the combined atmosphere of girls in the subcontinent and the freedom in the USA. But the migrant

Feroza has learnt to adjust herself to a different culture. She has resolved to marry a man whom she comes to like without bothering herself whether he is a Parsi or different faith. She decides to manage her life without allowing anyone to meddle in her personal affairs. *An American Brat* is a fine combination of conventions and customs. As a writer from the Parsi community, Bapsi Sidhwa picks her character against a time period (1970s) creating within a perspective with which the character views the world, based on the events of the story. Like the author, the protagonist is the 'other' in Pakistan, in more senses than one 'othered', since she is one of the minority Zoroastrian communities living in Islamic Pakistan.

Like other Third World Women, who are expatiated in the West, Bapsi Sidhwa who lives in the USA does not totally cut off from home. When she goes back to Pakistan, she feels like an exile. The voice of self-discovery and self-assertion of her protagonist Feroza is the voice of marginalised. Asian woman who protests the narrowness of religion and society. Sidhwa, through feroza, shows the consciousness of her privileged status and a greatly the privileges granted to her in the West. Sidhwa describes the increase of islamization of Pakistan and the reactions of minority Parci group to these major political changes through Feroza.

Chitra Banerjee Divakaruni, like Bapsi Sidhwa, is an immigrant in the United States. She is unable to connect herself with the situation of American authors. She decides to insist on the oppression of women in India as well as in America. She came across several women who were victims of abuse, victimised by the uncomfortable workings of American Society. She founded MAITRI, the first South Asian service helpline to help families from South Asia facing domestic violence, emotional abuse, cultural alienation and human trafficking. Much of Divakaruni's writing is inspired by her experiences and encounters suffering women in the organization MAITRI. Most of the Divakaruni's works are partly autobiographical, mainly the experiences of women who visited MAITRI and her exuberant first novel the *Mistress Of The Spices* highlights how transposed traditions survive on foreign soil. Laura Merin in a review in *World Literature Today* states. "Divakaruni builds an enchanted story upon the fault line in American Society that lies between the self and the community. Addressing the immigrant experience in particular,

she asks how to negotiate between the needs of each under the earth-moving stress of desire" (207).

The novel follows Tilo, an immigrant from India who runs a spice shop in Oakland, California. Tilo provides spices not only for cooking but also for the home sickness and alienation for the Indian immigrants. Divakaruni combines the unfamiliar, the female Indian immigrant experience with the familiar urban life in America, blending the two into a magical narrative that relates a gifted young woman's plight as an outsider in Southern California as a 'mistress of spices' the protagonist is named Nayan Thara, the star of the eye, though her parents were heavy with fallen hope at another girl. But the girl is special endowed with supernatural powers with uncanny clarity to see into the distant future. She is unloved by her parents but duly appreciated for her superfluous income. The pirates take the uncared daughter away to aid them in their plundering. She becomes Bagyavathi,bringer of luck by the pirates. In the Island, the snakes named her, Sarpa Kanya. For becoming the mistress of spices, she changed her name into Tilo, meaning 'a life giver' and a restorer of health and hope. Tilo's multiple identities, Chamelon like, make clear how complex in the problem of identity crisis that it Indians try to cope with in a foreign land. She encounters the various people who come to her for help exerts her magical power Geeta, Lalitha and Ahuja.

The protagonist Tilo is born from the experience of Divakaruni. In an interview to Mortin Marcus, Divakaruni admits that when she gave birth to her second child her incisions became infected and she had to have another surgery reminding in the hospital for a month and only half-conscious, most of time she had the sense that she was hovering between life and death, moving back and forth between and one existence and another. She bridged the purely realistic and mystic one, dealing exclusively with the Indian American community inclusive of three other ethnic groups living in the inner city Latinos, African Americans and the Native Americans.

Divakaruni as a social activist of MAITRI, delineates the various aspects of life in a post industrial consumerist and technology dominated society. Through Tilo, Divakaruni talks of the boundaries that separate communities and people. Tilo becomes the mistress on a faraway island, the female universe, and traditional geographic locations and out of the conventional male world. This world though inhabited by both halves of humanity-

male and female-is actually a male world. Tilo selects one such male world America to help the battered, marginalized and suppressed women. Within the male universe, she lives in the store,an isolated female world.

Both Feroza and Tilo present the different cultures-home, culture of origine and host land, the culture of adoption. Though they have conservative background, they take bold independent decision. They refuse to be suffocated by the male dominated environment. whether in California, Chicago or Calcutta, they learn to their new and changing culture with the clearer vision and careful introspection, they understand that a brave new world has come into bring and in that world bold decisions have to be made. They symbolize the necessity of inventing and re-inventing one's self by going beyond what is given and by transcending one's origin.

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SIGNS OF SUICIDAL TENDENCY IN THE POETRY OF SYLVIA PLATH: A STUDY

Mahamood Unaiz K.N[1] and Dr. S. Karthik Kumar[2]

[1]PhD Research Scholar, Department of English, Annamalai University, Annamalainagar, Tamil Nadu, India
[2]Associate Professor, Department of English, Annamalai University, Annamalainagar, Tamil Nadu, India

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To end is to start;
to surrender is to know.
Despair and depression,
together they grow.
Hope shall meet hopeless
when there's nowhere to go.
　　　　　　　Farewell poem, Misao Fujimura

Before throwing himself into the mist filled drop of the Kegon waterfalls, Misao Fujimura, a 16-year-old Japanese philosophy student, carved this poem onto a tree trunk as his final farewell. This happened in the year 1903, during a time when traditional Japanese sensibilities, embedded in Buddhism, Confucianism, and Shinto tradition came up against the world's views: Marxism, Capitalism, Individualism, and other conflicting ideologies. The Industrial Revolution had turned the planet into a smaller place. Japanese values, formally isolationist, came into direct contact with foreign sensibilities. Despair and confusion were obvious reactions to changes as large and unexplainable as these. Miaso Fujimura has become the symbol of that despair and confusion that plagued Japan in the latter days of the Industrial Revolution. He is remembered for nothing more than his suicide note.

This article discusses some of the general principles and studies about suicidal writers and literature and offer an explanation of Plath's selected poems in order to show how they illustrate known signs and warnings of pending suicide. While it may be obvious to look at a poet's work and analyze suicidal intentions after the death has occurred, the hope of this essay is to reveal a potential source of information for educators, family and friends of writers who may be at risk. With this knowledge, an individual can find that perhaps indicators found in poems and personal letters can be a way to prevent the suicide

of a friend or loved one. Although it iss often difficult for a friend or family member to believe, a person who commits suicide might exhibit predictable patterns of conduct. As with other behavioural indicators, like those associated with a physical addiction or mental illness, a person intending to commit suicide may go through several stages before the final act. While not an exact science, an individual can prepare himself/herself to understand how a suicidal individual might be trying to communicate.

"Dying

Is an art, like everything else.

I do it exceptionally well"   ("Lady Lazarus")

The concept of Plath's poetry was bilateral, poetry helped Plath to structure her life, but at the same time, her life affected the nature of her poetry. Sylvia Plath's tragic suicide on February 11, 1963, shocked the literary world, and her confessional and accusatory writings became a major tool for analyzing her life. Plath's depiction of a bold, victimized persona compelled critics to consider how the details of her personal life explained the subject matter of her poems; and, rightfully so, since it is undeniable that Plath herself embraced the idea of divulging the details of her personal life and feelings through her work. As Plath is well aware, the struggles described in her poetry are caused by an underlying mental illness, and she has a history of depression, suicidal tendencies, and mental therapy, which included electro-shock treatment.

Plath's published poetry and journals publicly expose how she expressed what it felt like to be her. For instance, in a journal entry dated October 3, 1959, Plath opens the entry with: "Very depressed today. Unable to write a thing. Menacing Gods. I feel outcast on a cold star, unable to feel anything but an awful helpless numbness" (517). To a thorough reader, the sentiment of this entry rings familiar and presents the foundation from which Plath builds her idea of suicide. Specifically, in the poems composed near the end of her life, she describes a self that is preparing for suicide.

In his book, *Death, Mourning & Caring*, Robert Marrone describes what a person can look for:

Suicidal ideation, triggering events, and warning signs are interrelated elements that are often present in suicides." Suicidal ideas, threats, and attempts often

precede a suicide. The most commonly cited warnings of potential suicide include (a) extreme changes in behavior, (b) a previous suicide attempt, (c) a suicidal threat or statement, and (d) signs of depression, hopelessness, and a sense of a meaningless life. (193)

Those thinking of suicide can be helped simply by someone asking about and listening to their feelings; though, ironically, it seems that talking becomes easier and more necessary for those surrounding a suicidal individual after the fact. On the America Foundation for Suicide Prevention's website, survivor stories are included to help others cope with the loss of a loved one to suicide:

> "…During the first couple of months after my sister's suicide, we talked about her incessantly. We reminisced about how she acted and looked. We had an insatiable desire to reconstruct the weeks before she died. We recounted the last conversations, moods, phone calls, photographs and meals, hoping that somehow our memories would explain the answer to why she'd killed herself. That question still gnawed at our guts, creating a big, black, empty hole…" (Debbie,199)

Despite the fact that it is not always possible to detect warning signs – because sometimes those warning signs are simply not there – hope exists to uncover suicidal intentions. Specifically, the methods of a suicidal writer might adhere to a pattern of revelation, which could be found in the writer's personal letters, diaries, poems and therapeutic exercises.

In suicidal writers' work, warning appears since the desire to commit suicide and/or the projected act of suicide become subjects for the stories. For example, one way of expressing a desire to commit suicide in poetry may come from words and phrases associated with feelings of depression that cause self-destructive behaviours. Once the writer has taken her life, her work is no longer a chronicle of a struggle to toe the line without crossing it, but an evident display of someone who needed help not to step over the boundary. When discussing suicidal poets in general, educator, editor, and writer Fred Moramarco examines how confessional poetry about suicide is a source of inspiration to the writer, at least until the final act: "So long as these poets remained alive, the tension between a flirtation with suicide through the articulation of potential self-destruction in language, and the irretrievable finality of the act itself charged their work with the energy

of affirmation" (142). Moramarco's use of the word "affirmation" can be interpreted as affirmation of the perceived self, the act of suicide and, consequently, the perceived self in the act of suicide. In the case of Plath, the thematic presence of isolation, rejection, death and rebirth, whether by shedding a figurative skin or through death, shows a final perceived self shaped by suicidal thoughts. However, some do argue that perhaps Plath didn't intentionally commit the final act but only meant to test her expanding boundaries.

Plath was subjected to tremendous stress as a result of the breakdown of her family.After her husband, Ted Hughes, left her to be with his lover, Assia Wevill, Plath was left on her own to care for two small children. Because Hughes's departure fuelled Plath's depression, she began taking medications to help her cope and function on a daily basis, which her mother, Aurelia Schober Plath, blames for encouraging rather than suppressing her suicidal thoughts, especially since such medications contain side-effects that increase suicidal thoughts (Yankowitz). Since Plath's first suicide attempt (via an overdose of sleeping pills) was thwarted, it's reasonable to assume that Plath might have more readily entertained suicidal thoughts because she thought someone would save her again. Additionally, perhaps Plath thought that this dramatic act might bring her family back together or simply punish her husband for his careless actions. A. Alvarez asserted that she orchestrated a dangerous, risky cry-for-help based on the clues left behind: "Had everything worked out as it should – had the gas not drugged the man downstairs, preventing him from opening the front door to the au pair girl – there is little doubt she would have been saved. I think she wanted to be; why else leave her doctor's telephone number?" (36). Since we will never know Plath's true intentions that day, it is necessary to consider her actions within the whole context of her life. By doing this, we extend our perspective to consider not only her specific actions in life, but also what she had to say in her writing.

Plath's aggression is palpable in a rant from her journals dated May 19, 1958, in which she discusses her discovery of absolute proof that her husband is cheating on her, and she fully acknowledges her attraction to both internal and external dialogues about suicide:

"Why is it I so despise this brand of male vanity? Even Richard [previous boyfriend] had it, small, sickly & impotent as he was at nineteen. Only he was rich,

had family and so security: a lineage of men able to buy better wives than they deserved.…I know what Ruth would tell me, and I feel I can now tell her. No, I won't jump out of a window or drive Warren's car into a tree, or fill the garage at home with carbon monoxide & save expense, or slit my wrists & lie in the bath". (391)

The poetic voice of Plath often resembles the tone of her journal. Steven Gould Axelrod provides a definition of what is known as "confessional poetry," which is commonly used to describe Plath's work and links her words to her ultimate intentions: "The Confessional poem is the autobiography of crisis – a crisis which characteristically has two dimensions. One dimension is psychological.…The other dimension of the crisis embodied by the Confessional poem is social" (5). The psychological dimension of Plath's crisis includes expression of her interior mind stimulated by depression, and the social dimension includes rejection of the public sphere where she would ultimately express herself. While she may give us a persona in her poetry, the emotions placed into the poem come from Plath. Five poems from *'The Collected Poems'* with final draft dates close to the time of her death, "Elm," "Lady Lazarus,", "Words," "Contusion" and "Edge," exemplify a progression of suicidal indicators in chronological order.

In the poem, "Elm," dated April 19, 1962, Plath utilizes multiple points-of-view to express a sense of "hopelessness," as well as to "[Make] negative comments about [her]self," two distinct signs of a potential suicide risk (Marrone 188). "Elm" is divided into fourteen, three-line stanzas, with each stanza giving us a bleak experience by the speaker (or speakers, since a dialogue seems to take place between the entities of a divided self). "She" is used only once, the second-person "you" is seen in the first five stanzas, while the first-person voice is present throughout (1, 2). A "linguistic analysis of a series of letters" written by someone who committed suicide cites a study by Stirman and Pennebaker (2001) that shows the importance of Plath's choice to use first-person: "suicidal poets used significantly more first-person singular nouns than did the nonsuicidal poets, indicating an increased focus on self" (Barnes et al. 671, 673). Plath begins the poem by preparing the reader to understand that her desperate circumstances no longer shock: "I know the bottom, she says. I know it with my great tap root: / It is what you fear.

/ I do not fear it: I have been there" (1-3). However, the experiences that follow throughout the poem stun the reader.

A state of self-deprecating instability is conveyed through Plath's vivid imagery and haunting words.In two middle stanzas, she shows the violent nature of her pain by describing its ability to break her apart: "Now I break up in pieces that fly about like clubs. / A wind of such violence / Will tolerate no by standing: I must shriek" and "I am inhabited by a cry. / Nightly it flaps out / Looking, with its hooks, for something to love" (19-21, 28-30). Also, Plath provokes the reader with an unforgiving portrayal of the losses the speaker has experienced. Similar to Plath's own experience with love, the speaker describes the emotion as if it's in darkness, as if she will never find love again: "Love is a shadow. / How you lie and cry after it / Listen: these are its hooves: it has gone off, like a horse" (7-9). The poem concludes with a sense of helplessness, indicating the underlying acceptance of the speaker's emotional state that demonstrates the belief in an unchanging, unpromising situation.

Dated October 23-29, 1962, "Lady Lazarus," establishes a distinct obsession with "Recurring suicidal thoughts or fantasies" by using a religious figure to represent rebirth as an extended metaphor and also demonstrates a flippant treatment of her own suicidal tendencies (Marrone, 188). As the female counterpart of Lazarus, Plath creates a supernatural being steeped in religious reference, and her tone articulates a sense of awe at her own inability to die, adding to mysterious aura of the continued existence. In his essay, "Plath's and Lowell's Last Words," Steven Axelrod points to a style of poetry as a way to interpret Plath's metaphoric representation of the mutated biblical figure: "The Confessional poet assumes that psychological and historical experience, the individual and the general, are related, and even at some deep level synonymous" (6). Plath again predominantly uses a first-person perspective; however, the idea of suicide is discussed more than the speaker herself. Her thirtieth birthday marks her third time to attempt death, and the speaker recounts her previous two endeavors with relish:

The first time it happened I was ten.

It was an accident.

The second time I meant

To last it out and not come back at all.

I rocked shut

As a seashell.

They had to call and call

And pick the worms off me like sticky pearls. (35-42)

In addition, Plath speaks of dying as an art form, with the survivor of suicide described as an exhibition later in the poem. Claiming to know the recipe for a successful attempt at death, the speaker recalls in-your-face details about her brushes with death: "I do it so it feels like hell. / I do it so it feels real. / I guess you could say I've a call" (46-48). She ends the poem with a warning to both God and the Devil, establishing "Lady Lazarus's" power beyond both, her imagery offering an unnatural rejuvenation: "Out of the ash / I rise with my red hair / And I eat men like air" (82-84). The distance between the speaker and reader created by Plath's association with a strong historical figure appears in future poems.

In her poem, "Words," with a final composition date of February 1, 1963, Plath's words represent a sense of "withdrawal" from society, into herself, and a "Giving away [of] possessions," though the possessions are mental and physical rather than material (Marrone 188). The poem begins with the sharp word "Axes" and compares the nature of words to the character of fleeing horses. In relation to the two previous poems discussed where the use of "I" is mainly used, "I" is used only once, which helps to convey a detachment also evoked by sound: "And the echoes! / Echoes traveling / Off from the center like horses" (1, 3-5). Further, this poem's message can be skimmed from the top by extracting the first line from each of the four, five-line stanzas: "Axes" (1), "The sap" (6), "That drops and turns" (11) and "Words dry and riderless" (16). If we interpret the speaker as the wood in which the axe is dropped, then her emotions, and consequently her words, become "The sap" that leaks. Following this, she seems to be giving away her words, even watches them leave and move along without her while she's separated from them. The speaker shows the reader that she can no longer see or recognize herself when she describes being unable to find her reflection in the departing words:

The sap
Wells like tears, like the
Water striving
To re-establish its mirror (6-9)

She concludes the poem with "a life," presumably a projection of the speaker's own life, submerged and separated from both society and her emotions, where it seems she can only look out as if within a mirror: "In the end, the poem's almost mechanical activity winds down to the utter stasis of death – under water, in reflected light, fixed" (20, Axelrod 7). Physically and mentally, Plath releases her words, withdraws and bestows her body to a muddy floor beneath a body of water.

Finalized only a few days after "Words," "Contusion," dated February 4, 1963, again paints a picture of absolute withdrawal and seems to "indicate that a decision has been made to attempt suicide" because the speaker details how death will feel (Marrone 188). Her depressing depiction of life sucked from a person, as well as the end alluding to sheets covering unused objects, points to two patterns of suicide writers as described by scholar Mircea Mihaies: "Melancholy and elegy are always present in the texts of the suicides, because, before being an act, suicide is a mental pattern" (72). While not a warm remembrance of her person, the elegy the speaker relays do in fact mourn an approaching death by writing about it, though she remains noticeably detached. Plath does not use first-person "I" or even a third-person "she," and she uses images presented in "Words," like the water and mirror, to extinguish life and reduce it to a single point of demise: "In a pit of rock / The sea sucks obsessively, / One hollow the whole sea's pivot" and "The heart shuts, / The sea slides back, / The mirrors are sheeted" (3-5, 10-12). Her final stanza explains that no reflection will ever appear because the mirrors now have been covered, which also presents a ghostly image (the sheet over the mirror) of the speaker when she looks into the mirror to see herself.

"Edge," dated only six days before her death, once again presents the reader with an image of rebirth, and does so in a way that matches a "Sudden change from extreme depression to a being 'at peace'" (Marrone 188). The speaker projects a morbid image of herself into the future, though continues to depersonalize herself by not using the first-person "I." Her sentiment toward life is revealed by the first line of the poem, as if the time for death has arrived: "The woman is perfected" (1). Additionally, if you look at her end words for the twenty couplets, a chilling perception about the death is uncovered: "Perfected" (1), "dead" (2), "accomplishment" (3), "necessity" (4) "empty" (11), "bleed" (15) and "bone" (18) convey the idea that emptying of blood and bone is a necessary

accomplishment in her life, that death is her perfection. Also, rather than fight her fate, the speaker treats the death as if it were something to be happy about, as if she joins nature as she should: "The moon has nothing to be sad about" (17). Put another way, nature should accept this premature death as a natural part of life and celebrate it – even memorialize it as if the speaker garners the worth of a white statue. Her sense of reconciliation follows tendencies of other suicidal writers, as seen in the previously referenced analysis that included a suicide writer who kept a diary: "As others who commented on the diary noted (e.g., Canetto, 2004), the woman sounded more confident and more positive about the future as the time of her death grew closer" (Barnes et al. 673). The last poem that Plath finalized, "Edge" stands out as final acceptance of her ultimate fate by lacking any sense of struggle.

At the end of her life, Plath succumbed to her suicidal feelings.Plath could not benefit from the mental expertise available today, but it seems reasonable to suggest that if she had, she might have been given a diagnosis beyond depression.In a study of people with borderline personality disorder, informants displayed a similar outpouring of mental anguish and self-hate as Plath: "'The contours of the surroundings is dissolving, everything is floating together into a grey mist, while twilight is falling behind me.'/'It's hard to believe in light, when you are living in darkness with yourself as enemy number one.'/'I have storms of emotions inside me'" (Perseius et al. 163). It's important to recognize the potential signs and symptoms of a person considering suicide in order to help understand that person's plight and secure needed help. By educating oneself about not only suicidal writers but also about mental illness and suicide in general, hopefully, we can all work to make a difference in the lives of others.

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REALITY THROUGH FANTASY IN AMISH TIRPATHI'S *SHIVA TRILOGY*

Dr. S. Karthik Kumar[1] and B. Pavankumar[2]

[1]Associate Professor, Department of English, Annamalai University, Annamalainagar, Tamil Nadu, India

[2]Assistant Professor of English, Ph.D Research Scholar, SRKR Engineering College, Chinna Amiram, Bhimavaram – Andhrapradesh

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Abstract

The entrance of the English language into the Indian artistic landscape has transformed the essence of almost everything, from sensation, spine-chilling, sentiment, and misfortune, to consistency with life and verse. Journalists today are attempting to reinterpret and reassess past stories in order to make them more accessible and relevant to current gatherings of people. Gone are the days when Indian English compositions were referred to as submissive and driven; they now have a distinct personality. Indian English has received universal approval, from Tagore to Naipaul. English fiction is on the rise, both in terms of pursuers and authors, as a result of colonialism and English training in schools and institutions. People today, especially young people, think it's easier to relate to English novels than to works in their first dialects. As our cities become more westernized, this is thought to be true. This study examines Amish Tripathi's smart *Shiva Trilogy*, which includes each of the three topics. Throughout history, folklore has been an unavoidable source and subject of amassment, documented in tangible text. At diverse ages, creators have attempted to re-unravel past dreams. The idea here is to provide yet another perspective on the many years' worth of dreams that have been put out for quite some time. Amish Tripathi adored women and fantastic characters in his *Shiva Trilogy*, being the grandson of a Sanskrit specialist and Pandit in Benaras. His female figures, who differ from their male counterparts, give him power and fire. The research article looks into Amish Tripathi's role in this long-standing tradition in a broader sense, as well as his commitment to Indian writing in English. It also gives a detailed literary analysis of the *Shiva Trilogy* to show how it shows how Indian folklore is told in the stories.

Amish Tripathi is a finance expert who studied at the Indian Institute of Management in Calcutta. In terms of history, folklore, and speculation, he is enthralled. He

is a history buff, and his inspiration for the novel came from authors such as Graham Hancock and Gregory Possehl, as well as the Amar Chitra Katha series of Indian comedies. Tripathi relied on the stories and tales that he had heard from his loved ones for the whimsical parts of the story. He believes that all social orders and faiths around the world contain awe and significance. Tripathi and his family eventually got into a conversation about mindfulness and the evil inside of men while surveying a verifiable programme. According to the programme, demons were known as "Daeva" in ancient Persia, and heavenly messengers were known as "Asuras." Tripathi felt compelled to write about this subject. Furthermore, no subject is more appropriate than Shiva, one of the most important Hindu celestial deities and the "destroyer of fiendishness." Shiva's story and experience would reflect the kind of thought Amish hoped to instil in his readers. He realised that Hindu celestial creatures were not "legendary animals or a fiction of great innovative capacity," but rather were once ordinary humans. It was their actions in human life that earned them the title of heavenly creatures. Indians have four different ways of loving God. Aakar, Nirgun ,An Avatar is a fictional character (indication of God, for instance, Ruler Ram, etc.) and a man who strives to become God or discovers God within himself (Gautama Buddha).

The preservation of the environment has been a theme in a lot of different kinds of art, like the *Yajnavalkya Smriti*, a sacred Indian text that discourages cutting down trees. The Mauryan period's *Arthashastra* by Kautalya emphasized the importance of forest organization. Composing is a cycle that develops steadily. New abilities emerge throughout long periods of time in each social development, whereas old powers remain spotless, even after the new powers have taken hold. In English, the Indian creators reflected on their outdated history of maintaining the abstract handicraft. They returned to India's rich inheritance to capture the ethos and sensibility of the country. Indian writing in English has evolved into a plethora of interconnected characterizations that portray the ease with which Indians live their lives as well as the complicated idea of Indian convictions in a single language, English. The main purpose of folklore researchers' insatiable energy is to make sense of the meaning of their present in relation to their ancient history. This common practice of repeating legendary tales includes the creation of new stories and characters based on the current scenario. In fact, young writers such as Amish Tripathi, Ashok Banker, and Ashwin Sanghi are putting folklore to the test.

Using it with a variety of compositional strategies Ashok Banker and Amish Tripathi combined folklore with dream mode for the model. These writers are modernizing Indian visions by employing this technique. The research article looks into Amish's role in this important practice in a broader sense, as well as his commitment to Indian writing in English. For example, *The Immortals of Meluha* (2010), *The Secret of the Nagas* (2011), and *The Oath of the Vayuputras* (2013), for example, would be analyzed in order to fictionalize Shiva. It also gives a literary analysis of the Shiva Trilogy in terms of the act of repeating Indian folklore, which is what the book is about.

It helped the Indian distribution business to grow in this way because of creative people like Amish Tripathi and Ashwin Sanghi. These experts have recovered folklore from beginning to conclusion. These contemporary writers have resurrected the long-forgotten "chivalrous period" captured in epic records. To make it all the more alluring and intriguing to today's crowds of onlookers, the architects combined folklore with fantasy. The "bold age" group, as exemplified in the epic construction, was finished with the concept of "realness" and began composing. The return of this deep practise recorded in tangible copy can be attributed to the dominating factor of epic dreams. In his Shiva Trilogy, Amish Tripathi has taken the lead in Indian episodic composition by dissecting Shiva's terrible dream and giving it a new perspective.

The three-piece arrangement honors the legendary legend "Shiva" and his adventures. Shiva has been depicted as a mortal man who, through his activities, elevates himself to the level of a heavenly god. It has looked at how the way dreams used to be shown has changed because of a focus on smart depictions of progress, an educated way of life, persuasive relationships, and a man's journey from a Tibetan clan to becoming Lord Shiva. The creator has worked hard to keep the saint as human as possible, to the point where Shiva reflects on his former lives' mistakes and his distaste for being recognised as the chosen Neelkanth, the Destroyer of Evil. The books depict Shiva as a person who acts as a hero and aids others via his dexterity. The Amish have also attempted to justify that Ruler Shiva was not a nonexistent person from folklore but rather a person from a series of experiences in his brilliant The Immortals of Meluha. He has also taken Vedic ideas from the sacred text and presented them as science in this fiction.Amish has taken advantage of

this chance by recreating mythic stories and characters in the manner in which they intended, as well as requiring their audience to stand out.

The representation of diverse events, places, and scenarios in the Shiva Trilogy beautifully increases the readers' resources by transporting them into another world of imaginative ability. The magnificent depiction of Meluha's city, Devagiri, also owes Ayodhya another charm. His one-of-a-kind blend of vibrant describing, rigid symbolism, and essential understanding procedures beautifully ensures one's mind.Amish has attempted to depict a swarm of emotions and distribute them proportionately among characters. Tripathi uses a variety of approaches to interest viewers, including the employment of distinct Greek conflict methods, the representation of military craftsmanship by Ganesha as a hero, and the dynamic, eager dedication of Shiva and Sati. Tripathi cautiously fans out picture-perfect sections in the Shiva Trilogy, like in children's writing.

Revising Dream works similarly to a plot novel in that it re-examines a long-ago planned game plan of codes, unlocks it with a new cryptographic-authentic key, and reveals "truth" from a web of deceptions. Despite revisionist history, the plot novel proposes a new framework of intriguing codes and conventions. There are clear plot lines in Tripathi's attempt to show Shiva as an official religious figure again, for example, but that's not the only example novel. In any case, new semi-mythopoeic, semi-intelligent explanations that exceed the profound understanding of Shiva's blue throat, Sati's end by fire, or Ganesh's elephant-head result in a new rubric of legends. New blends have taken the place of old dreams. The representation of concepts such as "somras" and "blue throat" provides guidance to the astute reader. There is a lot of emotion and elation in this book. There is also a lot of action, pressure, humor, twists, deception, disaster, and suffering.

Amish Tripathi has depicted Shiva as a fleshy individual, as if he were a regular person or a regular dweller. Tripathi uses a mythical framework to explore social themes inside the story. Blaudelaire coined the term "innovation" in the mid-nineteenth century. In his article, "The Painter of Current Life," he portrays innovation as a fashionable, fleeting, and unforeseeable constraint on the unrelenting and changeless in craftsmanship. The state of a current man's life, which is distance and discontinuity, or the nature of being current,

which is novel and corresponds to standard styles, is referred to as innovation. In the book, a variety of perspectives, things, and styles from today's structure are employed. According to Amish in his book, the fight between the incredible and the wicked is an advanced Mahabharata. There is an advanced plan room in the third book, "The Oath of the Vayuputras," where Shiva and Gopal are driven into a wealthy set-up of rooms with two distinct sleeping chambers. The suite had been furnished with every conceivable excess... In a few corners, different-sized reinforces and pads were thrown on the rugs, creating comfortable floor-sitting areas. The mantelpiece and wall racks were adorned with opulent gold and silver-plated accessories. At one point, Shiva is served idli for supper at the start of the day, which is an advanced food. During the conflicts, he uses current conflict developments in his writings.

Amish acknowledges that "legends are only confused memories of a legitimate past." "A past buried behind hills of earth and death." According to the Oxford Dictionary, a myth is a traditional story, particularly one about the early history of an individual's historical background or the clarification of a characteristic or societal quirk, and frequently includes a powerful being or oddity. The talented writers have unearthed dream source materials and put them to imaginative use. Legitimacy isn't a new concept in literature, but utilizing legends has given it a new flavour. The standard subject of Amish's novels, which cannot be ignored, is outlined by his use of imagination. In some ways, these legends are the most important parts of literature. A portion of the main characters in a legend are gods, while a few are superhumans. In Shiva's Trilogy, the ruler Ram is God, despite the fact that he is not a working person. In the original text, Nandi tells the reader that Lord Ram worked for the Chandravan Empire. Regardless, his existence and power are shown to the reader in the first place.There is a discussion of Lord Ram's standards and how people are actively following them at several points, such as during the discourse between Daksha and Shiva on Somras. Daksha is informing Shiva that Lord Brahma planned Somras and that they were distributed to everyone except for a specific social gathering known as Saptarishis or Brahmins. Anyway, everything is now distributed to all four ranks in accordance with Lord Ram's instructions. His ideas and efforts influenced the Meluhans' general populace. Shiva is an ordinary man in the story who is transformed into God by tradition. He is so revered that when all is said and done, he is a clear man whose Karma casts him as Neelkanth, the Mahadeva, the heavenly force of heavenly things.

Tears welled up in Ayurvati's eyes as she watched Shiva's throat turn blue. Om Brahmayenamah, Om Brahmayenamah, "she continued repeating. You have arrived, my lord! Neelkanth has arrived! ' The concept of a family is fantastic. In the book, these folks also accept a basic occupation. These personalities, who are initially depicted as shady, are eventually revealed to be outstanding. Sati's sister, Kali, as well as Ganesh, Sati, and Shiva's children, are Nagas.

These are the horrifying, wounded beasts. The essayist will sometimes use mythical and puranic elements as inspiration to show their audience something that is good or close to good.Several authors have used this method in their writings. When there is turmoil or pressure in the general populace, open mindfulness is achieved by employing a few legendary stories in dealing with the problems, and when a legendary piece of God is employed, it usually works on the minds of the entire community. The main point of discussion in Shiva's Trilogy will be Somras, which is wickedness. Water from the Saraswati stream is used and wasted in the construction of Somras piles. Shiva is engaged in warfare in order to save the stream. Perhaps the author's book is intended to raise awareness of the importance of conserving a few waterways that are about to be depleted. A few legendary stories are mentioned in the novels. The narrative of Parashuram and how and why he killed his mother comes to mind.

Carl Jung (1875–1961), a Swiss scientist, coined the phrase "primary guide" to describe this "aggregate absence." The models embody the essence of "collective carelessness."This included searching for explanations in folklore, religion, dreams, and dreams, as well as in writing. Northrop Frye (1912–91), a Canadian mythologist and specialist savant, used the phrase "unique" to describe a recurrent example of comprehension that may be found in works of composition and human sciences. These models are the results of scribbled, broad considerations. They are the early stage images that reside somewhere deep within our brains and seek expression in works of art.

In scholarly research, the word "perfect representation" refers to sporadic account designs, examples of movement, character types, themes, and images that may be found in a wide range of compositions, as well as nightmares, dreams, and, unexpectedly, social services. Such sporadic events are frequently regarded as the outcome of fundamental and

comprehensive instances in the human psyche, whose compelling exemplification by the aware seeker, since the person being referred to supplies the author's spiritualist models

The chosen works of this investigation, *The Immortals of Meluha* and *The Secret of the Nagas*, as well as the original *Things Fall Separated*, essentially have a place with two specific social works.The first is associated with Indian composition, whereas the last is associated with African composition. Regardless, there are a few shared convictions, discernments, characteristics, and concerns between these two.Things Fall Apart is a reasonable book, whereas *The Immortals of Meluha* and *The Secret of the Nagas* are dreamlike in his writing

They're intended to be the best deceptions, revealing the best realities to us. The concept of karma can be found in the works *The Immortals of Meluha* and *The Secret of the Nagas*. As a result, a unique life is dependent on no other individual concerns or workouts. Our concerns and activities will have a pleasant existence if they are fantastic. Those who are suffering in their current lives, on the other hand, are suffering as a result of their prior lives' transgressions.

Amish Tripathi, has sold somewhere about 2,000,000 copies of his Shiva Trilogy, which comprises The Immortals of Meluha, The Secret of the Nagas, and The Oath of the Vayuputras. The deal is expected to bring in over Rs 500 million, making the Shiva Trilogy the fastest-selling book series in Indian history. He has recently embarked on a project to create books based on the Ramayana. Tripathi appears to have been influenced by Ashok Banker, and his language is authentic and devoid of scholastic majesty. Without a doubt, he concocts a postmodern mash-up of ideas without considering the element of legitimacy. "These three main strands, folklore, history, and fiction, collide in the most off-kilter of ways, with potentially dangerous effects" (Gurevitch).

In this tale, Shiva is a god who is one of the magistrates of early-stage celestial creatures—Bramha, Vishnu, and Mahesh—who have been revered by Indian people for centuries. According to the text, Shiva plays with snakes, smokes a chillum (earthen pipe), and has a blue neck, all of which are marks of the saviour. He is depicted here as the inherent leader of the Gunas, who live at the foot of Mount Kailash in Tibet. Shiva doesn't name the bull on which he rides; perhaps it's the captain of the Suryavanshi family who

invites Shiva and his inborn Gunas to relax in Meluha (Kashmir), the world's most harsh and generally prevalent region. After arriving there to assist the Suryavanshi faction of Meluha in their fight against the adulterated Chandravanshi clan of Ayodhya, who, despite Lord Ram's affection, had strayed from his libertarianism message. They've been attacking the Suryavanshis while working with the Nagas to do bad things to the people.

The Meluhans are a relocated human race that live near Hariyupa (or Harappa), and its analysts have created Somras. Due to a lack of resources, the Chandravanshis continue to devise ways to devastate the Somras by diverting the course of the Saraswati River, which is essential for its construction. In addition, the Chandravanshis align with the Nagas, who are a military race with genuine deformations! Tripathi, on the other hand, is a god of refinement. As a result, Shiva can't stop consuming weed, despite the fact that he's been warnedand swears a fantastic deal.

Shiva, played by Tripathi, is a careless and unassuming guy. He doesn't think about Lord Ram, and he doesn't understand the meaning of the holy term "Aum" or, on the other hand, "Om." Nandi is likely to appear as a Guru to Shiva on occasion, such as when Shiva needs to be educated about the value of Aum. "My Lord, Aum is the holiest term in our religion," Nandi says. It is thought to be a raw natural sound. The universe's music was blessed to the point where, for a long time, an unbelievable number of people would not insult it by setting it down in "formed construction". When Tripathi says that "The Shiva Trilogy was created around the philosophical request of "What is Evil?" he isn't being philosophical. Despite the fact that he bases his book on the well-known Foucauldian view that individuals discarded by society are not repugnant but rather remarkable, the discussion on these centres is not substantial. Any apprehension is dispelled by the infection of fantasy. According to this text, the action takes place approximately 1850 BC, and the standard of ruler Ram is 1250 years ahead of it. However, in terms of organised folklore, Rama and Krishna cannot be placed in front of Shiva because the magistrate of heavenly creatures-Brahman, Vishnu, and Shiva-is the early stage of the big pantheon overseeing the cosmos, and Rama and Krishna should be considered Vishnu's representatives. When all else is equal, how should Shiva feel about Rama? In India, it is common to find images of Rama praising Shivalingum as he prepares to encircle Ravana's domain. At the end of the Deva-Asura War, Shiva earns the title of "Neelkanth," which is

generally explained as being given to him because of the way he flushed the harmful substance created by the ocean during the Deva-Asura War, but here Tripathi chooses the physical characteristic of the drinking of somras that turned the messaih's throat blue, like a traditional litmus test in a school lab! Tripathi does not have any other experience. His inventive personality is responsible for the fact that Mohan Jo Daro, one of the Indus Valley Civilization's usual environmental elements, was called after an intellectual Mohan! Tripathi conjures up visions from a variety of sources, ranging from Plato's Republic to Marx's Great World. Meluha's youth are considered state property.

In "Maika," the author tries to break down old barriers. For example, teenagers are raised by the state in the book.They pass several tests when they reach the age of sixteen. Anyone who passes the Brahmin assessment will be handed to any Brahmin parent yearning for a child. The number of Brahmins increased with time. Tripathi gets to work on anything that comes his way. Thus, if it is distance that he learns about in the first portion of the day paper, we can see that there are social occasions where "vikarma" individuals are made to suffer as untouchables as a result of misdeeds committed in a previous incarnation. If a person contracts a real ailment or a woman gives birth to a stillborn child, that person is referred to as having "vikarma." Shiva enthusiastically restricts this construction.

The Shiva Trilogy by Amish is about the rich and fantastical tradition of ancient India. A part lost in the abysses of time and people's obliviousness. Various sacred books in ancient India explained the situation of women, stating that they had equal standing to males. Women were given an equal chance in the realms of guidance, regulation, and property, as well as social and strict assistance, politics, and organisation. Women's roles in arranging life and family were explained in the Rig Vedic era, which is vividly depicted by Amish Tripathi in his novel, *The Immortals of Meluha*. The female characters in Amish's *The Immortals of Meluha* symbolize the peak of Vedic women, who revelled in their independence and liberty. Aside from their own work, they each had access to immense potential for understanding the most perplexing facts. The youthful generation of India will soon be enthralled by the prospect of contemplating the country's fundamental foundations, and a new generation of writers will ride the wave, churning out one book of fantastic fiction after another. In the same manner that there is always a high distinction

open in all concealment, there is also incredible and bad inside each and every one of us. Imaginative reading encourages us to recognize internal balances and to let go of vices. This investigation will assist scholars in evaluating folklore from many perspectives. This will resolve any concerns with antiquated and contemporary folkloric allusions.

Amish Tripathi attempts to confront the social reality of contemporary society in this book. He reinterprets the Shiva tale to address the nefarious plans of those in positions of power and how their infantile yearning leads to obliteration and catastrophe. To deal with these challenges, he proposes taking an objective approach. The fantastic elements of the Shiva legend are blended with modern realities. Legendary accounts are used to address the issue of normal contamination. As a result, we may claim that Amish has won in terms of laying down sociological and geographical fortitude, as well as recorded and stringent (especially from Puranas) convictions. All of the guideline characters are dedicated to assisting the government in any way they can. Examining the set of three is fascinating. In today's structures, provable facts, rationalities, and legendary elements are used in his legendary writings.

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ECO-CONSCIOUSNESS IN THE WORKS OF RUTH PRAVER JHABWALA AND R.K. NARAYANAN – A CRITICAL COMPARATIVE STUDY

Abhijeet P. Wadalkar[1] and Prof. Dr. Bharat Jadhao[2]

[1]Assistant Lecturer, Department of English, Jijamata College, Buldana
[2]H.O.D, Department of English, Jijamata College, Buldana

Introduction

"In general terms the ecological consciousness is understood as a reflection of the psyche of a variety of man's relationship with nature"

According to Hindu mythology there are Eighty Four Lack yonis (living bodies) on the earth. They all have their own ways of life. No one interferes with each other. When they are born, they follow their own eco-system, to be grown-up and to be well developed. Every living being looks after their own well-being Human beings have been searching hard to have a more beautiful and worth living habitat in the universe but their all efforts have come to nothing. Nothing is better and wonderful to occupy for habitat if compared to the mother earth. The earth is blessed with variegated flora and fauna, multiple animals to contribute to the charm of the earth. The nature has her own system of purification of reinstating her own pure and untainted form.

Though other animals know their limits, it is the human beings, having cognizance of all advantages and disadvantages, always ready to poke his nose in other's habitat. Right from Wordsworths to R.K. Narayanan umpteen number of writers, poets have been raising the issue. The present paper tries to seek out the concern of R.K. Narayanan Ruth Praver Jhabwala about surrounding nature and its impacts upon the habitant who survive it.

Human being live in two worlds first one is the world he / she receives in inheritance and the second worlds i.e. outside which shapes his / her inner world. Both worlds affect each other to deeper extent. The first world consists of his/her cultural upbringing, collective consciousness, the norms, the customs and the mores set by his / her society where he / she lives in. The second world is made of outer entities that is ambience

of surrounding environment. Both worlds are inseparable parts of human body, mind and soul. Man always perceives the world through the lances of inbuilt personality. Whatever teaching and preaching he / she receives moulds his / her perception to look at the surrounding world.

Literature is the store house of various kind of genres, those reveal the ways to many living- worlds.   When a child grows up in the world he / she is exposed to the world of flora and fauna. When he / she moves around, he / she comes across various kinds of animals, birds, insects, flowers, trees and many more living beings that strive to survive and lead a good life. Sometimes the world of these different species becomes the central axis of attraction of the child and it seeks its own reflection in that world.

When we move in the world of Malgudi created by R.K. Narayanan and the world developed by Ruth Praver Jhabwala, we happened to meet number of characters who have developed themselves according to the environment they reside in.   In the world of Narayanan mother nature is respected, revered duly looked upon while keeping the space with modernity.   Being a Hindu-cultured man Narayan's characters bear the marks of Hindu religious philosophy.   In this context following lines from, 'The Financial Expert are worth quoting-

"When the Goddess wants to help a man she sends him where all things are available : and who would have thought there was a deserted garden----"

(Legal Heirs of R.K. Narayanan, 'Financial Expert P.N. 70)

Here Marggya the protagonist running after the ideas to search a path which leads to boundless treasure to enjoy the riches. But still he realizes without the help of mother nature 'Working-wonder' is not possible that is why he comes out of his home to find lotus, grey cow's and many more sources that may help his mission to be successful.

When Margayya arrived at the pond what he found there a lonely and uncared place. Polluted water, dilapidated and deserted 'Mantap ' visited by unknown passersby once in a blue moon, left dirty and unaccomodating. Naryan herby implicitly says, we people are too self centric and petty creatures to look after and take care of our bountiful surrounding.   Nevertheless the nature has copious gifts to offer us in form of lotus in

greenish means polluted water. The reflection of Margaayya become more suggestive and imperative, when he contemplates.

"In the middle of the pond there were lotus flowers lotus flowers – red as the rising sun. They were half closing their petals." They know better than we do that it's nearing sun-set." (Legal Heirs of R.K. Narayanan, 'Financial Expert P.N. 62)

What does it mean----- ? forthcoming events can be predicted if we follow paganism the true creed of Wordsworthian worship. That requests us to be in tune with the surrounding nature.

The world of Ruth Praver Jhabwala is a world of contrast to Malggudi. In her Heat and Dust she perceives the surrounding nature as dusty and unhealthy. She feels the change brought to Indians. The dirt, the filth, the garbage, the smell of urination, the waste thrown by the residents of the place show how people are unaware to the changes being brought about in around the world. Delhi though the capital of India not exception to it.

Conclusion

R.K. Narayanan and Ruth Praver Jhabwala both are Indians writers. But looked at India from different perspectives. But so far ecological aspects are concerned both depicted Indians with same brush of acerbic-colours. In India Nature worship is next to the God. Indians are Pantheist, search God everywhere. Even in Gitanjali, Tagore explores the unlimited ways to seek Godliness in every corner of the nature. Though there are stray glimpses of nature her healing-power and her degrading state in the modern materialistic world found in the works of both writers, these are symbolic and suggestive to frame our life in future to come.

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A SPATIAL ANALYSIS OF CROPPING PATTERN AND CROPPING INTENSITY IN DINDIGUL DISTRICT

S. Siva Padma Devi[1] and Dr. C. Florence Annal[2]

[1]Research Scholar, Department of Geography, Mother Teresa Women's University, Kodaikanal. Email: santhapadma@gmail.com

[2]Assistant Professor, Department of Geography, M.V.Muthiah Government Arts College for Women, Dindigul. Email: laaly6@gmail.com, florenceannal@rediffmail.com

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Abstract

In the present paper an attempt has been made to analyze Spatial Analysis in cropping pattern and cropping intensity in agriculture of Dindigul District. Data were obtained from Statistical Handbook of Dindigul District. Copping pattern and cropping intensity have been presented in the percentage forms. Results of the study reveal that cropping pattern is much diverse with high level of cropping intensity in agriculture of the District. It has been found that Maize is still most cultivated crop in the District, covering an area of 20.1% to total cropped area during 2019-2020. Oilseeds has been found second most cultivated crop with increasing trend of area. The area under rice and pulses crop has decreased rapidly over the period. Cropping intensity has also continuously increased during the period. The highest cropping intensity has been recorded in Palani (108.21%) whereas lowest registered in Guiliamparai (100%) block of the District.

Keywords: *Cropping Pattern; Cropping Intensity; Net Sown Area; Gross Cropped Area*

I. Introduction

In general Geographical studies are mainly concerned with the phenomenal of spatial analysis. It deals with regions and, therefore the concept of region is of fundamental importance in geographical studies. A region may be defined as a part of the earth having certain characteristics which enable it to be recognized as a unit, distinguishing it from other units which surround it, and which may themselves be identified by similar or different characteristic features. Agricultural region is an uninterrupted area having some kind of homogeneity with specifically defined outer limit. Looking at the importance of agricultural terms in the agricultural regionalization, it is of paramount importance to

explain in some details the concepts of cropping patterns, crop concentration and diversification, crop combination and agricultural productivity (Majid Husain, 1996).

II. Cropping Patterns

Cropping pattern means the proportions of area under various crops at a point of time. The crop statistics are used to denote cropping pattern. The cropping pattern differs from macro to micro region, both in space and time and is governed largely by the physical, cultural and technological factors. For the purpose of agricultural regionalization and planning, it is necessary to divide the area/ region into homogeneous region on some well-defined basis (Majid Husain (1979)). There can be a number of physical, climatological and agronomic criteria on which cropping pattern can be made. It may vary from region to region depending on the terrain, topography, slope, temperature, amount and reliability of rainfall, soils and availability of water for irrigation. The perception and assessment of environment also guide to grow certain crops in a region. The cropping patterns of a region or areal unit may be determined on the basis of areal strength of individual crops. The first, second and third ranking crops of an areal unit may be called as the dominant crops of that unit. The importance of adoption of suitable cropping patterns in a developing country like India cannot be over emphasized. The horizontal expansion of agriculture is not possible without heavy capital investments. Only judicious utilization of land by adopting more remunerative cropping patterns, scientific rotation of crops and multiple cropping may help in overcoming the food and raw material problems of the country.

II. The Study Area

The district was bifurcated from Madurai district on 15th September 1985. Dindigul town which serves as the district headquarters has a rich historical background and located between $10^0 05'$ and $10^0 09'$ North latitude and $77^0 30'$ and $78^0 20'$ East longitude. Dindigul District located in the south western part of Tamil Nadu. This district is bound by Erode, Tiruppur, Karur and Tiruchirappalli districts in the North; Sivaganga and Tiruchirappalli districts in the East; Madurai district in the South and by Theni and Tiruppur districts and Kerala in the West. Geographically the district falls between $N100^0 05'$ and $N100^0 09'$ and $E77^0 0 30'$ and $E78^0 20'$ and it is spread over on an area of 6266.64 square km. presently, there are 8 taluks in the district. There are 1 Corporation (Dindigul) and 2 Municipalities

(Palani and Kodaikanal), 24 Town Panchayats and 7 Census Towns in the district. There are 14 Community development Blocks and 362 Revenue Villages (330 inhabited) in Dindigul district **(Fig: 1.1)**
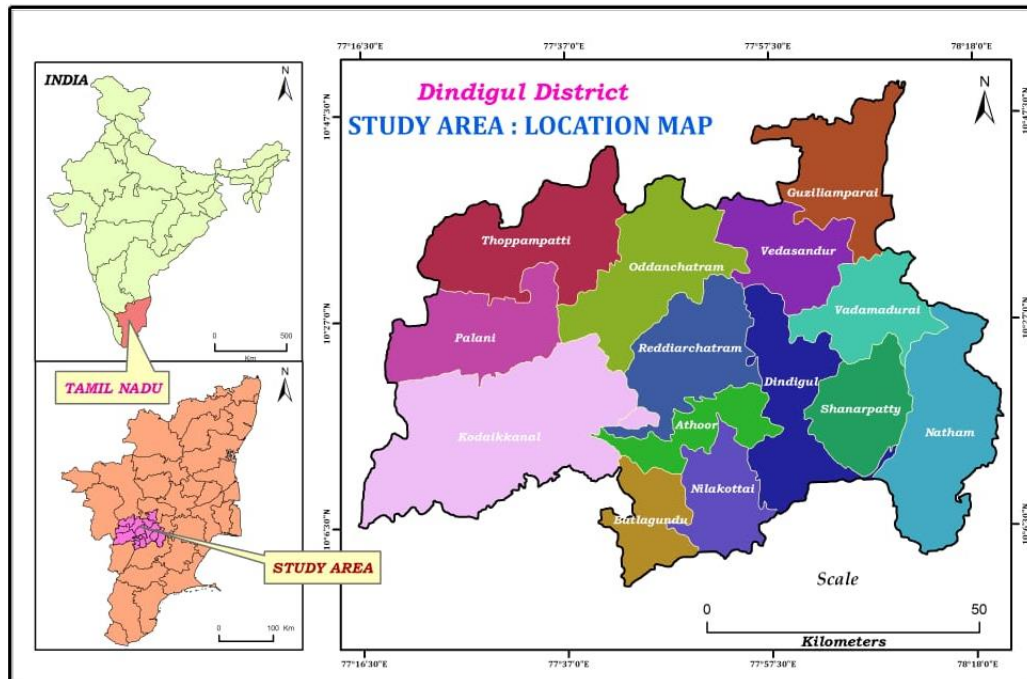
Fig: 1.1

III. Materials and Methods

The Present study is primarily based on secondary data obtained from various issues of Department of Statistics and other publications of the Directorate of Economics and Statistics, Government of TamilNadu, for the period 2019-2020. Cropping pattern shows the proportional area under various crops to total cropped area in the study area. Proportional area of various crops has been calculated with the help of total cropped area. Cropping intensity has been calculated by the ratio of net sown area to gross cropped area and multiplied by 100. Gross cropped area is the addition of net sown area and area sown more than once. Net sown area refers to total area sown with crops and orchards counting area sown more than once in the same year only once (Agricultural Census, 2019-2020).

$$Cropping\ Intensity = \frac{Total\ Cropped\ Area}{Net\ Sown\ Area} \times 100$$

IV. Results and Discussion

Cultivation of crops is the dominant occupation of Dindigul District and is the leading economical activity for the development of the District. The spatial variations in the cropping pattern of the present study area (Figure 1.2) are identified based on secondary data collected from the department of Statistics. Since the cropping pattern is seasonal and depends on monsoon rains, the land is not covered with vegetative growth throughout the year. Agricultural lands are divided into small fields based on site conditions and land holdings of the district. But the agricultural activities mainly depend on northeast monsoon rains both for rain fed and irrigated agriculture

More than 70% of the total cropped areas are devoted for food crops. Maize crop has always covered the largest area of total cropped area in the District and has recorded as 20.1% **(Table.4.1)**. The area under oilseed crop has continually increased from 18.05 per cent total cropped area in 2019-2020. The area under paddy and cotton and sugarcane crop has declined from 6.2 1.6 per cent and 0.7 per cent respectively of total cropped area during the period. The area under pulses (gram, mash, moong and massar) has also rapidly increased from 11.4 per cent of the total cropped area over periods. The area under oilseeds including mustard, rape seeds, linseeds, sasamum and groundnut 11.5 per cent of the total cropped area during same periods. The area under fruits and vegetables and other non food crops has increased over the period in the district. There has not been found large changes in the area of other crops including vegetables, fruits and fodder crops in the study area

4.1 Cropping pattern in Dindigul block wise

In the Dindigul, Area under land cultivation in the block was about 234926.6 hectares during the year of 2019-2020. Maize is the first dominating crop in the study region. Because of the rivers of Maruthanathi and Kamarajar dam are flows in this district **(Table.4.1)**

Out of the total cropped area 29.5 per cent was covered by oilseeds and 17.6 per cent area was under cholam. It means cholam were second dominating crops under area after oilseeds. The area under other crops, Fruits and vegetables and paddy were 13.2, 12.3, and 10.8 per cent respectively in first quinquennial. Area under pulses, other cereals, and

cumbu and spices percentage share was 7.8, 5.6, 2.0, 0.8 per cent respectively in this study region, which was almost negligible.

In the Batlagundu block, Area under land cultivation in the block was about 7206hectares during this year. An oil seed is the first dominating crop in this block. Out of total cropped area 26.9 percent were covered by oilseeds. The second dominating crop are other crops is 22.2 percent, Cholam is 14.4 per cent, Paddy is 11.9 percent, and Pulses is10.1 per cent. Fruits and vegetables, Cumbu, Other cereals, Cumbu, Cotton were first quinquennial. Irrigation facilities are moderate in this block. **(Fig.4.1)**

Table.4.1

Block Wise Cropping Pattern in Dindigul District (2019-2020)

S.NO	Name of the Blocks	Paddy %	Cholam %	Cumbu %	Other cereals %	Pulses %	Oil Seeds %	Cotton %	Sugar cane %	Fruits Veg %	Species %	Other Crops %
1	Athoor	10.8	17.6	0.8	5.6	7.8	29.5	0.3	0	12.3	2	13.2
2	Batlagundu	11.9	14.4	2.4	3.9	10	26.9	2.3	0	5.8	0	22.2
3	Dindigul	4.1	16.4	0.2	17.3	15	12.4	0	0.1	5.4	1.1	28.5
4	Gujiliyumparai	2.3	47.6	1.5	1.4	6.8	25.7	0.1	0.5	12.1	0.1	1.9
5	Kodaikanal	0	0	0	0	0	0	0	0	38.2	43.6	18.2
6	Natham	1.8	6	0	0.1	24	18.1	0	0.1	0.1	0.5	49.6
7	Nilakottai	13.2	28.6	2.5	14.3	11	11.9	0.4	1.3	4.6	0	11.7
8	Oddanchatram	0.3	18.8	0.1	27.1	1.9	14.5	7.8	0.2	11.9	4.5	12.9
9	Palani	26.4	4.7	0	19	13	16.7	1	6.4	0.6	0	12.1
10	Reddiyarchatram	1.9	9.7	0.1	27.3	2	14.3	6.2	0.1	5.4	2.8	30.2
11	Sanarpatti	3.1	22.1	0	1.5	19	17.8	0	0.2	0.3	0.2	35.8
12	Thoppampatti	3.5	19.1	0	20.7	20	18.2	3.9	1.5	5.7	0	7.1
13	Vadamadurai	4.1	34.1	0.2	6.2	22	19.2	0.1	0	9.3	0.1	5
14	Vedasandur	3.1	41.7	0.1	4	8.7	28.1	0.3	0	4.2	0	9.8

Source: Dindigul District Agricultural Statistical Handbook 2019-2020

In the Dindigul block, Area under cultivation in the block was about 9635.2 hectares during this year. Other crop is 28.5 per cent it is first dominating crops. The second dominating crops are other cereals (17.3), Cholam (16.4), Pulses (14.5), and Oilseeds (12.4). The first quinquennial is Fruits and vegetables (5.4), Pulses (4.1), Cumbu (0.2), Spices (1.1), and Sugarcane (0.1). In this block, Urbanization is developing than the other block.

In the Gujiliyumparai block, Area under cultivation in the block was about 10417 hectares in this year. Cholam (47.6) is the first dominating crop in this block. The second dominating crop is Oilseeds (25.7). Fruits and vegetables (12.1), Pulses (6.8) are first quinquennial. Such remaining crops are second quinquennial. In this block, most cultivating crop is cholam and oilseeds, because these crops no need of much water to irrigation.

In the Kodaikanal block, Gross cropped area is 15869 hectares. The first dominating crops are spices (43.6 per cent). The Second dominating crops are Fruits and vegetables and other crops were (38.2) and (18.2). Spices and Fruits and vegetables are high, because of the hilly region.
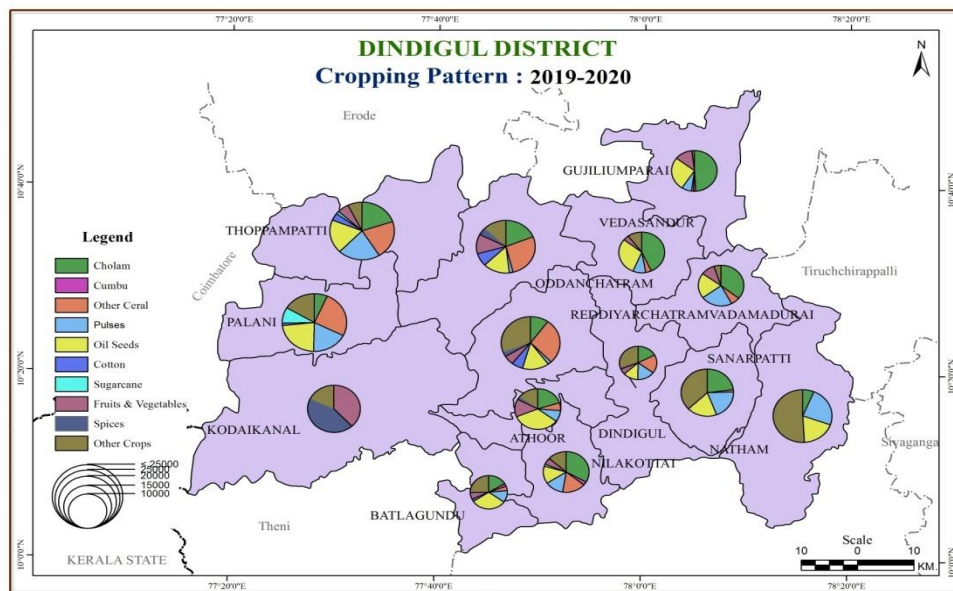

Fig: 4.1

In the Natham block, Total cropped area is 21505 hectares in this year. The first dominating crops are othercrops 45.9 per cent. The second dominating crops is Pulses and oilseeds were (21.9) and (24.1) per cent. Such remaining crops are quinquennial crops. In this blocks having skilled labour are high.

In the Nilakottai block, Total cropped area 11749 hectares in this year. The first dominating crops are Cholam is 28.6 per cent. The second dominating crops is other cereals (14.3), Paddy (13.2), pulses (1.4), Othercrops (11.7), Oilseeds (11.9). Fruits and vegetables (4.6 per cent). Cumbu (2.5), sugarcane (1.5 per cent) is first quinquennial. In this block, Mavoor dam is located in this region.

In the Oddanchatram block, Total cropped area 21494 hectares in this year. Other cereals are the first dominating crops 27.1 per cent. Cholam (18.8), Oilseeds (14.5), Fruits and vegetable (11.9), other crops (12.9) are second dominating crops. Cotton (7.8), Spices (4.5). Pulses (0.3), cumbu (0.1), sugarcane (0.2) are quinquennial. In this block cholam, oilseeds, fruits and vegetables, othercrops are highly cultivated. In this block, parappalar and Nanganchiar dam are located. The daily market places for agriculture and transport facilities are well.

In the Palani block, Gross cropped area 26303 hectares in this year. Paddy (26.4) are the first dominating crop. Other cereals (19), Oilseeds (16.7), Pulses (13.2), Othercrops (12.1), and Sugarcane (6.4) are the second dominating crop. Fruits and vegetables (0.6), Cotton (1.0) is quinquennial. Paddy is the most cultivating crop, because of the palarporundalar dam, varathamanathi dam, kuthiraiaru dam are located in this block. So, the irrigation facilities are well to the agricultural field.

In the Reddiyarchatram block, Gross cropped area 20139 hectares in the year of 2015-2016, Othercrops are first dominating crop value is 30.2. Other cereals (27.3), Oilseeds (14.3), cholam (9.7), such remaining crops are quinquennial. In this block, have occupied, moderate irrigation.

In the Sanarpatti block, Total cropped area 17792 hectares in the year of 2015- 2016, other crops (35.8) are the first dominating crop. The second dominating crop is Cholam (22.1), pulses (19), oilseeds (17.8). Paddy, other cereals, fruits and vegetables, spices,

sugarcane are quinquennial. Othercrops and cholam are highly cultivated crops. Because irrigation facilities, are mostly available in this block.

In the Thoppampatti block, Total cropped area 34009 hectares in this year, other cereals, pulses are the first dominating crops that the value is 20. Cholam and oilseeds are the second dominating crops values are (19.1), (18). Such others are quinquennial crops. In this block, Irrigation facilities are high, because of canal, well, tube irrigation are higher level than the other blocks, not equal to the Oddanchatram and Palani.

In the Vadamadurai block, Total cropped area 129846 hectares in this year, Cholam (34.1) are the first dominating crops. Pulses (22), Oilseeds (19.2), other cereals (6.2), Fruits and vegetables (9.3), paddy (4.1), other crops (5). In this block, cholam is highly occupied crops in the total cropped area, because of that crops no need of much water facilities.

In the Vedasandur block, Total cropped area 11271 hectares in this year, the first dominating crops is cholam (41.7). The second dominating crops are oilseeds (28.1), other crops (9.8), Pulses (8.7), paddy (3.7). In Vedasandur block, Kudagnar dam is located for the irrigation of agricultural field. **(Fig4.1)**

4.2 Cropping Intensity

Cropping intensity has been defined as the ratio between the net sown area and the gross or cropped area. The double and multiple cropped areas added into the net cultivated area gives the total cropped area. The Department of Agriculture, Government of India developed the following formula for the measurement of agriculture intensity

The agriculture intensity depends on the geo-climatic, pedological, socio-cultural and infrastructural factors. Thus, the agricultural intensity is generally high in the well irrigated alluvial plains areas, low intensity in the less rainfall areas.

Cropping intensity indicates the extent to which the unit of area has been used intensivelyfor various purposes of agriculture. The cropping intensity usually refers that the number of crops grown an area in particular time. Therefore higher intensity indicates the maximum and multiple usages of land and vice versa. The following formula is used toestimate the cropping intensity of Dindigul District. (Table 4.1)(Fig 4.1)

Table.4.1

Block Wise Cropping Pattern in Dindigul District (2019-2020)

S.No	Name of the Blocks	Cropping Intensity	Net Sown Area (in hectares)	Total Cropped Area
1	Athoor	101.98	14107.27	14386.5
2	Batlagundu	100	7206	7205
3	Dindigul	100.14	9621.38	9807
4	Gujiliyumparai	100	10417	10418
5	Kodaikanal	106.01	14969	15869
6	Natham	102.79	20921	21505
7	Nilakottai	106.05	11079	11749
8	Oddanchatram	101.45	21186	21493
9	Palani	108.21	24307	26303
10	Reddiyarchatram	102.78	19595	20139
11	Sanarpatti	105.3	16896	17791
12	Thoppampatti	100.54	33827	34005
13	Vadamadurai	103.4	12548.67	12985
14	Vedasandur	100.83	11178.96	11271.1

Source: Dindigul District Agricultural Statistical Handbook 2019-2020

Very High Cropping Intensity (>105)

The very high cropping intensity are found in the Southwestern area and Southern area in this blocks. They are Kodaikanal (106.01), Palani (108.21), and Nilakottai (106.05). Because Kodaikanal block are hilly area average rainfall is high and well climatic conditions are there. So, the major crops of Fruits and vegetables, spices and other crops are cultivated. Palani block are well irrigated area, the major crops of paddy, cholam, oilseeds, pulses, other cereals and other crops. Nilakottai are also well irrigated area, the major crops are paddy, cholam, pulses, other crops, and other cereals arecultivated in these blocks. Inspite of the hilly areas in Kodaikanal, Varathanathi and kuthiraiaru dams are in the Palani block.
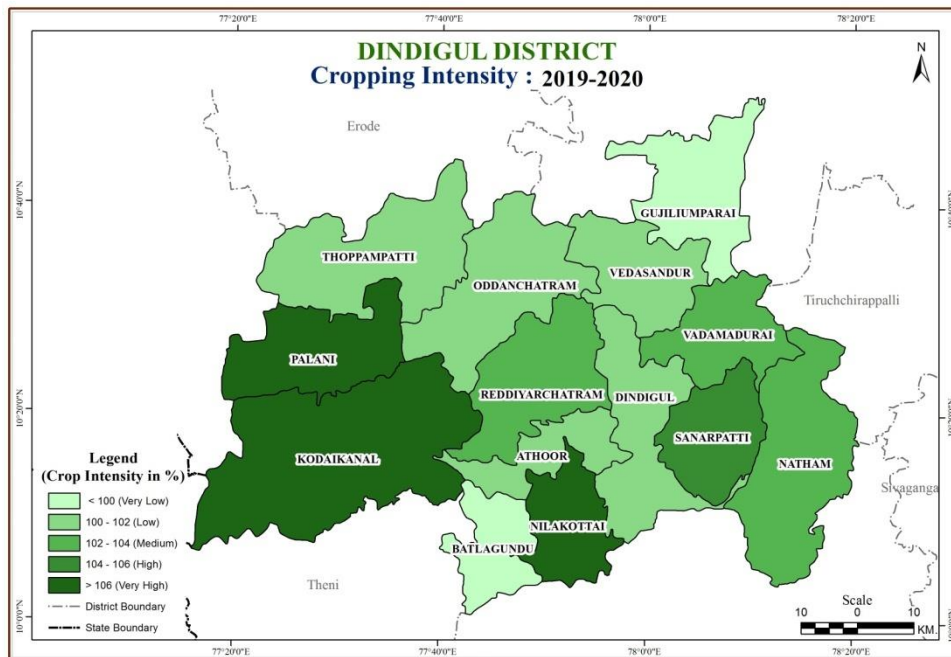
Fig: 4.2

High Cropping Intensity (104-105)

The high cropping intensity is found in eastern part of this block. That is Sanarpatti (105.3). In this blocks have irrigation facilities are available and rainfall in moderate in this block. The major crops are of Cholam, pulses, oilseeds; other crops are cultivated in these blocks.

Medium Cropping Intensity (102-104)

Out of fourteen blocks, there are three blocks are categorized in the cropping intensity. They are Reddiyarchatram (102.78), Vadamadurai (1034.74), and Natham (102.79). There were medium rainfall and irrigation in this area. The major crops are cultivated in this blocks are pulses, oilseeds, other crops, Cholam.

Low Cropping Intensity (100-102)

In the Fourteen blocks, there are five blocks are covering in the cropping intensity. They are Athoor (101.98), Dindigul (100.14), Vedasandur (100.83), Oddanchatram (101.45), and Thoppampatti (100.54). In this block have low rainfall and irrigation facilities are scanty. The major crops are Paddy, cholam, other cereals, oilseeds and pulses are cultivated.

Very Low Cropping Intensity (<100)

The very low cropping intensity are identified in this fourteen blocks are Gujiliyumparai (100), Batlagundu (100). The annual rainfall is less in this block and irrigation facilities are not available. Cholam, oilseeds, fruits and vegetables and other crops are cultivated.

VI. Conclusion

It can be concluded from the results of the study that Dindigul District, is more advanced in view of agricultural development with diversified cropping pattern and high level of cropping intensity. Nearly 41% of the total geographical area in Dindigul District is under cultivation. Forest occupies about 18% and other use occupies the rest of the area. The principal crops such as Cholam, Oilseeds and pulses are cultivated. The analysis of area under different crops revealed that the Cholam and Pulses dominates as single crop in most of the blocks in Dindigul District. Other crops Sugarcane, Cotton and Species have been recorded as miner grown crops. There is much need to take appropriate steps for increasing the area of pulses as area under pulses has rapidly declined over the period in the state. The level of cropping intensity has reached at the saturation. Changing of cropping pattern and availability of modem inputs helped in increasing the cropping intensity. The low intensity of cropping pattern it is because of high pressure of population with limited resource of land in the district. Population is increasing but the land is fixed.

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