ISSN 2349-3089

NeJCR

NORTHEAST JOURNAL OF CONTEMPORARY RESEARCH

Vol. 6 Number 1, December 2019

DARRANG COLLEGE RESEARCH JOURNAL

Northeast Journal of Contemporary Research (NeJCR)

A multidisciplinary research journal

NeJCR is an annual multidisciplinary research Journal of Darrang College, Tezpur, Assam, India. It publishes peer-reviewed original research papers and review articles of contemporary relevance in the field of science, arts and issues in the field of humanities and socioeconomic studies. The aim of the journal is mainly to encourage research activities in India and countries bordering it, thus it helps the young generation researchers to publish their research works. The objective is- to report on the latest research achievements, to strengthen academic exchanges, to promote cooperation in science and technology, to contribute to the progress in sciences and humanities at large. The papers submitted to the journal are reviewed by a group of experts.

NeJCR publishes full length research papers, review articles, short communications, book review etc. in the fields of science, humanities and socioeconomic issues such as anthropology, business studies, communication studies, crosscultural studies, demography, development studies, economics, education, ethics, geography, history, industrial relations, information science, international relations, law, linguistics, library science, methodology, philosophy, political science, population Studies, psychology, public administration, sociology, linguistics, literature, religious studies, women studies and so on.

EDITORIAL BOARD

Editorial office:
Northeast Journal of Contemporary Research (NeJCR)
Darrang College, Tezpur-784001, Assam, India
E-mail: *nejcr.darrangcollege@gmail.com*

Publisher :
Principal, Darrang College, Tezpur, Assam

ISSN 2349-3089

Northeast Journal of Contemporary Research

Vol. 6 Number 1, December 2019

NeJCR, Darrang College,
Tezpur-784001, Assam, India
E-mail: *nejcr.darrangcollege@gmail.com*

Editorial

Mahatma@150: More from Less for More

This year, the world is celebrating 150th birth anniversary of Mahatma Gandhi by paying tributes to him in a variety of ways. We therefore proposed to highlight some of Gandhi's contribution to world of knowledge, society and environment apart from his visionary contribution to the philosophy of non violence.

Mohandas Karamchand Gandhi , reverently known as Mahatma Gandhi and affectionately called as Bapu, Father of the Nation is one among the very few who has carved a niche for himself as well as the country across the world as a leader representing not only the common man, but also one of the most celebrated international visionary who founded and propagated the philosophy of non violence. He is known across the world for his diverse contribution to a wide range of areas right from being the icon of Indian freedom struggle to becoming Saint, Seer, Educationist, Philosopher , Environmentalist, Nature Cure Expert and many more. He is a man of action with culture, character and philosophy of his own. He is a 'Yugpurush' in real sense who will live in the annals of history for ever till the end of human civilization.

It is about 110 years since Gandhi gave the world his vision of the possible human society and envisioned a society in which the driving force was Love Force and used the term interchangeably with Soul Force and Truth Force. Gandhi's view on development was based on sustainability and he meant development for over all development of the human persona that would be self – regulated and development was for aiming at peace and harmony with self , with others and with nature. Gandhiji deeply concerned with people , planet, prosperity and partnership as the Sustainable Development Goals (SDGs). He laid primary responsibility with the individual and emphasized that individual has to be educated around his behavior so that she can work towards sustainable development of self, others and nature. Accordingly he believed that self –regulated individuals would build sustainable practices and institutions which would draw sustainably from nature. It was a great tribute to Gandhi when in 2007 the United Nations declared October 2 as World Non- Violence Day.

In the 150th year of Mahatma we move from *symbolism* to *substance* and for that matter in the areas of higher education we should practice and absorb some of the basic lessons of Gandhian Philosophy. It is here we have to combine practice with theory, hand with heart and head. Accordingly Gandhi viewed unless education is imparted through *engagement* with different facets of society, how will our students learn to be responsible and responsive to the persistent unmet needs. If entrepreneurship has to be promoted , and if start-ups have to emerge to meet these glaring gapes, then ecosystem for *mapping* the unmet needs, *tapping* the innovative and entrepreneurial potential and *capping* the increasing frustration of youth will have to be developed.

Gandhian philosophy is also equally relevant in today's globalised and multicultural world which generate conflicts in many levels- from local to global- and there are many sites of it ranging from the personal to public life and conflict from the interpersonal to the international , is one of the

processes of society. Thus, in conflict situation, the truth becomes the end of the process of conflict and nonviolence becomes the means to accomplish it. The logic of *Satyagraha* is based on the assumption that good ends can never be attained through the wrong means, thus *Satyagrahi* is obliged to employ nonviolence as only means in a conflict situation. Satyagraha employs self suffering as a dominant method in dealing with conflict with the positive impression that the opponent can be turned to see the truth by touching his/her conscience. It is assumed here that a more explicit image of truth will grow out of the dialectical process of conflicting parties. It needs to be mentioned that while *Satyagrahi* tries to convert his opponent, he/she also remains open for opponents in the same manner. Thus, from conflict transformation point of view, Gandhi's Satyagraha is a creative dialogue and remarkably significant if one carries out conflict along productive lines and wish to reach a win-win situation that means all the parties should be satisfied with the result of the conflict.

Here Gandhina Engineering is of profound significance as we are amassing our resources in an astoundingly high speed. It is here Gandhi's two tenets are very important for us : 'I would prize every invention of science made for the benefit of all' and 'Earth provides enough to satisfy every man's need but not every man's greed'. The first tenet referred to affordability and the second tenet referred to sustainability. Thus the essence of Gandhian Engineering is all about 'getting more from less for more and more people of the world', it means getting more (performance) from less (resource) for more (people), not just for more (profit). What Gandhi had said – benefit of all – not for just a few but for more and more people. Getting More from Less for More (MLM) should therefore be the mantra of today's world. Ironically, it was Mahatma Gandhi, that was India's greatest gift to world in the 20th Century.

On 150th years of his birth, we must resolve to follow the path shown by our Father of the Nation and that would be our rich tributes to *Bapu.*

Dr. Joysankar Hazarika
Editor in Chief, NeJCR
Principal
Darrang College, Tezpur, Assam, India

Northeast Journal of Contemporary Research, December 2019. Vol. 6 No. 1, pp 1-9
ISSN 2349-3089 ©NeJCR, 2019

Antibiotic sensitivity pattern of some enteric pathogens collected from Tezpur, Assam and antimicrobial activity of ethanolic extract of *Scoparia dulcis* L.

Rajashree Bordoloi[1], Abhijit Das[2,*] and Sushmita Sonowal[1]
[1]*Department of Botany, Darrang College, Tezpur-784001, Assam, India*
[2]*Department of Zoology, Darrang College, Tezpur-784001, Assam, India*

ABSTRACT

Diarrhoea remains a major problem in the South East Asian countries, including India. There is therefore, a need to understand the nature of antibiotic resistance patterns of various enteric pathogens causing diarrhoea. The investigation was conducted to understand the antibacterial activity of certain drugs presently in use for the treatment of enteric disease with its status of resistant, intermediate or sensitive. Study was also conducted to understand the efficacy of plant extracts as many of the drugs presently in use have grown resistant and have probable side effects. A total of 54 stool samples were collected from children upto six years of age from the children ward of Kanaklata Civil Hospital, Tezpur and from the nearby villages of Gutlong, Panchmile and Napaam, Assam, India. The plant material tested was the leaf part of *Scoparia dulcis* Linn. The bacterial strains showed multidrug resistance. The MAR was found to range from 31% to 68%. The findings indicate that the clinical isolates of the enteric pathogens are multidrug resistant and alternative drugs need to be designed for better management of the disease. Ethanolic extract of the leaves of *Scoparia dulcis* L. showed an inhibition zone of 11mm with 10 µl plant extract, 16 mm with 20 micro µl plant extract and 17 mm with 30 µl plant extract. Moreover, phytochemical analysis conducted on the plant extracts revealed the presence of phytochemicals such as flavinoids, glycoside, cardiac glycoside, steroid, tannins, alkaloids, phytosterol and terpenoids. The leaf extracts of *Scoparia dulcis* L. can therefore be used for better drug designing.

Key words: Diarrhoea, enteric pathogens, antibiotic resistance, MAR index, phytochemical screening

INTRODUCTION

Infectious diarrhoeal diseases are responsible for considerable morbidity and mortality, especially in developing countries (Guerrant *et al.*, 1990). Resistance has emerged even to newer, more potent antimicrobial agents and is commonly seen in organisms like *Salmonella, Shigella* and *Vibrio cholerae* (Sack *et al*, 1997; Replogle *et al.*, 2000; Hoge *et al.*, 1998; Threlfall *et al.*, 1997; Jiang *et al.*, 2002; Niyogi *et al.*, 1999; Jesudason, 2002; Chunder *et al.*, 1997; Kain *et al.*, 1991). In one study it was found that the *V. cholerae* isolates were generally susceptible to tetracycline. Intermediate level of resistance to ciprofloxacin was also reported (Garg *et al.*, 2010).

Bacteria have the genetic ability to

*Corresponding author's Email: abhijitd23@gmail.com

transmit and acquire resistance to drugs which are utilized as therapeutic agents. The number of multi-drug resistant microbial strains and the appearance of strains with reduced susceptibility to antibiotics are continuously increasing. Therefore, there is a need to search new infection fighting strategies to control microbial infections (Sieradzki *et. al.*, 1999). There is a great need to reduce the indiscriminate use these potent antibiotics, the drug of choice for serious endemic infections like enteric fever. There is a need to educate both the general public and the health practitioners that most diarrhoea does not require antibiotics. It is also necessary to carry out periodic monitoring of drug resistance in enteropathogens in different geographic areas so that an appropriate agent can be chosen for empiric therapy (Mukhopadhyay and Sur, 1996; Taneja *et al.*, 2014).

Due to the cost effectiveness, safety, increasing failure of chemotherapy and antibiotic resistance, search for plant resources has been increased for their potential antimicrobial activity (Hammer *et al.*, 1999). Medicinal plants are used locally in the treatment of infections caused by fungi, bacteria, viruses and parasites. Different plants have been used as a source of inspiration in the development of novel drugs. Plant derived medicines are widely used because they are relatively safer than the synthetic alternatives and they are easily available and cheaper. Many plant species have been evaluated for their antimicrobial activity in the past 20 years. The active components of many drugs found in plants are secondary metabolites (Robbers *et al.*, 2016).

The use of plants for treating diseases is as old as the human species. Plants used for traditional medicine contain a wide range of substances that can be used to treat chronic as well as communicable diseases (Saleh *et al.*, 2009). Plants are the richest source of drugs of traditional systems of medicine, modern medicines, nutraceuticals, food supplements, folk medicines, pharmaceutical intermediates and chemical entities for synthetic drugs (Hammer *et al.*, 1999). It is Ayurveda, the foundation of the medicinal science of Hindu culture, in its eighth division deals with specific properties of drugs and various aspects of science of life and the art of healing (Rastogi & Mehrotra, 2002). Among those antibacterial foods that are becoming more common in western diet are green tea and ginger (Sharma *et al.*, 2009). The use of plant extracts and phytochemicals with known antimicrobial properties can be of great significance in therapeutic treatments. In the last few years, a number of studies have been conducted in different countries to prove such efficiency. The active compounds of many drugs found in plants are secondary metabolites. The identification and isolation of such active compounds makes it more effective in therapeutic application (Sathyadevi *et al.*, 2014).

Hence, more studies pertaining to the use of plants as therapeutic agents should be emphasized, especially those related to the control of antibiotic resistant microbes. The objective of this research work was to evaluate the antibiotic resistance pattern of some enteric pathogens and to determine the antibacterial activity of the leaf extracts of *Scoparia dulcis* L.

MATERIALS AND METHODS

A total of 54 pathogens were isolated between 2008 and 2010 from the stool samples collected from the patients admitted to Kanaklata Civil Hospital, Tezpur, Assam and the nearby villages of Gutlong, Panchmile and Napaam. The antibiotic disks required for the sensitivity test were procured from Himedia, Mumbai, India. The leaves of the plant (*Scoparia dulcis* L.) required were collected locally from Tezpur during December, 2016 and identified following standard literature (Sharma *et al.*, 2009). The leaves were washed and shade dried for extraction of the active components.

Bacterial identification

The microorganisms isolated are identified by standard biochemical methods as stated

in the Bargey's Manual of Determinative Bacteriology (Holt *et al.*, 1994).

Antimicrobial susceptibility test

The antimicrobial susceptibility was determined according to Kirby and Bauer disk diffusion method using commercially available antimicrobial discs (Hi-Media Laboratories, Mumbai, India). The nutrient medium Mueller-Hinton agar with a pH of 7.2 to 7.4 was poured into plates to a uniform depth of 5mm and refrigerated on solidification. Prior to use, the plates are transferred to an incubator at 37°C for 10 to 20 minutes to dry of the moisture that develops on the agar surface. The plates were then heavily inoculated (500µlt per plate) to ensure the confluent growth of organisms. The antibiotic discs were then aseptically applied on the surface of the agar plate at well spaced intervals. Once applied, each disc is gently touched with a sterile applicator stick to ensure its firm contact with the agar surface. Following overnight incubation, the plates are examined for the presence of inhibition of bacterial growth which was indicated by a clear zone surrounding each disc. The susceptibility of an organism to a drug is determined by the size of this zone.

The measurement of the diameter of the zone of inhibition was done in millimeters and its size was compared to that contained in a standardized chart. Based on this comparison, the test organism was determined to be resistant, intermediate, or susceptible to the antibiotic. The antibiotic sensitivity test was carried out using the antibiotic discs of Kanamycin (30 mcg), Nalidixic acid (30 mcg), Neomycin (30 mcg), Norfloxacin (10 mcg), Rifampicin (5 mcg), Tetracycline (10 mcg), Streptomycin (10 mcg), Novobiocin (5 mcg), Gentamicin (10 mcg), Erythromycin (15 mcg), Cotrimazine (25 mcg), Furazolidone (50 mcg), Ampicillin (10 mcg), Chloramphenicol (30 mcg), Ciprofloxacin (10 mcg), Cinoxacin (10 mcg). The MAR (multiple antibiotic resistance) index (Krumperman, 1985) was then calculated (Bauer *et. al.*, 1996).

Extraction of plant material and test for antibacterial activity

The plant materials were obtained locally from Tezpur. It was then shade dried, powdered and subsequently subjected to the extraction process (Kambizi and Afolayan, 2001). The extraction was done by a Soxhlet apparatus using ethanol as a solvent. The plant material tested were the leaf parts of *Scoparia dulcis* L. To the powdered plant material ethanol was added and incubated with stirring for 24 hours. Soxhlet extraction of the plant powders was also subsequently done. The filtered extracts were then evaporated to dryness and re-dissolved in ethanol to obtain the required concentration. The extracts were passed through a filter of 0.2 micron porosity (Sartorius, Germany) and then kept at –4°C till use.

Filter paper discs (Whatmann paper no.1) were sterilized by autoclaving and the extract was added onto each disc to obtain concentrations of 10 µl, 20 µl, and 30µl per disc. The discs thus prepared were dried before use. Culture for drug sensitivity was carried out on Nutrient agar (Himedia, Mumbai) upon prior subculture on Nutrient broth. Fresh cultures of the bacterial pathogens were used for testing the plant activity. The antibacterial activity of the plant extract was evaluated using the disc diffusion method. The disc inhibition zone was evaluated by using a modification of the method described earlier (Bauer *et. al.*, 1996).

Phytochemical analysis:

The freshly prepared extracts were chemically tested for the presence of different phytochemical constituents such as alkaloids, flavonoids, phenolic compounds, steroids, saponins, tannins, etc. by using standard methods (Khandelwal, 2004).

RESULTS & DISCUSSION

From the 54 stool samples collected and studied 28 species of *Escherichia coli*, 15 species of *Shigella*, and 11 species of *Salmonella* were identified by standard biochemical methods discussed earlier. The strains showed multidrug resistance. The pathogens showed resistance towards Kanamycin, Nalidixic acid, Rifampicin, Novobiocin, Erythromycin, Ampicillin, Vancomycin and Cinoxacin. However, most the strains were sensitive to Neomycin, Norfloxacin, Streptomycin, Gentamycin, Chloramphenicol and Ciprofloxacin (Table-1). Table-1 also shows the antibiogram of the pathogens with different antibiotics. The MAR index was found to range between 31% and 68%. Different antimicrobial have become widely available and the capricious use of antibiotics has led to the rapid emergence of bacterial resistance, with a greater infection burden for vulnerable individuals. Many studies have shown a dramatic shift in antibiotic resistance among pathogenic bacteria, which has led to the swift spread of many infectious diseases (Ries *et al.*, 1994; Threlfall *et al.*, 1992; Weber *et al.*, 1994; Yamamato *et al.*, 1995; Sebiomo *et al.*, 2011).

It was found that ethanolic extract of the leaves of *Scoparia dulcis* L. showed an inhibition zone of 11mm with 10 µl plant extract, 16 mm with 20 micro µl plant extract and 17 mm with 30 µl plant extract (Plate 1). The control experiment containing ethanol with no plant extract showed no bacterial growth inhibition or antibacterial activity.

Indian medicinal plants are used in various system of medicine because of its minimal side effects and cost effectiveness (Irfan & Atiya, 2004). The currently available antibiotics like ceftazidime, chloramphenicol and co-trimoxazole have been documented to be potentially toxic and possess harmful side effects (Suputtamongkol *et al.*, 1991). Chloremphenicol has predictable haemopoietic suppression and aplastic anaemia.

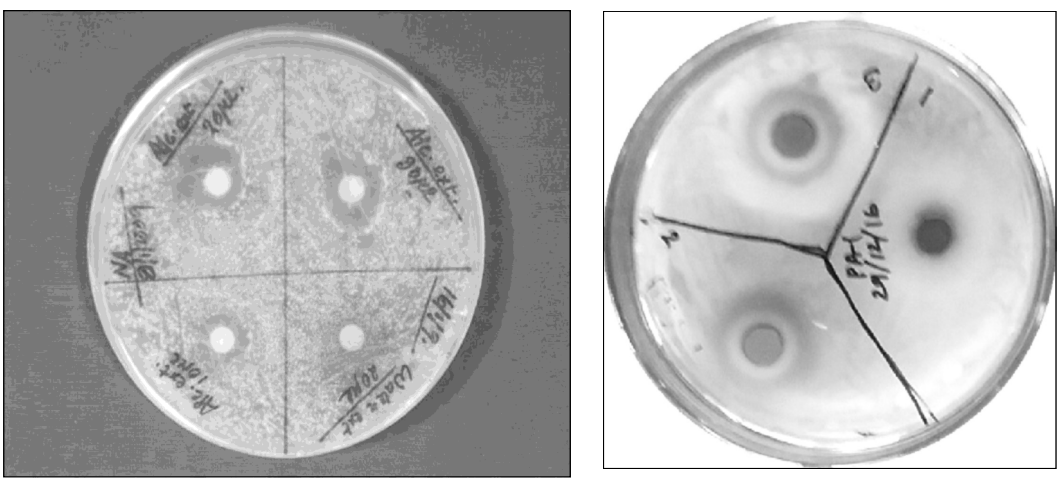


Plate 1. Culture plates showing antibacterial activity of *Scoparia dulcis* L. at various concentrations

The results showed the antibacterial activity of leaf parts of *Scoparia dulcis* L. Indian medicinal plants are regularly used in various systems of medicine because of minimal side effects and cost-effectiveness (Muthu *et al.*, 2005). Further attempts may be focused on finding out the active component from the leaves of *Scoparia dulcis* L. which could be an important source of new antimicrobial agent against the enteric pathogens.

In the present investigation it has been found that that the MAR index ranges from 0.31 – 0.68, which indicates that the enteric pathogens collected, identified and studied are resistant to 31% to 68% of the antibiotics taken in the study. However, all the strains are sensitive to chloramphenicol. This clearly depicts that the strains are multi-drug resistant and new works are to be focused on developing new antibiotics with more efficacy.

The phytochemical analysis conducted on the plant extracts revealed the presence of phytochemicals such as flavinoids, glycoside, cardiac glycoside, steroid, tannins, alkaloids, phytosterol and terpenoids (Table 2). Flavonoids are hydroxylated phenolic substance known to be synthesized by plants in response to microbial infection. Their activity is probably due to their ability to complex with extracellular and soluble proteins and to complex with bacterial cell walls.

The currently available antibiotics such as chloramphenicol and co-trimoxazole have been documented to be potentially toxic and possess harmful side effects (Suputtamongkol *et al.*, 1991). Plant extracts can provide effective medicines and they are also cost effective with no side effects. In the present study the ethanolic extracts of the leaves of *Scoparia dulcis* L. showed good bacterial inhibition zones. The MIC (minimum inhibitory concentration) measurement study indicates that these plant extracts can be used in developing effective medicines against diarrhoeal diseases. However, the works on plant extracts has been done with crude extracts only and therefore efforts will be focused on purifying these extracts by column chromatography, HPLC and other biochemical techniques in further studies and thus finding out the active component responsible for the zone of inhibition.

Table 1. Shows the antibiotic resistance pattern of different bacterial strains and the MAR index

Culture no.	Resistance pattern	MAR index
AJ1	K, Na, R, T, No, E, A, Cx	0.50
AJ2	Na, R, T, S, No, G, E, Co, Cx	0.56
AJ3	Na, Ne, R, T, No, G, E, Co, A, Ci, Cx	0.68
AJ4	Na, N, R, T, S, No, Co, Ci, Cx	0.56
AJ5	Na, R, T, No, E, Cx	0.37
AJ6	Na, R, T, No, E, Ci, Cx	0.43
AJ7	Na, R, T, No, E, Cx	0.37
AJ8	K, Na, R, T, No, E, Cx	0.43
AJ9	Na, R, T, No, G, Cx	0.38
AJ10	Na, R, T, No, Cx	**0.31**
AJ11	K, Na, R, T, S, No, Co, A, Cx	0.56
AJ12	K, Na, R, T, No, E, Cx	0.43
AJ13	Na, R, T, No, E, R	0.38

AJ14	Na, R, T, No, G, E, Cx	0.43
AJ15	K, Na, R, T, No, E, Co, A, Cx	0.56
AJ16	Na, R, T, S, No, F, A, Cx	0.50
AJ17	Na, R, T, No, E, F, A, Cx	0.50
AJ18	K, Na, R, T, No, G, F, Cx	0.50
AJ19	Na, R, T, No, E, Co, Cx	0.43
AJ20	Na, R, T, No, E, Cx	0.38
AJ21	K, Na, R, No, E, Co, Cx	0.43
AJ22	Na, R, T, No, G, E, A, Cx	0.50
AJ23	Na, R, T, No, E, A, R	0.43
AJ24	K, Na, R, T, No, E, Co, Cx	0.50
AJ25	Na, Ne, R, T, S, No, G, E, Cx	0.56
AJ26	Na, R, T, S, No, G, E, Co, Ci, Cx	0.62
AJ27	K, Na, R, T, No, G, E, Co, A, Ci, Cx	**0.68**
AJ28	Na, R, T, No, E, Co, A, Cx	0.50
AJ29	K, Na, Ne, R, T, No, E, Cx	0.50
AJ30	Na, R, T, S, No, G, E, Co, Cx	0.56
AJ31	K, Na, R, T, No, G, E, Ci, Cx	0.56
AJ32	Na, R, T, No, G, Co, A, Ci	0.50
AJ33	Na, R, T, S, No, G, E, Cx	0.50
AJ34	K, Na, R, T, No, F, Ci, Cx	0.50
AJ35	K, Na, Ne, R, T, No, G, E, Co, Cx	0.62
AJ36	Na, R, T, No, G, E, Co, Ci, Cx	0.56
AJ37	Na, R, T, No, Co, F, Ci, Cx	0.50
AJ38	Na, R, T, S, No, Co, Cx	0.43
AJ39	K, Na, R, T, Co, A, Ci, Cx	0.50
AJ40	Na, R, T, No, G, E, Cx	0.43
AJ41	Na, R, T, No, E, F, Ci	0.43
AJ42	Na, Ne, R, T, No, E, Co, Cx	0.50
AJ43	Na, R, T, No, G, Cx	0.37
AJ44	Na, R, T, S, No, E, Co, Ci, Cx	0.56
AJ45	Na, R, T, No, Co, A, Cx	0.43
AJ46	Na, R, T, No, G, Cx	0.37
AJ47	K, Na, R, T, No, G, Co, Cx	0.50
AJ48	K, Na, R, T, No, G, Co, Cx	0.50
AJ49	Na, Ne, R, T, No, A, Ci, Cx	0.50
AJ50	K, Na, R, T, S, No, G, Ci, Cx	0.56
AJ51	Na, R, T, S, No, E, F, A, Ci, Cx	0.62
AJ52	Na, R, T, No, E, Co, F, Cx	0.50
AJ53	Na, Ne, R, T, No, G, Co, Ci, Cx	0.56
AJ54	Na, R, T, No, Cx	0.31

Table 2. Phytochemical screening of *Scoparia dulcis* L.

Phytochemical constituents	Aqueousextract	Ethanolicextract	Acetone extract	$DMSO_4$ extract
Flavonoid	-	+	+	+
Glycoside	-	+	+	+
Cardiac glycoside	-	+	+	+
Steroid	-	+	-	+
Tannins	+	+	+	+
Alkaloids	-	+	+	+
Phytosterol	-	-	+	+
Terpenoids	-	+	-	+

K, Kanamycin (30mcg); Na, Nalidixic acid (30mcg); Ne, Neomycin (30mcg); N, Norfloxacin (10mcg); R, Rifampicin (5mcg); T, Tetracycline (10mcg); S, Streptomycin (10mcg); No, Novobiocin (5mcg); G, Gentamicin (10mcg); E, Erythromycin (15mcg); Co, Cotrimazine (25mcg); F, Furazolidone (50mcg); A, Ampicillin (10mcg); Ci, Ciprofloxacin (10mcg); Cx, Cinoxacin (10mcg); MAR, multiple antibiotic resistance.

CONCLUSION

In the present investigation it has been found that that the MAR index ranges from 0.31 – 0.68, which indicates that the enteric pathogens collected, identified and studied are resistant to 31% to 68% of the antibiotics taken in the study. However, all the strains are sensitive to chloramphenicol. This clearly depicts that the strains are multi-drug resistant and new works are to be focused on developing new antibiotics with more efficacy. The currently available antibiotics such as chloramphenicol and co-trimoxazole have been documented to be potentially toxic and possess harmful side effects. Plant extracts can provide effective medicines and they are also cost effective with no side effects. Based on the present investigations it can be concluded that the plant can be a potential source for herbal drug against the human pathogenic bacteria. In the present study the ethanolic extracts of the leaves of *Scoparia dulcis* L. showed good bacterial inhibition zones. The MIC (minimum inhibitory concentration) measurement study indicates that these plant extracts can be used in developing effective medicines against diarrhoeal diseases. However the works on plant extracts has been done with crude extracts only and therefore effort need to be focused on purifying these extracts by column chromatography, HPLC and other biochemical techniques and thus find out the active component responsible for the zone of inhibition.

REFERENCES

Bauer A.W., Kirby W.W.M., Sterris J.C., and Turck M. 1996. Antibiotic susceptibility testing by a standard single disc method. *American Journal of Clinical Pathology*, 45: 493 – 496.

Chunder N., Bhattacharya S.K., Biswas D., Niyogi S.K., and Kumar R. 1997. Isolation of a fluoroquinolone resistant *Shigella dysenteriae* 1 strain from Calcutta. *Indian Journal of Medical Research,* 106: 494-496.

Garg P., Chakroborty S., Basu I., Datta S., Rajendran K., Bhattachyarya T., Yamasaki T., Bhattacharya S.K., Takeda Y., Nair G.B., and Ramamurthy T. 2010. Expanding multiple antibiotic resistance among clinical strains of *Vibrio cholerae* isolated from 1992-97 in Calcutta, India. *Epidemiology and Infection,* 124: 393-399.

Hammer K.A., Carson C.F., and Riley T.V. 1999. Antimicrobial activity of essential oils and other plant extracts. *Journal of Applied Microbiology,* 86(6): 985.

Hoge C.W., Gambel J.M., Srijan A., Pitarangsi C., and Echeverria P. 1998. Trends in antibiotic resistance among diarrheal pathogens isolated in Thailand over 15 years. *Clinical Infectious Diseases,* 26: 341-345.

Holt J.C., Krieg N.R., Sneath P.H., Staley J.T., and Williams S.T. 1994. Bergey's Manual of Determinative Bacteriology, Williams and Wilkins Company, Baltimore, USA.

Irfan A.K., and Atiya K. 2004. A panaroma of ethnobotany. In : Ethnomedicine and human welfare, Ukaaz Publishers, Hyderabad, India.

Jesudasan M.V. 2002. *Shigella* isolation in Vellore, South India (1997—2001). *Indian Journal of Medical Research,* 115: 11 – 13.

Jiang Z.D., Lowe B., Verenkar M.P., Ashley D., Steffen R., and Tornieporth N. 2002. Prevalence of enteric pathogens among international travelers with diarrhea acquired in Kenya (Mombasa), India (Goa), or Jamaica (Montego Bay). *Journal of Infectious Diseases,* 185: 497-502.

Kain K.C., Barteluk R.L., Kelly M.T., He X., de Hua G., and Ge Y.A. 1991. Etiology of childhood diarrhea in Beijing, China. *Journal of Clinical Microbiology,* 29: 90 -95.

Kambizi L., and Afolayan A.J. 2001. An ethnobotanical study of plants used for the treatment of sexually transmitted diseases (njovhera) in Guruve district, Zimbabwe. *Journal of Ethnopharmacology,* 71: 5-9.

Khandelwal K.R. 2004. Practical Pharmacognosy, Nirali Prakshan, Pune, India, 149-156.

Krumperman P.H. 1985. Multiple antibiotic resistance indexing of *Escherichia coli* to identify high-risk sources of fecal contamination of foods. *Applied Environmental Microbiology,* 46: 165 – 170.

Mukhopadhyay S.P., and Sur D. 1996. Case study to strengthen health sector preparedness and response in flood prone districts in West Bengal. *Journal of Communicable Diseases,* 7: 11—17.

Muthu S.E., Nandakuma S., and Rao U.A. 2005. The effect of methanolic extract of *Tamarindus indica* Linn. on the growth of clinical isolates of *Burkholderia pseudomallei*. *Indian Journal of Medical Research,* 122: 525 – 528.

Niyogi S.K., Dutta D., Bhattacharya M.K., and Bhattacharya S.K. 1999. Multi-drug resistant non-typhoidal *Salmonella* spp. associated with acute diarrhoeal disease. *Indian Journal of Medical Research,* 110: 183-185.

Rastogi R.P., and Mehrotra B.N. 2002. Glossary of Indian Medicinal Plants, National Institute of science communication, New Delhi, India.

Replogle M.L., Fleming D.W., and Cieslak P.R. 2000. Emergence of antimicrobial-resistant Shigellosis in Oregon. *Clinical Infectious Diseases*, 30: 515-519.

Ries A.A., Wells J.G., Olivola D., Ntakibirora M., Nyandwi S., and Ntibakivayo M. 1994. Epidemic *Shigella dysenteriae* type I in Burundi: panresistance and implications for prevention. *Journal of Infectious Diseases*, 169: 1035 – 1041.

Robbers J., Speedie M., and Tyler V. 1996. Pharmacognosy and Pharmacobiotechnology. Williams and Wilkins, Baltimore, 1-14.

Sack R.B., Rahman M., Yunus M., and Khan E.H. 1997. Antimicrobial resistance in organisms causing diarrheal disease. *Clinical Infectious Diseases,* 24 (1): 102-105.

Saleh A.I., Mohammad Al-Dosari S., Abdul M., Alsheikh M., and Abdel-Kader S. 2009. Evaluation of the hepatoprotective effect of *Fumaria parviflora* and *Momordica balsamina* from Saudi folk Medicine against experimentally induced liver injury in rats. *Research Journal of Medicinal Plants*, 3(1): 9-15.

Sathyadevi M., Suchithra E.R., and Subramanian S. 2014. *Physalis peruviana* Linn. fruit extract improves insulin sensitivity and ameliorates hyperglycemia in high-fat diet low dose STZ-induced type 2 diabetic rats. *Journal of Pharmaceutical Research*, 8(4): 625-632.

Sebiomo A., Awofodu A.O., Awosanya F.E.A., and Ajayi A.J. 2011. Comparative studies of antibacterial effect of some antibiotics and ginger (*Zingiber officinale*) on two pathogenic bacteria. *Journal of Microbiology and Antimicrobials,* 3(1): 18-22.

Sharma U., Saini R., Kumar N., and Singh B. 2009. Steroidal saponins from *Asparagus racemosus*. *Chemical & Pharmaceutical Bulletin,* 57(8): 890-893.

Sieradzki K., Wu S.W., and Tomasz A. 1999. Inactivation of the methicillin resistance gene mecA in vancomycin resistant *Staphylococcus aureus*. *Microbial Drug Resistance*, 5(4): 253-257.

Suputtamongkol Y., Dance D.A., Chaowagul W., Wattanagoon Y., Wuthiekanun V., and White N.J. 1991. Amoxycillin-clavulanic acid treatment of melioidosis. *Transactions of the Royal Society of Tropical Medicine and Hygiene,* 85: 672—675.

Taneja N., Kaur J., Sharma K., Singh M., Kalra J.K., and Sharma N.M. 2014. A recent outbreak of cholera due to *Vibrio cholerae* 01 Ogawa in and around Chandigarh, North India. *Indian Journal of Medical Research,* 117: 243 – 246.

Threlfall E.J., Graham A., Cheasty T., Ward L.R., and Rowe B. 1997. Resistance to ciprofloxacin in pathogenic enterobacteriaceae in England and Wales in 1996. *Journal of Clinical Pathology,* 50: 1027-1028.

Threlfall E.J., Ward L.R., Rowe B., Raghupati S., Chandrasekaran V., and Vandepitte J. 1992. Widespread occurrence of multidrug resistant *Salmonella typhi* in India. *European Journal of Clinical Microbiology and Infectious Diseases*, 11: 990 – 993.

Weber J.T., Mintz E.D., Canizares R., Semiglia A., Gomez I., and Sempertegui R. 1994. Epidemic cholera in Ecuador: multidrug resistance and transmission by water and sea food. *Epidemiology and Infection*, 112: 1 –11.

Yamamoto T., Nair G.B., and Takeda Y. 1995. Emergence of tetracycline resistance due to a multi-drug resistance plasmid in *Vibrio cholerae* O139. *FEMS Immunology and Medical Microbiol*ogy, 11: 131 – 136.

Northeast Journal of Contemporary Research, December 2019. Vol. 6 No. 1 pp.10-17
ISSN 2349-3089

Botanical Identity and Utilitarian Aspects of the 'Best Quality Tejpat' from Northeast India

Akhil Baruah
Phytodiversity Research Cell, P.G. Department of Botany,
Darrang College, Tezpur – 784 001, Assam, India.

ABSTRACT

Cinnamomum impressinervium Meissn., a taxon identified/discovered from Northeast India, as the 'best quality tezpat spice' has been overviewed, for its botanical/morphological identity along with their utilitarian aspects like essential oil characters of leaves, uses and propagation technology, for easy reference.

Key words: *Cinnamomum impressinervium*, botany, essential oil, uses, propagation, Northeast India.

INTRODUCTION

Tezpat or Indian cassia is a kind of leafy spice obtained from an evergreen, aromatic tree species *i.e*. *Cinnamomum tamala* Nees & Ebrem, occurring in tropical and sub-tropical Himalayas, including Northeast India. The leaf of this species is used as the genuine source of 'tejpat spice of commerce'. It is popular among the people of northern India and since antiquity ++has been used as a flavouring agent which is inevitable in the preparations of vegetarian and non-vegetarian dishes. This leafy spice is however, been obtained from a number of other tree species belonging to the genus *Cinnamomum* Schaeffer (Baruah 2011, 2016).

While conducting an ethnofloristic survey on the aromatic, spice and medicinal plants in Northeast India, we came across a very interesting and promising species of the genus *Cinnamomum* Schaeffer (Family: Lauraceae) and identified the same as *C. impressinervium* Meissn (Baruah 2000, Baruah *et.al.* 2000). This very particular species is known by the local people of Dima Hasao district of Assam as 'Best Quality Tejpat' (**Figure 1A** & **1B**) and even sold its leaves in the local markets by the same name (Baruah and Nath 2001).

The authenticity of utilizing the leaf as 'Best Quality Tejpat' has been reported by analyzing the essential oil compositions which is very rich in eugenol (Nath and Sarma Baruah 1994, Nath *et.al.* 1999). The percentage composition of eugenol in the leaf oil of *C. impressinervium* (Nath and Sarma Baruah 1994, Nath *et. al.* 1999) is reported to be higher (up-to 88.30%) than that of the leaf oil (up-to 82.50%) of *C. tamala* Nees. (Atal and Kapur 1982, Nath *et.al.*1999).

The market survey on the essential oil of *C. impressinervium* reported that, this particular oil can be used as a substitute of 'Clove leaf oil' (Nath 1998).

**Corresponding author's Email:* drakhilbaruah@yahoo.co.in

A **B**

Figure 1A & B. *Cinnamomum impressinervium* – A. Fresh leafy twig, and B. Dry leaves (Best Quality Tejpat)

A. BOTANICAL IDENTITY

Cinnamomum impressinervium Meissn. in DC Prodr. 15(1): 25.1864; Hk.f. Brit. Ind. 5:129. 1885; *C. cacharensis* R. N. Parkar ? Kanjilal *et al.* Fl. Assam 4:58. 1940. (Figure 3A). Baruah & Nath. J.Econ.Tax.Bot. 29(2): 294-327. 2005.

A middle-sized evergreen tree; 20-25ft tall, branchlets teret and slender; Bark rough, aromatic, brown, inside creamish-brown, on exposure turning brown, 6-10mm thick; Leaf buds silky; Leaves alternate, sub-opposite or opposite on the same twig, coriaceous, aromatic, smell like "tejpat" leaves, glabrous, shining above, dark green, pale below, elliptic-oblong to elliptic-lanceolate, apex acute to acuminate, base decurrently acute, variable in size, 2.5-3.8 x 7-14cm, triplinerved, lateral nerves reaching near the base of the acumen, suprabasal perfect to imperfect, midrib stout, 2^0 nerves sub-horizontal, nervules not so distinct; Epidermal cells pentagonal to polygonal and highly sinuous, hypostomatic, stomata sunken, stomata/ mm^2 550, stomatal index 19.52, Areoles tetragonal to polygonal, vein endings simple, average frequency of areole/mm^2 7.88; Petiole stout, slightly concave above, 0.8-1.1cm long; Panicle sub-terminal to axillary, shorter than leaves, up-to 6.5cm long, glabrate, perianth 3+3, sub-equal, minutely puberolous on truncate cup-shaped fruiting tepals, pedicel obconic, pedicel with fruiting tepal up-to 8mm long.
(**Figure 2).**
Phenology: Flrs. February - April, Frts. May - August.

Ecology & distribution: Found growing in both wild and homestead gardens of Dima Hasao and Cachar districts of Assam at an elevation between 800-1050m.

B. UTILITARIAN ASPECTS

B1. Leaf essential oils characters

The yield and physico-chemical characters of leaf oil of *C. impressinervium* (cultivated one) as reported are given below –

Oil yield (FWB) = 2%
Colour = Yellowish-brown
Odour = like Tejpat leaves/ Clove leaf oil
Taste = Spicy, pungent
Refractive Index (25^0C) = 1.5320
Optical Rotation (25^0C) = $+16^0$
Density (25^0C) = 1.0350

GC analyses of leaf oils from cultivated and wild plants of *C. impressinervium* as reported (Nath and Sarma Baruah 1994, Nath *et.al.* 1999) revealed the presence of 10 components each accounting 97%-96.8% of the total oil where **eugenol** alone constitutes 83.2% to 88.3%. Other components of above 1% concentration of the oil are d-3-carene (1.6%-7.2%), limonene (2.3%-4.1%), eugenyl acetate (1%-1.1%), etc. The chemical compositions of the leaf oils are presented in **Table 1.**

Figure 2. A Fruiting twig of *Cinnamomum impressinervium* (Line diagram by Author)

Table 1. Composition of the leaf essential oil of *Cinnamomum impressinervium*

Components	**Peak area (%)**	
	Cultivated plant	**Wild plant**
α-pinene	0.5	1.2
β-pinene	0.1	0.2
d-3-carene	1.6	7.2
Limonene	4.1	2.3
p-cymene	0.6	0.7
guaiacol	0.1	0.4
α –terpineol	0.3	0.4
Eugenol	88.3	83.2
b-caryophyllene	0.1	0.2
Eugenyl acetate	1.1	1.0
Total	96.8	97.0

Source: Nath and Sarma Baruah 1994, Nath *et.al.* 1999

B2. Uses

C. impressinervium is considered as the 'best quality tejpat tree' and its leaves are sold in the local markets as the 'best quality tejpat'.

Smoke of dry leaf is used to inhale for curing cold, cough and toothache.

Decoction of leaves is sometimes used as a stimulant and for the treatment of colic, diabetes, diarrhea and rheumatic pains (Baruah & Nath 2006).

B3. Propagation technology

B3a. Seed propagation of *C. impressinervium*: *C. impressinervium* is naturally propagated by means of seeds. Scientific research work on this promising spice crop with regards to using seed has been carried out by Saikia & Nath (2003). The fresh and mature seeds of this species depulped using luke-warm water and treated with 500 ppm solution of GA3 showed highest percentage of germination (92.5). The seeds indicated a dormancy period up-to 6 weeks even when the nursery beds were provided with proper shading and regular watering. With the increase of storage period, the seeds started losing their viability.

The percentage germination of the seeds as recorded by Saikia & Nath (2003) showed that the seeds of depulated conditions exhibited germination earlier with better result in comparison to the seeds of normal (pulped) condition. However, the depulped seeds treated with luke-warm and cold water at 500ppm of GA_3 showed maximum percentages of germination (92.5 and 70.0 respectively) than that of their normal conditions (47.5%)

It is also recorded (Saikia & Nath 2003) that the seeds sown at one week of drying and storage period from the date of their collection give maximum germination in both normal (92%) and depulped (80%) conditions. The rate of germinations however, gradually decline with the increase of drying and storage periods. Germination is checked completely at 7 weeks of drying and storage condition

The results thus, clearly indicate that *C. impressinervium* seeds when sown under fresh condition show germination even up to 11^{th} week from the date of their sowing, although optimum germination was recorded (92.5%) in the seeds of depulped category when they were treated with luke-ware water at 500ppm of GA_3. The rate of the germination was found to be comparatively slower up-to period of 3^{rd} and 4^{th} week in depulped and pulped conditions which were thereafter became speedy within the period of 4^{th} to 11^{th} and 5^{th} to 11^{th} weeks respectively. It was however, found to be checked completely after 11^{th} week. The seeds of *C. impressinervium* thus indicate a range of dormancy period from 2 to 11 weeks in a nursery bed condition as recorded in the present experiments. However, the seeds loss their viability when they are allowed to dry and store for a period of 7 weeks under room condition at a temperature of 26-36°C and relative humidity 86-97% although a minimum percentage of germination (4%) is recorded for the seeds of 42 days drying and storage

The acceleration of germination process of seeds treated with GA_3 could be attributed to the fact that the GA_3 induces mobilization of stored reserve for metabolism or enzyme activity in the embryo results the quicker germination as reported previously for the species like *C. zelyanicum* (Sebastain *et.al*. 1995) and *C. camphora* (Bahuguna *et.al*. 1987). However, the delay and inhibition of seed germination in *C. impressinervium* may be due to their aromatic pulps which act as inhibitor, as indicated previously in the species like *C. camphora* (Bahuguna *et.al.* 1987) and *Litsea cubeba* (Baruah & Nath 1998).

B3b. Vegetative propagation of *C. impressinervium*: Vegetative propagation of *C. impressinervium* Meissn was studied by Baruah (2009, 2011). The cuttings (current year lateral shoots)

of the species exhibited 100% rooting at 90 days intervals. The regeneration techniques developed in the study provided a good deal of protocol, for multiplication of this new and promising species of *Cinnamomum* used as tejpat (best quality tejpat) through stem cuttings.

Baruah (2009), the author of the present communication followed the following experimental procedures for propagation and multiplication trial of *C. impressinervium*, using stem cuttings.

The stem cuttings were obtained from the plants grown in the Experimental Botanic Garden **(Figure 3)** of CSIR-NEIST (formerly known as RRL), Jorhat, Assam. The plantlets of the population of the said garden were collected by the present author (then CSIR Research Fellow) along-with his Ph. D. guide Dr. S. C. Nath (Retired Senior-most Scientist of the said institute) during the middle of the last decade of the 20th century from a homestead garden of Haflong area of Dema-Hasao Distrcit of Assam, and accordingly planted under their supervisions. The stem cuttings used in the experiment were differed from the conventional one, and these were alike with those used by Nath and Baruah (2000). Comparatively healthy 3-5 months old lateral shoots/cuttings possessing 2-5 moderate sized leaves and swollen bases were selected, from their mother plants. These were detached gently with the help of fingers, from the axis of their main branches. The sizes of the cuttings were ranges from 5.5cm to 11cm.

Figure 3. Plantation of 'Best Quality Tezpat' at CSIR-NEIST, Jorhat

The experiments were conducted during October' 2006, inside of the 'Green Shade House' of P.G. Department of Botany, Darrang College, and subsequent period are considered for the study of, rooting response of the cuttings. The rooting medium like loamy soil with equal proportion of sandy soil is used. The sandy soil used was collected from 'Jahajghat' bank of the mighty river Brahmaputra near Tezpur, Assam of Northeast India.

The selected cuttings are planted at 12 x 12cm spacing in raised nursery beds of the above rooting medium in 3 replications (25 Nos. of cuttings in each replication). The mulching provided for the nursery beds has been done by covering with 4-6cm thick layering of dry grasses cut into small pieces and shocked in water for about 36-48 hours. The cuttings are planted in the nursery bed or rooting medium by making them 40^0-60^0 angle to the rooting surface and 3-5cm depth of the rooting medium. During the period of experimentation, the atmospheric temperature ranged from 14 to 27^0C and likewise, soil temperature ranged from 11 to 18^0C. Care was taken to provide sufficient exposure to the foliar parts of the cuttings. Necessary shading and watering arrangements was also made to maintain a constant temperature and moisture at the nursery beds.

The rooting response of the cuttings were observed from 30^{th} day onwards from the date of their plantation at an intervals of 30 days up-to 90 days, and the data on callusing and rooting percentages along with the number and length of the roots were recorded taking into account the average of 12 randomly selected cuttings, taken out from the beds for **(Figure 4)** each data.

The data on rooting response of *C. impressinervium* cuttings as reported (Baruah 2009) were presented in **Table 2**. *C. impressinervium* cuttings exhibited 41.67% callusing at 30 days intervals and 66.67% rooting at 60 days intervals, where the lengths of primary (1^0) roots were 3.32cm. The cuttings of *C. impressinervium* exhibited 100% callusing and rooting at 60 and 90 days intervals, respectively. Likewise, at an interval of 90 days, the cuttings exhibited 9.13cm long primary (1^0) roots, and at an interval of 90 days, the length of secondary (2^0) and tertiary (3^0) roots were recorded as 2.53cm and 0.43, respectively.

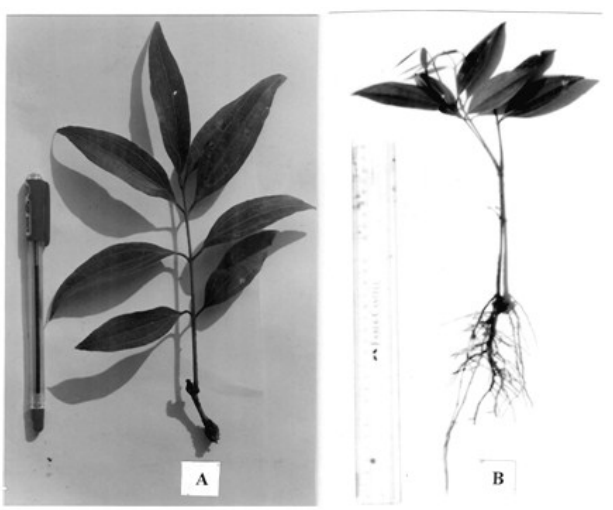


Figure 4. Rooted cuttings of *Cinnamomum impressinervium* (Scale = 30cm) – A. Root callusing, B. Eight months old.

Table 2. Rooting response of the lateral shoots of *C. impressinervium*

Rooting response	Observation intervals after		
	30 days	**60 days**	**90 days**
Callusing (%)	41.67	100	--
Rooting (%)	--	66.67	100
Average No. of 1^0 roots	--	2.67	3.58
Average length of 1^0 ro (cm)	--	3.32	9.13
Average No. of 2^0 roots	--	5.27	11.25
Average length of 2^0 root (cm)	--	0.62	2.53

Vegetative propagation of *C. pauciflorum* using stem cuttings of lateral shoots with swollen bases was carried out (Nath and Baruah 2000). In *C. pauciflorum*, 100% rooting as well as cent percent survival was recorded. The study on the vegetative propagation of *C. impressinervium* exhibited 100% rooting too.

REFERENCES

Atal C.K. and Kapur B.M. 1982. Cultivation and Utilization of Aromatic Plants. RRL Jammu-Tawi Publication. India.

Bahuguna V.K., Rawat M.S. and Thapa V.S. 1987. Preliminary investigation on dormancy and germination behaviour of *Cinnamomum camphora* Nees. seeds. Van Gagyan. 25(1&2): 35-37.

Baruah A. 2000. *Cinnamomum* species associated with the livelihood of people in North-East India: A systematic census with emphasis to ethnobotany. Ph. D. Thesis. Gauhati University. Assam.

Baruah A. 2009. Vegetative propagation of two species of *Cinnamomum* Schaeffer. Medicinal Plants. 1(2): 121-123.

Baruah A. 2011. *Tejpat – the Indian Bay Leaves*. Lambert Academic Publishing, Germany.

Baruah A. 2016. Taxonomic Diversity and Utilitarian Aspects of Tejpat Spice. North-east J. Contemporary Rsearch. 3(1): 1-6.

Baruah A. and Nath S. C. 2006. Ethnobotanical evaluation of *Cinnamomum* Schaeffer species used as spices and condiments in Northeast India. *Ethnobotany*. 18 (1&2): 27-35.

Baruah A. and Nath S. C. 2001. Best Quality Tejpat – *Cinnamomum impressinervium* Meissn. *Spice India*. 14(5): 5-7.

Baruah A. and Nath S.C. 1998. Germination studies on the seeds of *Litsea cubeba* Pers.- A promising essential oil crop of industrial value. Indian Perfumer. 1998. 42(2): 86 – 91.

Baruah A., Nath S.C. and Boissya C.L. 2000. Systematics and diversities of *Cinnamomum* species used as "Tejpat" in Northeastern India. *J. Econ. Tax. Bot*. 24(2): 361-374.

Nath S.C. 1998. Summary of the completed project on "Commercial resources of *Cinnamomum* species in Eastern Himalayan region of India: Survey, Identification and Conservation for sustainable use" *In* ENVIS Bulletin - Himalayan Ecology and Development. 6: 21 -22.

Nath S.C. and Baruah A. 2000. An effective method for vegetative propagation of two Cinnamon sources. *In* Conserva-

tion of Biodiversity Edts. V.P. Agarwal and S.K. Gupta, Society of Biosciences Publications, Muzaffarnagar. India. Pp. 147-154.

Nath S.C. and Sarma Baruah A.K. 1994. Eugenol as the major component of the leaf oil of *Cinnamomum impressinervium* Meissn. J. Essent. Oil Res. 6: 211-212.

Nath S.C., Baruah A. and Hazarika A.K. 1999. Essential oils of the leaves of *Cinnamomum* Schaeffer members. Indian Perfumer. 43(4): 182-190.

Saikia N. and Nath S.C. 2003. Germination studies on the seeds of *Cinnamomum impressinervium* Meissn. Indian Perfumer. 47: 73-77.

Sebastain S., Farooqi A.A. and Subbaiah T. 1995. Effect of growth regulators on germination and seedling growth of Cinnamon (*Cinnamomumzeylanicum* Breyn). Indian Perfumer. 39(3): 127-130.

Northeast Journal of Contemporary Research, December 2019. Vol. 6 No. 1 pp .18-25
ISSN 2349-3089

A checklist of the avian diversity in different habitat types in Greater Jamugurihat area, Sonitpur, Assam

Manisha Das
Department of Zoology, Tyagbir Hem Baruah College, Jamugurihat-784180, Assam, India

ABSTRACT

A total number of 72 species of birds belonging to 35 families were recorded from greater Jamugurihat area, Sonitpur, Assam, based on fieldwork carried out in April 2018 to March 2019. Out of these species 19 were water birds, 7 were water dependent birds while 46 species were terrestrial birds. There were one endangered species, one vulnerable species and one species were listed as near threatened. The avian diversity of this area is under threat due to various anthropogenic and environmental problems. The conservation threats of this area have been highlighted in this paper.

Key words: Avian diversity, Jamugurihat area, Anthropogenic, Conservation

INTRODUCTION

Diversity of avifauna is one of the most important ecological indicators to evaluate the quality of habitats. Birds are often common denizens of ecosystems and they have been considered as an indicator species of inhabited areas (Blair,1999). Population of birds is a very sensitive indicator of degree of population in both terrestrial and aquatic ecosystem (Gaston, A.J. 1975, Ali, S. *et al.,* 1987).The estimation of local densities of avifauna helps to understand the abundance of various species of other organisms (Turner, W.R. 2003). Wetlands are the most productive important part of the global ecosystem, which support many valuable aquatic flora and fauna (Anonymous, Ramsar convention Bureau). Man's dependence and association with the wetlands has been started since the beginning of civilization. Wetlands are locally known as 'Beel', 'Jolah', 'Pitoni' etc. It plays a vital role in creation of good ecosystem balance and in maintaining healthy environmental condition of the area. Wetland and water birds are inseparable elements and support a rich array of water birds communities (Grimmett. R. *et al.,* 2007). Water birds are an important component of most of the wetland ecosystem as they occupy several trophic levels in the food web of wetland nutrient cycles. (Custer, T.W. *et al.,*1977)

As far as bird diversity is concerned, India is a blessed country, having more than 1300 species which is over 13% of the world bird species (Grimmette. R., C. *et al.,*1999). But unfortunately India is the third among the countries having the largest number of threatened and rare species followed by Brazil and Indonesia (Dandapat, A.D. *et al.,* 2010). However, there is insufficient knowledge available regarding the bird communities and their dynamics in India (Khan, J.A., *et al.,* 1993, Safiq, T., S. *et al.,* 1997, Stattersfield, A.J., *et al.,*1998)

*Corresponding author's Email: manishadas245@gmail.com

The eastern Himalaya, including NE India is a global hotspot of biodiversity and Endemic Bird area (Myers, N., *et al.,* 2000, Mittermeier, R.A., *et al.* 2005). Continued degradation of forest, habitat loss, urbanization are the major threats for avian biodiversity in North-East India (Pandit, M.K., *et al.* 2007), which has remained poorly explored and much of its biodiversity has been lost without any record (Singh, S., A. *et al.*2012). As far as avian diversity of North-East region is concerned, many workers have been done o lot of work on this regard. The state of Assam is a constituent unit of Eastern Himalayan Biodiversity Region; one of the two biodiversity 'Hot spots' in the country. The climate of Assam is typically tropical monsoon rainfall type with high level of humidity and heavy rainfall. The climatic conditions and wide variety of physical features witnessed in Assam have resulted in a diversity of ecological habitats such as forests, grasslands, wetlands, which harbour and sustain wide ranging floral and faunal species placing.

Assam is one of the 'endemic bird areas' in the world. With 950 bird species the state is home to 53.5% of bird species found in the Indian Sub-continent and 17 species of birds are endemic to Assam. This richness and diversity in bird species is due to the fact that the North-East Assam in particular, is a meeting place of two zoogeographic sub-regions, the Indian and the Indo-Chinese within the framework of the oriental Zoogeographic Region (Choudhuary, A.U., 2000). Assam is having more than 750 wetland areas which support a vast diversity of bird. Water birds need feeding and shelter ground in and around wetland areas. Wetland provides many such habitats where they can lay their eggs.

Jamuguri is a town in Sonitpur District of Assam. This is a newly planned town. The town is situated beside northern part of the river Brahmaputra and has a number of open field, paddy field area and swampy areas. Jamuguri falls in the tropical rainforest climate region. Climatic condition is very good for various types of agricultural crops. Climatic condition and physical features of this area help to rich the avifaunal diversity. The present study is focused not only preparing the checklist of birds but also to find out their occurrence, status as well as to create awareness for their conservation.

METERIALS AND METHODS

Study area: Jamugurihat occupies an area of 20 sq km, and the latitude 26.7314˚N and longitude 92.9276˚E. Jamugurihat lies between Kani Dekorai and Jia Bhoroli river. Sijusa is situated in the northern part of Jamugurihat and the 6th edition of Kaziranga National Park is extended upto Panur the southern part of Jamugurihat.

Data collection: Field surveys were conducted for a period of one year starting from April 2018 to March 2019 covering all the seasons' i.e. Premonsoon, Monsoon, Retreating monsoon and winter. The survey followed Line transect method (Bibby, C., *et al.*199218). All the survey was carried out early morning, first three hours after sunrise and evening three hours before sunset. For data collection four to five days were allotted in one month. For watching and identifying birds Binocular (10x50) and telescope (25-40x) are used and field characteristics were noted down during the study period. Opportunistic observations were also added to the list so as to miss any species during the survey period. The photographs were taken during the study period with Canon camera with high zoom (48x).

Data analysis: Birds are identified using field guide books. The common and scientific names of the birds given in the world, recommended English Names. The threatened status of the birds given in the checklist is per IUCN Red List of Threatened Texa (Birdlife International (2008). The birds were listed following the nomenclature of Rasmussen & Anderson (2012). Their Migratory and Resident status was categorized as R=Resident, W= Winter visitor, L=Local and altitudinal migrant, Bm=Breeding migrant

(summer), P=Passage migrant birds according to (Choudhury, A. (2000) in the context of Assam. Their IUCN status is also confirmed from the Red Data list for birds (www.iucn.org)

RESULT AND DISCUSSION

During the study period a total number of 72 species of birds belonging to 35 families were recorded. Out of these 19 species were water birds, 7 water dependent birds while 46 species were terrestrial birds depicted in the **Table-1**. All the species were least concerned expect one endangered species viz., Greater Adjutant, one Vulnerable species, viz., Lesser Adjutant and one species were listed as near threatened, viz,. River turn as per the IUCN Red list. There were 67 resident species, 8 winter visitor, two species, i.e, Common hoope and Indian roller was Local and altitudinal migrant and one species, i.e., Indian Plaintive Cuckoo was breeding migrant in summer.

18 species were represented only by one species each. The dominant family of birds were Ardidae contributing to 8 species(11.11 %) followed by Saturnidae contributing 6 species each (8.33%), Jacanidae contributing 4 species (5.55%), Motacillidae, Cuculidae, Corvidae, Coraciidae, Megalaimidae, Rallidae contributing 3 species each(4.16%), Columbidae, Paridae, Muscicapidae, Laniidae, Passcridae, Pycronotidae, Ciconiidae and Anatidae contributing 2 species each (2.77%) and Cisticolidae, Ploceidae, Estrildidae, Discruridae, Oriolidae, Campepphagidae, Zosteropidae, Meropidae, Picidae, Phalacrocoacidae,Upipidae, Accipitridae, Phasianidae, Psittacidae, Laridae, Leiothrichidae, Strgidae, Tytonidae and Hirundinidae contributes 1 species each in the community comprising of 1.38%.

Birds occupy all most all habitat types and diversity of birds often serves as a good indication of overall diversity of a given area. Birds are also known to be responsive to any kind of changes to their ambient conditions hence can be used as bio-indicator. The present short span study which is recorded 72 bird species reflects a moderate type of bio-diversity for the present study areas. Study area indicates 19 species are water birds, 7 water dependent species and 46 birds in terrestrial habitat. Large number of water logging area, beels and open fields are found in the Panpur area. Panpur is nearer to the Kaziranga National Park so different types of faunal diversity are prevailing here. Water birds prefer swamps with vegetation for their nesting. But the human activities disturb them and birds migrated to another places for searching their home.

Table 1. Check list of birds recorded in Tezpur area during April 2018- March 2019

Family	Sl no.	Common name	Scientific name	Conservation status	Habitat	Migratory or Resident
Saturnidae	1	Jungle myna	*Acridotheres fuscus*	LC	T	R
	2	Common myna	*Acridotheres tristis*	LC	T	R
	3	Bank myna	*Acridotheres ginianus*	LC	T	R
	4	Pied myna	*Gracupica contra*	LC	T	R
	5	Common hill myna	*Gracula religiosa*	LC	T	R

	6	Grey headed starling	*Sturnia malabarica*	LC	T	R
Muscicapidae	7	Red breasted flycatcher	*Ficedula parva*	LC	T	R
	8	Oriental magpie robin	*Copsychus saularis*	LC	T	R
Motacillidae	9	White wagtail	*Motacilla alba*	LC	WD	W
	10	Grey wagtail	*Motacilla cinerea*	LC	WD	W
	11	Olive backed pipit	*Anthus hodgsoni*	LC	T	R
	12	Paddy field pipit	*Anthus rufulus*	LC	T	R
Cisticolidae	13	Common tailor bird	*Orthotomus sutorius*	LC	T	R
Paridae	14	Cinereous tit	*Parus cinereus*	LC	T	R
	15	Sultan tit	*Melanochlora sultanea sultanea*	LC	T	R
Ploceidae	16	Baya weaver	*Ploceus philippinus*	LC	T	R
Estrildidae	17	Scaly breasted munia	*Lonchura punctulata*	LC	T	R
Discruridae	18	Black drongo	*Edolius macrocercus*	LC	T	R
Pycronotidae	19	Red vented bulbul	*Pycnonotus cafer*	LC	T	R
	20	Red whiskered bulbul	*Pycnonotus jocosus*	LC	T	R
Passcridae	21	House sparrow	*Passer domesticus*	LC	T	R
	22	Eurasian tree sprrow	*Passer rutilans*	LC	T	R
Oriolidae	23	Black hooded oriole	*Oriolus xanthornus*	LC	T	R
Corvidae	24	Rufous treepie	*Dendrocitta vagabunda*	LC	T	R
	25	House Crow	*Corvus splendens*	LC	T	R
	26	Eastern jungle crow	*Corvus macrorhychos*	LC	T	R
Campephagidae	27	Large cuckoo shrike	*Coracina macei*	LC	T	R
Zosteropidae	28	Oriental white eye	*Zosterops palpebrosus*	LC	T	R
Laniidae	29	Grey backed shrike	*Lanius tephronotus*	LC	T	R
	30	Long tailed shrike	*Lanius schach*	LC	T	R
Meropidae	31	Green bee eater	*Merops orientalis*	LC	T	R
Columbidae	32	Yellow-footed Green pigeon	*Treron Phoenicoptera*	LC	T	R

	33	Spotted dove	*Spilopelia chinensis*	LC	T	R
Cuculidae	34	Asian koel	*Eudynamys scolopaceus*	LC	T	R
	35	Indian cuckoo	*Cuculus micropterus*	LC	T	R
	36	Indian plaintive cuckoo	*Cucomantis passerinus*	LC	T	Bm
Megalaimidae	37	Blue throated barbet	*Megalaima asiatica*	LC	T	R
	38	Lineated barbet	*Megalaima lineata*	LC	T	R
	39	Coppersmith barbet	*Xantholaema haemaceph-ala*	LC	T	R
Picidae	40	Stripe breasted woodpecker	*Dendrocopos atratus*	LC	T	R
Coraciidae	41	Indian roller	*Coracias benghalensis*	LC	T	R, L
	42	White breasted kingfisher	*Halcyon smyrnesis*	LC	WD	R
	43	Common king-fisher	*Alcedo atthis*	LC	WD	R
Ardidae	44	Little cormorant	*Microcarba niger*	LC	WB	R
	45	Great cormorant	*Phalacrocorax carbo*	LC	WB	R
	46	Indian pond heron	*Ardeola grayii*	LC	WB	R
	47	Great egret	*Egretta alba*	LC	WB	R
	48	Cattle egret	*Bubulcus ibis*	LC	WB	R
	49	Intermediate egret	*Egretta intermedia*	LC	WB	R
	50	Little egret	*Egretta garzetta*	LC	WB	R
	51	Grey heron	*Ardea cinerea*	LC	WB	R
Jacanidae	52	Bronze winged jacana	*Metopidius indicus*	LC	WB	R
	53	Pleasant tailed jacana	*Hydrophasianus chirurgus*	LC	WB	R
	54	Red wattled lapwing	*Vanellus indicus*	LC	WD	R
	55	Yellow watted lapwing	*Vanellus Malabaricus*	LC	WD	R
Ciconiidae	56	Greater adjutant	*Leptoptilos dubius*	EN	WB	R

	57	Lesser adjutant	*Leptoptilos javanicus*	VU	WB	R
	58	Asian openbill	*Anastomus oscitans*	LC	WB	R
Phalacrocoacidae	59	Indian cormorant	*Phalacrocorax fuscicollis*	LC	WB	R
Upipidae	60	Common hoope	*Upupa epops*	LC	T	R,W, L
Anatidae	61	Spotbill duck	*Anas poecilorhyncha*	LC	WB	R
	62	Lesser whistling duck	*Dendrocygna javanica*	LC	WB	W, M
Accipitridae	63	Black kite	*Milvus migrans*	LC	T	R
Rallidae	64	White breasted water hen	*Amaurnis phoenicurus*	LC	WB	W,R
		Common moorhen	*Gallinula chloropus*	LC	WB	W,R
	66	Water cock	*Gallicrex cinerea*	LC	WB	R
Leiothrichidae	67	Jungle babbler	*Turdoides striata*	LC	T	R
Psittacidae	68	Red ringed parakeet	*Psittacula krameri*	LC	T	R
Laridae	69	River turn	*Sterna aurantia*	NT	WD	W,R
Strgidae	70	Spotted owlet	*Athene brama*	LC	T	R
Tytonidae	71	Barn owlet	*Tyto alba*	LC	T	R
Hirundinidae	72	Barn swallow	*Hirundo rustica*	LC	T	W

Based on Rasmussen, P.C. & Anderson, J.C. (2012)
IUCN Red list Legend: LC-Least concerned; VU -Vulnerable; NT=Near threatened; EN-Endangered
Habitat: WB-Water bird; WD-Water dependent Bird; T- Terrestrial bird.
Migratory or Resident status: R-Resident, W-Winter visitor, L-Local and altitudinal migrant, Bm- Breeding migrant (summer), P-Passage migrant.

CONCLUSION

Avifaunal diversity has been decreasing due to the ecosystem as they play various roles as Scavengers, pollinators, predators of insect pest, bio-indicators of different kinds of environment like urbanization and industrialization (Sharma, I.K. 1982, Bhattacharjee, P.C., *et al.,* 1985), human disturbance (Talukdar, B.K. 1997, Chakravarty, A.K.1981) illumination (Sandhu, P.S. *et al.,* 1980). They are very sensitive indicators of pollution problems and function as early warning system (Gole, P. 1984, Becker, P.H. 2003). Protection and maintenance of avifaunal diversity is important in maintaining species diversity of plants and animals. Therefore birds are reared not only for preserving ecological balance but also for products of economic importance and as down feathers (Someone, A., M. *et al.,* 2002). The study site is rich in avifauna but problems have arisen recently as the habitats of these birds are threatened due to unplanned activities being

carried out in favour of human development. In the area of Jamugurihat includes swampy areas, paddy fields and river bank of mighty Brahmaputra. Human activities like construction of buildings and noise due to vehicles are creating

REFERENCE

Ali, S.and Ripley, S.D. 1987. A Compact Handbook of the Birds of India and Pakistan, Second Edition. Oxford University Press, Delhi, 737 pp.

Anonymous, Ramsar convention Bureau, 1990. Proc.5th meeting Conf Contracting Parties (Glands, Switzerland).

Becker, P.H. 2003. Biomonitoring with bird. In Bioindicators and biomonitors, (Eds. B.A. Markert, A.M. Breure and M.C. Zechmeister).Amsterdam: Elsevier Science Ltd. Pp. 677-736.

Bhattacharjee, P.C., and B.C. Hazarika 1985. Roosting sites and roosting birds at Gauhati Municipal area. In Second international symposium on life sciences. November, 14-16,1985. NEHU Shillong.

Bibby, C., Burgess, N. D. and Hill, D. A., 1992. *Bird Census Techniques*, Academic Press, London.

Birdlife International.2008. Birdlife state of World's bird. Birdlife Inter-national Online.

Blair, R.B.1999. Birds and butterflies along an urban gradient: Surrogate taxa for assessing biodiversity? Ecol. Appl., 9, 164-170.

Chakravarty, A.K. 1981. Effects of human interference on waterfowl of pools in Bangalore (Karnataka), India. In Symposium on Tropical Ecology, (Eds. R.S. Ambasht and H.N. Pandey). Silver Jubliee, October 5-10,1981, Bhopal. pp. 37-38.

Choudhuary, A.U., 2000. The role of Birds of Assam. Gauhati: Gibbon Books and World wide fund for nature 240 .

Custer T.W and Osborne RG. 1977. Wading birds as biological indicators. Long survey, U.S. Fish and Wilflife Service, Washington, DC.

Dandapat, A., D. Banerjee and D. Gaston, Chakraborty. 2010. The case of the Disappearing House Sparr ow (Passer domesticus indicus). Veterinary World 3 (2): 97-100.

Gaston. A.J. 1975. Methods for estimating Bird populations. J.Bombay Nat. Hist. Soc., 72, 271-283.

Gole, P. 1984. Birds of a polluted river. J. Bomb. Nat. Hist. Soc. 81: 613-625.

Grimmette, R., C. Inskipp and T. Inskipp. 1999. Birds of Indian Subcontinent. New Delhi: Oxford University Press. 384 p.

Grimmett R and Inskipp T. 2007. Birds of Southern India. Om Books International, New Delhi, India.

Khan, J.A., D.N. Khan and A. Ahmed. 1993. Preliminary Investigation of bird community structure at Aligarh, India. Tropical Ecology 34: 217-225.

Mittermeier, R.A., P.R. Gill, M. Hoffman, J. Pilgrim, T. Brooks, C.G. Mittermeier, J. Lamoreux and G.A.B. da Fonseca. 2005. Hotspots Revisited: Earth's Biologically Richest and most Endangered Terrestrial Eco-regions. Mexico, Cemex. 390 p.

Myers, N., R.A. Mittermeier, C.G. Pandit, Mittermeier, G.A.B. da Fonseca and J. Kent. 2000. Biodiversity hotspots for conservation priorities. Nature 403: 853 -858.

Pandit M.K., S. Sodhi, L.P. Kob, A. Bhaskar and B.N. Brook. 2007. Unreported yet massive deforestation during loss of biodiversity in Indian Himalaya. Biodiversity Conservation 16:153-163.

Rasmussen, P.C. & Anderson, J.C. (2012) Birds of South Asia. The Ripley Guide. Vol and 2 Second edition

(National museum of natural History-Smithsonian Institution, Michigan State University and Lynx Editions, Washington, DC Michigan and Barcelona) 378(1) &684(2).

Safiq, T., S. Javed, and J.A. Khan. 1997. Bird community structure of middle altitude oak forest in kumaon Himalayas, India: a preliminary investigation. International Journal of Ecology and Environmental Sciences 23: 389-400.

Sandhu, P.S. and H.R. Dang 1980. Roosting behaviour of parakeets in relation to human disturbance. In Second all India Symposium on life sciences, March 9-11, 1980. Institute of Science, Nagpur.

Sharma, I.K. 1982. Adverse effects of air, water and soil pollutions on flora and fauna of towns and villages of Western Rajasthan. In Symposium on environment consciousness, problems of pollution and conservation in Rajasthan. October 1-3,

Simeone, A., M. B. Araya, M. Bernal, E. N. Diebold, K. Grzybowski, M. Michaels, J. A. Teare, R. S. Wallace and M. J.Willis. 2002. Oceanographic and climatic factors influencing breeding and colony attendance patterns of Humboldt Penguins Spheniscus humboldti in central Chile. Marine Ecology Progress Series 227:43–50.

Singh, S., A. Borkotoki and C.K. Sarmah. 2012. Species distribution of Spiders in Barpeta district of Assam: A diversity measure. E-International Scientific Research Journal IV (1): 47-57.

Stattersfield, A.J., M.J. Crosby, A.J. Long and D.C. Wege. 1998. Endemic Bird Areas of the World: Priorities for biodiversity Conservation. Cambridge, UK: Birdlife Inter-national. (Birdlife Conservation Series No. 7). 815 p.

Talukdar, B.K. 1997. Waterbirds of Dibrusaikhowa wildlife sanctuary. *Assam J. Nat. Cons. 9*(*2*):243-250.253.

Turner, W.R. 2003. Citywide biological monitoring as a tool for ecology and conservation in urban landscapes: the case of the Tucson bird count. Landscape and Urban Planning, 65, 149-166. www.iucn.org. Accessed on 2 June 2015.

Northeast Journal of Contemporary Research, December 2019. Vol. 6 No. 1 pp. 26-37
ISSN 2349-3089

Stabilization of Curcumin in Aqueous Chitosan-Tergitol-15-S-7 System

Palash Moni Saikia* and Pankaj Hazarika
Department of Chemistry, Darrang College, Tezpur-784001, Assam, India

ABSTRACT

The stability provided to curcumin by chitosan alone and in the presence of non ionic surfactant Tergitol-15-S-7 has been investigated by spectrophotometric analysis of the kinetics of degradation of curcumin. The interaction of curcumin with chitosan has been found to be exothermic and driven by hydrophobic interactions, hydrogen bond formation, and electrostatic interactions. The interaction of curcumin with chitosan, in presence of Tergitol-15-S-7 have been studied by monitoring the changes in the absorption and the fluorescence spectra at physiological *p*H (7.4). The apparent binding constants and the distribution of curcumin in the interior of chitosan have been evaluated by fluorescence quenching method. It has been observed from the fluorescence quenching techniques that curcumin is non-uniformly distributed in the colloidal chitosan solution. Curcumin is located mostly inside the hydrophobic interior of chitosan while a small fraction resides in the cationic centres of chitosan.

Key words: Curcumin; Stabilization; Chitosan; Tergotol-15-S-7; Surfactant; Binding constant

INTRODUCTION

Most natural dye molecules appears to defy implementation to model biological system due to poor aqueous solubility and fast metabolism. In order to improve the aqueous solubility, stability and bioavailability of the drug significant efforts have been put forward on impregnation of the water insoluble natural drug molecules onto biopolymeric pores.

Curcumin(1,7-bis(4-hydroxy-3-methoxyphenyl)-1,6-heptadiene-3,5-dione, Scheme 1), the yellow pigment obtained from the Indian spice curry Turmeric (*Curcuma longa* Linn) is one of the most potent bioactive polyphenolic compound available in nature. Curcumin possesses remarkable therapeutic properties such as anticancer,antioxidant, anti-arthritic, antiamyloid, anti-ischaemic, and anti-inflammatory, and many other desirable clinical benefits. It was also established that curcumin has great potential to prevent protein aggregation in shattering diseases such as Alzheimer's and Parkinson's. Despite of its highly promising features as a health-promoting agent, poor aqueous solubility of curcumin(~11 ng/ml in plain aqueous buffer *p*H 5.0) in neutral aqueous medium remains a major trouble in its bioavailability, clinical efficiency and metabolism. However, curcumin is moderately soluble in aqueous solutions of high *p*H, both polar aprotic and polar protic solvents, and in micelles. But, curcumin decomposes in alkaline conditions. A number of attempts have been made to increase the aqueous solubility and stability and hence the bioavailability of curcumin through encapsulation of curcumin in phospholipids, cyclodextrine, hydrogel, liposomes, polymeric micelles, nanoparticles, etc.

*Corresponding author's Email: palashms@rediffmail.com

The curcumin solubility and stability can also be improved by chemical alteration, complexation or interaction with macromolecules. Curcumin binds to a variety of biopolymers and is known to retain its medicinal activity in the bound states.

Chitosan, [(1-4)-2-amino-2-deoxy-β-D-glucan], is a positively charged linear polysaccharide with unique physicochemical properties including its solid-state structure and the chain conformations in the dissolved state supporting numerous living organisms is also a food-grade polymer. The useful features of chitosan, e.g., its abundance, flexibility, nontoxicity, hydrophilicity, biocompatibility, biodegradability, antibacterial property, and high resistance to heatmakes chitosan suitable for biomedical application such as drug delivery, tissue engineering, wound dressing, etc. Because of the high content of amine functional groups, as well as the hydroxyl groups on the glucosamine unit, the protonated amine groups can attract metal anions, viz., molybdate, vanadate, palladate, chromate, cadmium, etc., and can absorb a number of dyes such as reactive, basic, acidic, disperse dyes in acidic (pH < 5) solutions. Chitosan also binds the herbal pigment curcumin with high affinity at considerably high *p*H (*p*H = 7.0-10.5) through its glucosamine unit. Moreover, chitosan effectively interacts with surfactants in aqueous solutions.

It is assumed that, the viscous transient network of chitosan entraps the curcumin moiety in the physiological *p*H of the medium. Incorporation of surfactants to the curcumin- chitosan system may alter the sensitivity of the chitosan and thus the nature of the interactions. However, there is no report showing the quantitative estimation of binding of curcumin with chitosan in presence of surfactants and its affect on the stability of curcumin in the system at physiological *p*H. UV-visible spectroscopy and fluorescence quenching are efficient tools applied to understand the interactions, distribution and localization of the dye, curcumin due to the molecular environment of chitosan polymer. Therefore, the present study aims to determine the extent of binding of aqueous curcumin with chitosan in absence and in the presence of Tergitol-15-S-7following the changes in the absorption and fluorescence of curcumin in different chitosan concentrations.

MATERIALS AND METHOD

Materials. Curcumin (purity ~ 95%) was obtained from Sigma-Aldrich and used as such. Chitosan with a degree of deacetylation of 80.5% (Molecular Weight 1,73000 gm/mol) was purchased from Sigma-Aldrich and used as such. Tergitol-15-S-7AR grade was also obtained Sigma-Aldrich and used as such. The *p*Hs of the systems was measured by using an Orion Multiparameter Kit after calibrating the instrument at *p*H 7.00 and 4.00. All other chemicals used were of analytical grade. Doubly distilled water has been used in preparation of all the solutions.

UV-Visible analysis. The absorbance readings of curcumin were taken from 200 to 600 nm using a Shimadzu UV-2550 UV-Vis double beam spectrophotometer. In the experiments for study of the kinetics of degradation of curcumin, the UV-Vis spectra were recorded over 60 min at 2 min intervals.

The binding process of curcumin with chitosan can be described by the following equilibrium:

$$curcumin + chitosan \leftrightharpoons [chitosan - curcumin] \quad (1)$$

The equilibrium constant K for the above equilibrium can be written as:

$$K_s \leftrightharpoons \frac{[chitosan-curcumin]}{[chitosan][curcumin]} \quad (2)$$

Assuming 1:1 complex formation between chitosan and curcumin, linear plot has been made by following the absorbance changes at a suitable wavelength, as a function of reciprocal concentration of chitosan or curcumin according to the equation, the modified Benesi- Hildebrand equation (3) given below

$$\frac{1}{\Delta A} = \frac{1}{K\Delta\varepsilon[\,curcumin]}\left(\frac{1}{[chitosan]}\right) + \frac{1}{\Delta\varepsilon[curcumin]} \qquad (3)$$

Here, ΔA and Δε correspond to the change in the absorbance and the molar extinction coefficient at the wavelength of the study (at 422 nm), respectively. [chitosan] and [curcumin] corresponds to the equlibrium concentrations of chitosan and curcumin, respectively.

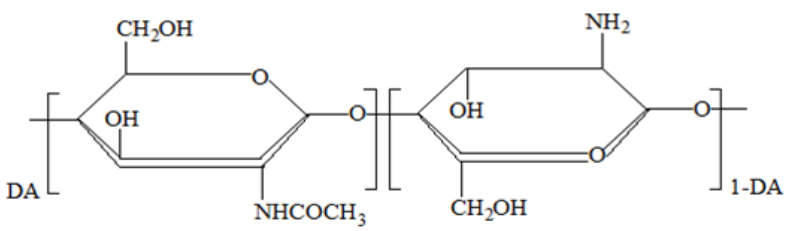
Fluorescence analysis. Fluorescence spectra were taken from 350 to 700 nm using a Hitachi F -2500 fluorescence spectrophotometer with the excitation and emission slit widths set at 5 nm. The excitation wavelength for each 0.025mM curcumin solution was 425 nm. The temperatures were maintained within ±1K. The binding constants can be estimated by following the fluorescence changes also. The fluorescence intensity of curcumin increases significantly in presence of chitosan. The changes in fluorescence intensity at 420nm due to curcumin were followed as a function of concentration of chitosan according to Eq. (4) to estimate the binding constant, K.

$$\frac{1}{F-F_o} = \frac{1}{F_{complex}-F_o} + \frac{1}{F_{complex}-F_o}\left(\frac{1}{K[citosan]}\right) \qquad (4)$$

Here, F_o and F are the respective fluorescence intensity from curcumin at a suitable wavelength in of 540-550nm in the absence and presence of chitosan.

RESULTS AND DISCUSSION

Binding of curcumin with chitosan. The aqueous solution of curcumin (2.5×10^{-5} mol dm^{-3}) containing 25% MeOH, shows the maximum absorption at 425 nm at *p*H 7.4 (phosphate buffer). Aqueous curcumin shows an absorption band at 425 nm and a shoulder at 365 nm. The absorption band at 425nm of curcumin is due to the enol form with conjugated π-bond system which is predominant in both solutions and in solid form of curcumin while the shoulder is due to the absorption by a symmetrical structure with the conjugation broken at the diketo groups as shown in Scheme 2. The absorption intensities of the 425 nm band of curcumin increase with increase in the chitosan concentration at the fixed *p*H of 7.4 (Figure 1).



Scheme 1. Structure of chitosan

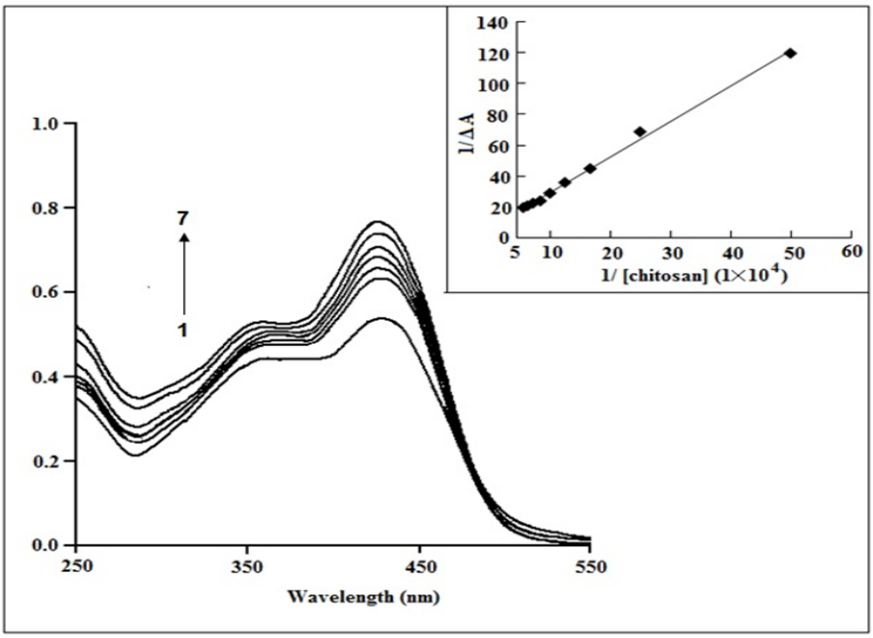
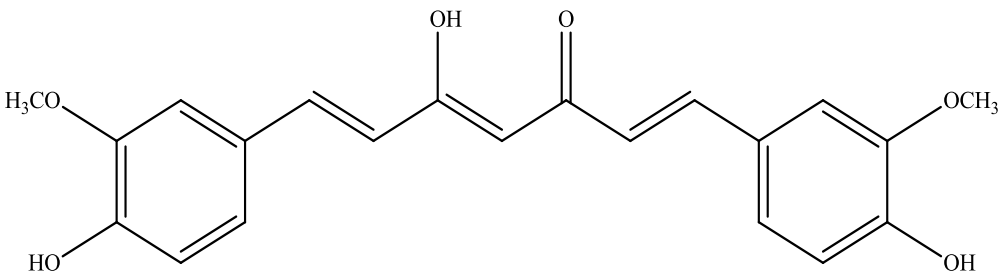


Figure 1. Absorption spectra of curcumin (2.5×10^{-5} mol dm^{-3})at *p*H 7.4 in presence of various concentrations of chitosan at 298(±0.1) K. [chitosan]: (1) 2μM, (2) 4μM, (3) 6 μM, (4) 8μM, (5) 10 μM, (6) 12 μM, (7) 14 μM. Inset: Plot of the determination of binding constant.

Although the spectra of curcumin bound to chitosan are similar to that in absence of chitosan, the intensities of the 425 nm band increases significantly on addition of chitosan which indicates that curcumin interacts with the polymer. Curcumin exists mainly as neutral form below *p*H 8.0.



Scheme 2. The enol form of curcumin

At the physiological *p*H range, the anionic fraction of curcumin is likely to interact with the cationic polymer. In solution of higher *p*H (pH > 6.5), the free amino groups of chitosan molecules become less protonated and the hydrophobic character along the chitosan chain becomes stronger. Therefore, the chitosan self-aggregates are formed in phosphate buffer solutions by intra and inter-molecular hydrophobic interactions.The agglomerates of chitosan that are formed may entrap the enol form of curcumin. Moreover, there may be intermolecular hydrogen bond formation between curcumin and the hydroxyl groups of the glucosamine unit of chitosan. The hydrogen bond interaction has also been pictured out betweencurcumin and phosphatidylcholine in addition to the hydrophobic interaction.The binding constant have been estimated following the changes in absorption intensity at 425 nm due to curcumin at various concentrations of chitosan, at *p*H 7.4 (phosphate buffer), varying the concentration of chitosan from 2μM to 16μM and keeping curcumin concentration at 25μM and fitting the data to the double reciprocal plot (Eq. (3)). Within this concentration range of chitosan the λ_{max} of curcumin slightly shifts from 425 nm to 421 nm. As shown in Figure 1 (Inset) fitting the data to equation (3) the linear plot with a squared correlation coefficient of 0.99 was obtained, from which the binding constant has been estimated as $2.01(\pm0.5)\times10^4\ M^{-1}$ at *p*H 7.4 and a temperature of 298K (±0.1) of the system.

The binding between curcumin and chitosan has also been studied by fluorescence measurements. The fluorescence of curcumin is mainly dependent on the medium. Curcumin exhibits a very weak fluorescence band at ~ 550 nm in aqueous buffer solutions containing 25% MeOH after excitation at 425 nm. It has been reported that in hydrophobic macromolecular environment, the fluorescence intensity significantly increases with a Stokes shift of about ~ 80 nm.However, on the addition of increasing amount of chitosan at a fixed concentration of curcumin ($2.5\times10^{-5}\ M^{-1}$), the fluorescence spectrum becomes sharp and fluorescence intensity considerably increases with a slight hypsochromic shift from 550 nm to 539 nm due to binding of curcumin with chitosan (Figure 2). It has been well documented that in aqueous buffer medium ($2.5\times10^{-5}\ M^{-1}$) curcumin containing 25% MeOH alone cannot fluoresce significantly.The hydrophobic regions are available within chitosan molecule in aqueous solution into which a fraction of curcumin partitions and fluoresce considerably. The number of hydrophobic regions per unit volume increases as more chitosan is added to the solutions and protects curcumin from the fluorescence quenching in aqueous surroundings. As a consequence, when the concentration of chitosan increases in the bulk solution the fluorescence intensity of chitosan bound curcumin increases spectacularly. The slight spectral shift in the λ_{em} has been observed upon the complexation of curcumin with chitosan as the microenvironment of curcumin was changed. The dye is supposes to reside in the slightly nonpolar region of the polymer where the polarity and so the dielectric constant of the microenvironment are much lower than that in bulk water.The binding constant for the binding of curcumin with chitosan was estimated by following fluorescence intensity changes at 540 nm, after excitation at 425 nm for solutions containing curcumin with varying chitosan concentrations from 0.02mM to 0.2mM at *p*H 7.4 (phosphate buffer) at 298 (±0.1) K. For the above mentioned equilibrium (4), the binding constant K has been estimated as $2.25(\pm0.5)\times10^4\ M^{-1}$.

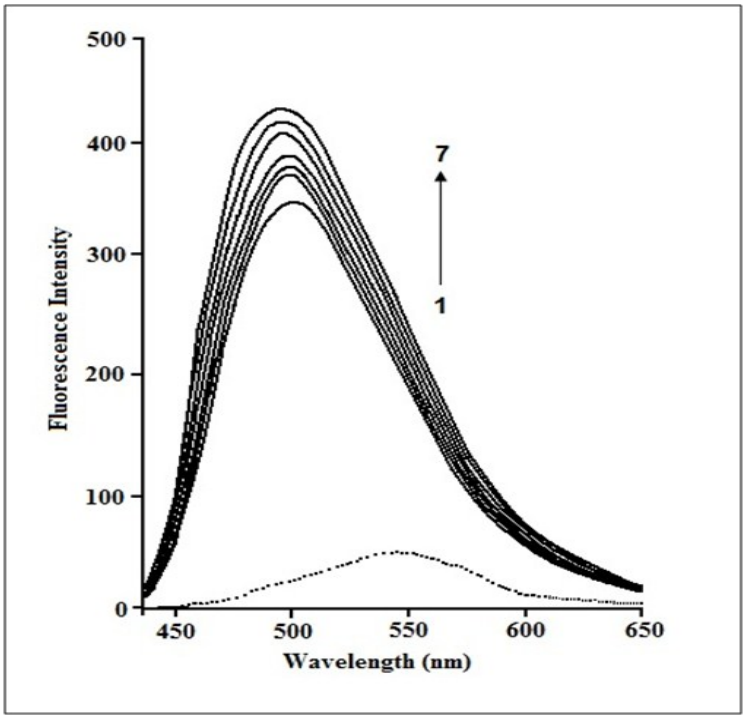


Figure 2. Fluorescence spectra of curcumin (2.5×10^{-5} mol dm^{-3}) at *p*H 7.4 in presence of various concentrations of chitosan at 298(±0.1) K. [chitosan]: (1) 2μM, (2) 4μM, (3) 6 μM, (4) 8μM, (5) 10 μM, (6) 12 μM, (7) 14 μM.k

Curcumin in chitosan-Tergitol-15-S-7 surfactant system. The spectra of 2.5μM aqueous curcumin induced by chitosan in presence of 1.0 mM Tergitol-15-S-7 at *p*H 7.4 and 298 (± 0.1) K have been shown in the Figure 3. The intensity of 420 nm band increases significantly with corresponding increase in the concentration of chitosan in presence of Tergitol-15-S-7. The binding constant of curcumin-nonionic surfactant-polymer system has been determined by monitoring the change in absorbance values of the aqueous curcumin at progressively increasing concentration of chitosan, in fixed concentration of Tergitol-15-S-7. The binding constant has been found to be 2.19(±0.5) $\times10^5$ M^{-1} which indicates that the curcumin-chitosan binding in the presence of Tergitol-15-S-7 is about ten times stronger than that in absence of the surfactant. This implies that there is greater hydrophobic interaction between the dye and the chitosan-Tergitol-15-S-7. In chitosan- Tergitol-15-S-7 system the positively charged polymer interacts with Tergitol-15-S-7 by electrostatic means. The electronegative oxygen atoms of the PEO chains of Tergitol-15-S-7 might associates with the electropositive chitosan chains. The excess polymer chains left after association with Tergitol-15-S-7 may form a transient network which is also available to interact with curcumin. As a result, the hydrophobic interaction of curcumin with chitosan in the presence of Tergitol-15-S-7 is more pronounced.

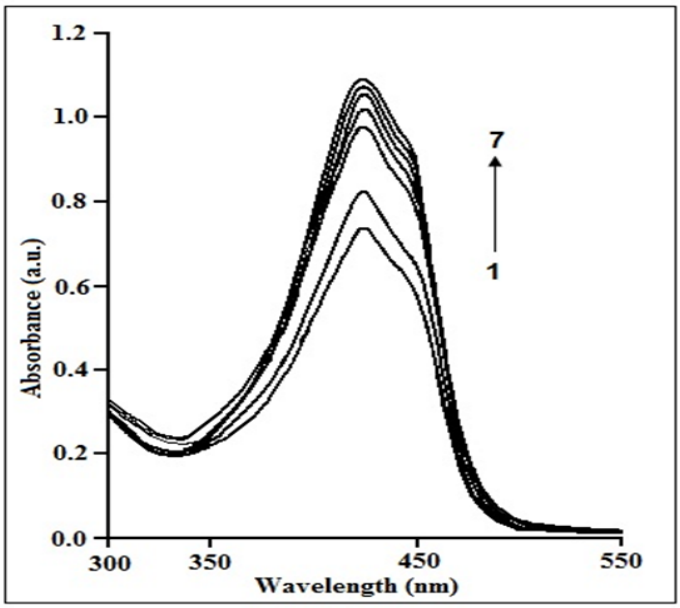


Figure 5. Absorption spectra of curcumin (2.5×10^{-5} mol dm^{-3})at *p*H 7.4 in varying concentrations of chitosan in presence of 1×10^{-3} mol dm^{-3} TW80 at 298(±0.1) K. [chitosan]: (1) 2μM, (2) 4μM, (3) 6 μM, (4) 8μM, (5) 10 μM, (6) 12 μM, (7) 14 μM.

The fluorescence studies have also been carried out for the aqueous curcumin in non-ionic surfactant-chitosan system and from the results obtained the binding constant have been determined. The fluorescence intensity of the aqueous curcumin containing 25% MeOH increases effectively with increasing concentration of chitosan, with a blue shift from 550 nm to 490 nm, in the presence of Tergitol-15-S-7. This large blue shift is due to change in micro-environment from a polar field to a less polar field. Thus, chitosan- Tergitol-15-S-7 system is more effective in binding curcumin molecule the surfactant free chitosan medium under physiological *p*H.

Nature of binding sites in chitosan. To understand the nature of binding sites of the curcumin -chitosan binding, experiments were carried out by following quenching studies using two quenchers, viz., acrylamide, a hydrophobic quencher and potassium iodide, a hydrophilic quencher. The concentrations of the quenchers were varied from 0 to 0.15 M, keeping the ionic strength constant. Small aliquots of quencher stocks have been added to curcumin samples and fluorescence spectra were recorded after each addition. The fluorescence intensity of chitosan bound curcumin decreased regularly with the increase in the concentration of the quenchers with no shift in λ_{em}.

The steady-state fluorescence quenching data obtained with the two different quenchers have been analysed according to the well known Stern-Volmer equation in order to obtain quantitative quenching parameters

$$\frac{F_o}{F} = 1 + K_D[Q] \qquad (5)$$

where, F_o and F are the intensities of the fluorophore (chitosan-curcumin) in the absence and presence of the quencher Q, respectively and K_D is the Stern-Volmer quenching constant and [Q] is the molar concentration of the quencher.

However, in order to understand the relative population of curcumin in different layers of chitosan, the fluorescence intensity changes of the flurophore in the presence of the quenchers were treated with equation (6) which is a modified form of the Stern-Volmer equation (5)

$$\frac{F_o}{\Delta F} = \frac{1}{f_a K_{D'}[Q]} + \frac{1}{f_a} \qquad (6)$$

Here, $\Delta F = F_o - F$ is the difference between the fluorescence intensities from the fluorophore (chitosan-curcumin) in the absence and presence of quencher Q at any point in the quenching titration, f_a is the fraction of the total fluorophores to the quencher, and K'_D is the Stern-Volmer constant.

Figure 4 shows the Stern-Volmer plot for fluorescence quenching of curcumin-chitosan by potassium iodide. On fitting the data obtained from quenching in the presence of potassium iodide to Equation (6) a linear plot has been obtained with a squared correlation coefficient of 0.995. The fitted parameters were found to be f_a=0.30±0.01 and K'_D=17.54± 2.26 M^{-1} for potassium iodide quenching. Similarly, fitting the data obtained from quenching in the presence of acrylamide to equation (6) a linear plot has been obtained with a squared correlation coefficient of 0.997and f_a value of 0.38±0.01 and K'_D = 20.6±4.43 M^{-1} at *p*H 7.4 . From the results obtained it has been observed that there is significant quenching by both of the quenchers, but the quenching by the hydrophobic quencher is slightly greater than that by the hydrophilic quencher. This fact confirms that curcumin is non-uniformly distributed into different regions of chitosan in the physiological *p*H of the medium. We have used a chitosan sample with a high degree of deacetylation (80.5%) and with an increase in DD, the number of amino groups in the polymer increases and as a result a highly cationic chitosan is obtained. The presence of large numbers of amine groups facilitates electrostatic interaction between the cationic groups located on the polyglucosamine chains of the polymer and the negatively charged anionic curcumin. On the other hand, the polymer is a high molecular weight polymer, and thus the polymer configuration in solution becomes a nearly spherical providing hydrophobic environment to entrapped curcumin. In high chitosan concentrations, most of the neutral curcumin partitioned to the compartments made up of chitosan chains.

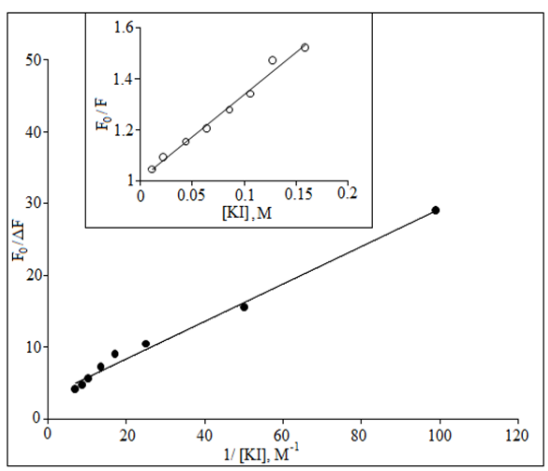


Figure 4. The plots of fluorescence quenching of curcumin-chitosan solution by KI at *p*H 7.4, line shows fitting to equation (6); Inset shows the data for the quenching of curcumin fluorescence by KI fitting to equation (5).

Kinetics of the binding of curcumin with chitosan. In the phosphate buffer medium at *p*H 7.4 or above, deprotonation of curcumin occurs first.Curcumin is initially deprotonated during the course of hydrolysis and results in *trans*-6-(4′-hydoxy-3′-methoxypenyl)-2,4-dioxo-5-hexenal. The hydrolysed product then further degredated to smaller molecular components such as vanillin, feruloyl methane, and ferulic acid. The contribution from these molecules to the absorption maximum of 425 nm of curcumin in aqueous buffer medium is negligible. More than 90% of curcumin decomposed rapidly in buffer systems at physiological *p*H (*p*H 7.4) conditions For the kinetic study of degradation of curcumin, the absorbance changes of aqueous (25% MeOH) curcumin solutions in presence and absence of chitosan have been monitored as a function of time. Since, the maximum absorption occurred at 422 nm in presence of chitosan, the studies have been carried out monitoring at λ_{max} 422 nm.

As shown in Figure 1 there is a substantial decrease in the UV-visible absorption curve of curcumin as a function of time at *p*H 7.4 (phosphate buffer). However, in presence 10μM of chitosan the degradation of curcumin has been suppressed to a larger extent as the decrease in absorption maxima is negligible compared to the original value. The linearity of the time dependent degradation of curcumin (figure not included) shows that the reaction is of pseudo first order. The pseudo first order rate constant has been determined using the equation introduced by Sengupta *et. al*.As shown in inset of Figure 1 the linear curve has been obtained with a squared correlation coefficient of 0.991. The rate constant for the degradation of curcumin in phosphate buffer medium has been obtained as 0.20 min^{-1} at *p*H 7.4. In presence of chitosan (10μM), the rate constant has been obtained as 0.076 min^{-1}.Thus, the degradation occurs approximately 3 times slower in presence of chitosan (0.1mM). Hence, the yield of suppression of degradation by chitosan (10μM) is 62 ± 5%. In chitosan-Tergitol-15-S-7 system, the rate constant of degradation of curcumin has been obtained as 0.009 min^{-1} and thus the yield of suppression of degradation is 95.5 ± 5%. The above observations strongly indicate that, chitosan-nonionic system can effectively diminish the degradation process of curcumin at physiological *p*H condition.

The thermodynamic parameters for interaction. The energy efficiency of the curcumin- chitosan system has been studied by monitoring the change in the binding constant, K values as a function of temperature in the temperature range between 298 and 313 K. ΔG^o has been determined from the equation,

$$\Delta G^o = - RT \ln K \quad (7)$$

ΔG^o value has been obtained as − 5.64 kcal/mol. ΔH^o and ΔS^o have been determined using the van't-Hoff equation.

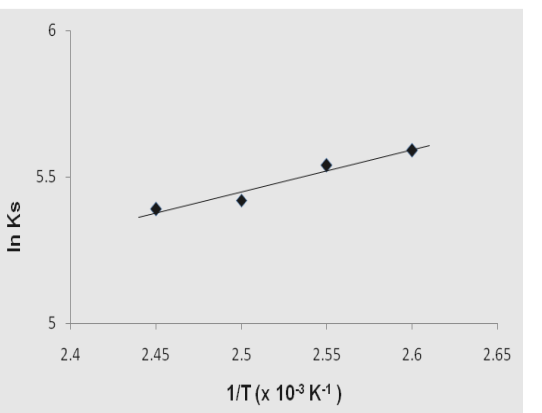


Figure 5. The van't- Hoff plot for the interaction of curcumin with chitosan at *p*H 7.4 (phosphate buffer).

It has been found that K values significantly decreases with increasing temperature. The van't-Hoff plot for the interaction of curcumin with chitosan at *p*H 7.4 is shown in Figure 5. The values ΔH^o and ΔS^o have been determined as − 21.52 kcal/mol and 23.08 cal/mol/K. The ΔH^o values for the transfer of curcumin from aqueous phase to chitosan rich colloidal phase were larger than the total free energy change, ΔG^o, indicates that the process is enthalpy driven, although there is a little contribution of small positive entropy changes. Thus, the strong interactions between curcumin and chitosan are driven by both hydrophobic force and hydrogen bond formation between the hydroxyl group of the glucosamine chains of chitosan and curcumin. And the rest of curcumin free in solution as anionic curcumin interacts with the cationic polymer.

CONCLUSION

The present work clearly shows that, curcumin strongly interacts with chitosan even at the physiological *p*H of the system and the interaction is more pronounced in presence of surfactants. It was observed that the value of the binding constant of chitosan-curcumin binding in chitosan- Tergitol-15-S-7 system is large compared to its value in chitosan.. Fluorescence quenching studies clearly signifies that one fraction of curcumin occupies the hydrophobic interior of chitosan, while the other fraction of curcumin as anionic curcumin occupies the cationic centres of the polymer. Chitosan exhibit the ability to suppress the hydrolytic degradation of curcumin with an impressive yield of about 77 ± 5%. On the other hand, in presence of Tergitol-15-S-7 the yield is increased up to 95.5 ± 5%. Thermodynamic studies reveal that the binding process is driven by both enthalpy and entropy indicating both hydrophobic, electrostatic and hydrogen bond formation between curcumin and chitosan. This study suggests that chitosan -surfactant systems could be effectively used to stabilise curcumin and other water-insoluble bioactive molecules.

REFERENCES

Amiji, M. M. 1995. Pyrene fluorescence study of chitosan self-association in aqueous solution. *Carbohydrate Polymers,* Vol-26,21 l–213.

Barik, A., Priyadarsini, K. I., Mohan, H. 2003. Photophysical studies on binding of curcumin to bo vine serum albumin. *Photochemistry and Photobiology,* Vol-77(6), 597–603.Bachmeier, B.E., Melchart, Dieter. 2019. Therapeutic Effects of Curcumin—From Traditional Past to Present and Future Clinical Applications, *Int. J. Mol.Sci.,* Vol. 20(15), 3757.

Began, G., Sudharshan, E., Sankar, K. U., Rao, A. G. A. 1999. Interaction of curcumin with phosphate dylcholine: A spectrofluorometric study. *J. of Agricultural Food Chem.* Vol-47(12), 4992–4997.

Benesi, H. A., Hildebrand, J. H. 1949.A spectrophotometric investigation of the interaction of iodine with aromatic hydrocarbons.*J. Am. Chem. Soc.* Vol-71(8), 2703 –2707.

Bong, P. H. 2000. Spectral and photophysical behaviours of curcumin and curcuminiods. *Bull. Korean Chemical Society,* Vol-21, 81–86.

Boruah, B., Saikia, P. M., Dutta, R. K. 2012. Binding and stabilization of curcumin by mixed chitosan–surfactant systems: A spectroscopic study, *J. Photochemistry and Photobiology A,* Vol-245, 18–27.

Boruah, B., Gohain, B., Saikia, P. M., Borah, M., Dutta, R. K. 2011. Acid–base equilibrium of neutral red in aqueous nonionic surfactant–polymer systems. *J. Mol. Liuids,*Vol-160, 50–56.

Chen, Z. G. Wanga, P. W., Wei, B., Moa, X. M.,

Cui, F. Z. 2010. Electrospun collagen–chitosan nanofiber: A biomimetic extracellular matrix for endothelial cell and smooth muscle cell. *Acta Biomaterialia*, Vol-6, 372–382.

Hiraku, O., Machida, Y.1999. Biodegradation and distribution of water-soluble chitosan in mice. *Biomaterials,* Vol-20, 175-182.

Iwunze, M. O. 2004. Binding and distribution characteristics of curcumin solubilized in CTAB mi celle. *J. Mol. Liquids,* Vol-111, 161–165.

Jia, Y., Hu, Y., Zhu, Y., Che, L., Shen, Q., Zhang, J., Li X. 2011. Oligoamines conjugated chitosan derivatives: Synthesis, characterization, in vitro and in vivo biocompatibility evaluations. *Carbohydrate Polymers*, Vol-83, 1153 –1161.

Kaminaga, Y., Nagatsu, A., Akiyama, T., Sugimoto, N., Yamazaki, T., Maitani, T., Mizukami, H 2003. Production of unnatural glucosides of curcumin with drastically enhanced water solu bility by cell suspension cultures of catharanthus roseus. *Febs Letters*, Vol-555(2), 311–316.

Khopde, S. M., Priyadarsini, K. I., Palit, D. K., Mukherjee, T. 2000. Effect of solvent on the excited-state photophysical properties of curcumin. *Photochem. Photobio.*Vol-72(5), 625–631.

Kim, H. S. , Claude, B. , Tondre, C. 1990. Microenvironment effects on the kinetics of electron-transfer reactions involving dithionite ions and viologens. 1. A comparison between two types of polyelectrolytes, *J. Phys. Chem.*,Vol-94, 7711-7716.

Knill, C. J., Kennedy, J. F., Mistry, J., Miraftab, M., Smart, G., Groocock, M. R., William, H. J. 2004. Alginate fibres modified with unhydrolysed and hydrolysed chitosans for wound dressings. *Carbohydrate Polymers*, Vol-55, 65–76.

Kunwar, A., Barik, A., Pandey, R., Priyadarsini K. I. 2006, Transport of liposomal and albumin loaded curcumin to living cells: An absorption and fluorescence spectroscopic study. *Bichim. Biophy. Acta*, Vol-1760, 1513–1520.

Letchford, K., Liggins, R., Burt H. 2008. Solubilization of hydrophobic drugs by methoxy poly (ethylene glycol)-block-polycaprolactone diblock copolymer micelles: Theoretical and ex perimental data and correlations. *J. Pharm. Sc*, Vol-97, 1179–1190.

Leung, M. H. M., Kee, T. W. 2009. Effective stabilization of curcumin by association to plasma pro teins: Human serum albumin and fibrinogen. Langmuir, Vol-25 (10),5773–5777.

Li, L., Braiteh, F. S., Kurzrock, R. 2005. Liposome encapsulated curcumin: In vitro and in vivo effects on proliferation, apoptosis, signaling, and angiogenesis. *Cancer*, Vol-104, 1322–1331.

Maheshwari, R. K., Singh, A. K.; Gaddipati, J., Srimal, R. C. 2006. Multiple biological activities of curcumin: A short review. *Life Science*,Vol-78, 2081–2087.

Mahmoodi, N. M., Salehi, R., Arami, M., Bahrami, H. 2011. Dye removal from colored textile waste water using chitosan in binary systems. *Desalination*, Vol-267, 64–72.

Mitra, S. P. 2008. Stabilizing effect of chitosan on curcumin from the damaging action of alkaline pH and ultraviolet light. *Journal of Surface Science & Technology*, Vol-24, 39–55.

Payton, F., Sandusky, P., Alworth, W. L. 2007. NMR study of the solution structure of curcumin. *Journal of Natural Products*, Vol-70, 143–146.

Pepic, I., Filipovic-Grcic, J., Jalsenjak, I. 2009. Bulk properties of nonionic surfactant

and chitosan mixtures. *Colloids and Surfaces A: Physicochem. Eng. Aspects*, Vol-336, 135–141.

Perrin, D. D. 1963. Buffers of low Ionic strength for spectrophotometric pK determinations.*Australian Journal of Chemistry*, Vol-16(4), 572 – 578.

Ravi Kumar, M. N. V. 2000. A review of chitin and chitosan applications. *Reactive & Functional Polymers*,Vol-46, 1–27.

Ravindranath, V., Chandrasekhara, N.1980. Absorption and tissue distribution of curcumin in rats. *Toxicology*,Vol-16 (3), 259–265.

Sengupta, S. K., Mishra, S., Rani, V. R. 2000. A study on equilibrium and kinetics of carbocation to carbinol conversion for di and tri arylmethane dye cations in aqueous solutions: Relative stabilities of dye carbocations and mechanism of dye carbinol formation. *Indian J. of Chem istry*, Vol-39A, 703–708.

Shah, C. P., Mishra, B., Kumar, M., Priyadarsini, K. I., Bajaj, P. N. 2008. Binding studies curcumin to polyvinyl alcohol/ polyvinyl alcohol hydrogel and its delivery to liposomes. *Current Science*, Vol-95, 1426–1432.

Srimal, R. C., Dhawan, B. N. 1973. Pharmacology of diferuloyl methane (curcumin), a non-steroidal anti-inflammatory agent. *J. Pharm.Pharmacol.*Vol-25(6), 447–452.

Tomeh, M.A., Hadianameri, R., Zhao, X. 2019. A Review of Curcumin and Its Derivatives as Anti cancer Agents, *Int. J. Mol. Sci.*, Vol- *20*(5), 1033.

Tonnensen, H. H. 2002. Solubility, chemical and photochemical stability of curcumin in surfactant solutions. *Pharmazie*, Vol-57 (12), 820–824.

Tsuda, T. 2018. Curcumin as a functional food-derived factor: degradation products, metabolites, bio activity, and future perspectives, *Food Funct.*, Vol-9, 705-714.

Wang, Y.-J., Pan, M.H., Cheng, A.L., Lin, L.I., Ho, Y.S., Hsieh,C.Y., Lin, J.K. 1997. Stability of curcumin in buffer solutions and characterization of its degradation products. *J. Pharm. Biomed. Analysis***,** Vol-15, 1867–1876.

Webster, A., Halling, M. D., Grant D. M. 2007. Metal complexation of chitosan and its glutaraldehyde cross-linked derivative. *Carbohydrate Research*, Vol-342, 1189–1201.

Wong, Y. C., Szeto, Y. S., Cheung, W. H., McKay G. 2003. Equilibrium studies for acid dye adsorp tion onto chitosan. *Langmuir,* Vol-19 (19), 7888–7894.

Yu, H., Huang, Q. 2010. Enhanced in vitro anti-cancer activity of curcumin encapsulated in hydropho bically modified starch. *Food Chemistry*, Vol-119, 669–674.

Northeast Journal of Contemporary Research, December 2019. Vol. 6 No. 1 pp.38-47
ISSN 2349-3089 ©NeJCR, 2019

Beneficiaries' protection in ESI scheme - A study in Assam

Bidyut Bikash Baishya[1*] and Dipanjan Chakraborty[2]
[1]*Department of Economics, Pragjyotish College, Guwahati-781009, Assam, India*
[2]*Department of Commerce, Darrang College, Tezpur -784001, Assam, India*

ABSTRACT

Every human being of a society needs some sort of protection against providential mishaps over which common masses has no control. Among this risk the most important is the risk of medical emergencies. In India, only 3% of population is covered by some form of health insurance, either social or private (Visaria and Gumber 2008). These groups of people necessitate the provision of health insurance, although their capacities to pay insurance premiums are very low. One of the existing mandatory health insurance schemes in India for Organized Sector is – Employees' State insurance Scheme (ESIS) and it is more relevant because this was the first social insurance measures introduced in India and is executed and administered through Employees State Insurance Corporation (ESIC) way back in the year 1948 & 1958 in India and Assam respectively. But, after it's more than 59 years of implementation in the state like Assam and despite all the endeavours made by the Corporation for the effective functioning of the ESI Scheme in the country, public discernment of the Corporation has not been very positive. Therefore, this paper will attempt to assess the working of various mechanisms, specially the EI Court & Grievances Redressel Cell of the Corporation for the administration of the ESI schemes as well as to assess the perceptions or awareness of the beneficiaries both working in factory and establishments to safeguard their rights.

Key words: *Health Insurance, Factory & Establishments, Insured Persons*

INTRODUCTION

Every human being of a society needs some sort of protection against providential mishaps over which common masses has no control. ILO (1984) defines Social Security as - "the security furnished through appropriate organisation against certain risks to which its members are exposed. These risks are essentially contingencies against which the individual of small means cannot effectively provide for by his own ability or foresight alone or even in private combination with fellows." Today India has the largest demographic dividend. For such a large number of the working force (63% in between the age group of 35 years to 65 Years) a comprehensive measure that provides social security is utmost necessary. This protection is provided through proper organizations to the individual members of the society who are exposed to certain risk. The existing mandatory health insurance scheme in India for Organized Sector is – Employees' State in-

**Corresponding author's Email:* bidyut78@gmail.com

surance Scheme **(ESIS)** and Central Government Health Scheme **(CGHS).** The **Employees' State Insurance (ESI)** Scheme is more relevant because this was the first social insurance measures introduced in India and is executed and administered through **Employees State Insurance Corporation (ESIC)** way back in the year 1948 in India and in Assam Region of India in the year 1958.

THE EMPLOYEES'STATE INSURANCE (ESI) SCHEME AND THE EMPLOYEES'STATE INSURANCE CORPORATION [ESIC]:

The ESI Act of 1948 was the first social insurance measures introduced in India encompasses certain health related eventualities that the workers are generally exposed to, such as sickness, maternity, temporary or permanent disablement, occupational disease or death due to employment injury, resulting in loss of wages or earning capacity-total or partial. The ESI Act applies to Non-seasonal factories using power and employing ten or more persons and Non-seasonal and non-power using factories and establishments employing twenty or more persons.

The administration of the ESI Scheme as per the ESI Act has been entrusted to the Employees' State Insurance (ESI) Corporation. The ESI Act provides various powers to the Corporation for its proper functioning. The ESI Corporation provides benefits to the insured persons and their dependents under the ESI Scheme in three categories- a] Medical Benefits, b] Cash Benefits and c] Other Benefits. Further, the two most prominent working mechanism of the corporation are - Employees' Insurance (EI) Court and Grievances Redress Cell.

EMPLOYEES' INSURANCE (EI) COURT

Where a dispute arises under the provision of the ESI Act as amended from time to time, the matter in the dispute is decided by the EI Court constituted under Section 74 of the Act and not by a civil court. An appeal shall lie to the High Court from an order of an EI Court if it involves a substantial question of law. The State Government shall, by notification in the Official Gazette, constitute an EI Court for such local area as may be specified in the notification. The Court shall consist of such number of Judges as the State Government may think fit. (Sec.74). The State Government may appoint the same Court for two or more local areas or two or more Courts for the same local area (**ESI ACT, 2010**). Where more than one Court has been appointed for the same local area, the State Government may by general or special order regulate the distribution of business between them.

GRIEVANCES REDRESS CELL

The ESI Corporation is making the redress of the grievances and complaints of the insured person and employers covered under the ESI Scheme through the Grievances Redress Cell. The Corporation has also set up an elaborate system at various levels for speedy redress of grievances and complaints. Managers in charge of branch offices, insurance medical officers in charge of dispensaries and medical superintendents in charge of hospitals are responsible for the redress of grievances and complaints at the grassroots level. At the regional level, Regional Director and Public Grievance Officer are responsible for the redress of grievances and complaints. At the Corporate level, a Director is appointed for the purpose **(Vasanthagopal & Mathew 2009).**

REVIEWS OF LITERATURE

Pachman, J.A. et.al, studied the major aspects of the social security system in the US, its benefits, structure, and its relationship to the retirement decision, methods of determining costs and its financing. They also presented ex-

[1]Pachman, J. A. and others, Social Security Perspective for Reform, The Brookings Institutions, Washington, D.C. 1968

plicit or implicit recommendations for changing the system. These recommendations comprise an agenda for reform. The proposal was presented in three dimensions. The first dimension regards the historical development and the present institutional setting of social security. The second dimension was the modest proposal to improve social security within the present framework. Finally, a list of immediate and urgently needed changes that could be consistent with the longer terms goals was presented for consideration in the next round of social security legislation, more modest changes should be enacted to move the system in the desired direction. Such changes would stress adjustments in the minimum benefits and in the benefits paid to widows and survivors.[1]

International Labour Organization monograph concerned primarily with the five principles of social security schemes, now in force in Great Britain, these consist of National Insurance, Industrial Insurance, Family Allowances, National Assistance and the National Health Service.

Speaking on the occasion of the golden jubilee celebration of the Employees' State Insurance Scheme, AtalBihariVajpai, the then Prime Minister emphasized the need to increase the reach of social security to the large number of workers in the unorganized sector. He stated that the Employees' State Insurance Scheme should endeavor for providing social security umbrella to the poorest of the poor workers and people in the unorganized sector for achievement of national goals set by Mahatma Gandhi.

Dr C.S. Kedar, IAS, Director General, ESIC said that the improvements in the performance of ESIC are attributable to the valuable cooperation and active participation received from its various stakeholders i.e. IPs, Employers, State Governments, Corporation members and the employees of the Corporation. The Corporation has made several provisions like Self-certification, Amnesty Scheme for settlement of Legal Disputes, relaxation in inspections policy to meet the needs of the Employers. The burden on State Govt. has also been eased out in certain cases like in Super Specialty treatment. He further said that, ESI Corporation during this Diamond Jubilee Year would like to extend coverage to other States of the North Eastern Region namely Sikkim, Manipur, Mizoram and Arunachal Pradesh.

THE PROBLEM STATEMENT

Despite all the endeavours made by the ESI Corporation for the effective functioning of the ESI Scheme in the country, public discernment of the Corporation has not been very positive. The Corporation provided machinery like **EI Court** and **Grievances Redress Cell,** whereby consumers can file their complaints which will be heard by the forums so that action can be taken against those who violets the rules. But, the beneficiaries felt that the working mechanism of the corporation specially the **EI Court** and **Grievances Redress Cell** is always questioned regarding their promotion and protects the interest of consumers against deficiencies and defects in services. Therefore, a study on the perception of insured persons as to delivery of services by ESIC is vital for success of ESI schemes and to cure the various maladies that afflicted.

THE OBJECTIVES

In the light of above statement of problems and review, this paper tries to examine the perception of Insured Persons **(IPs)** in Assam Region regarding efficiency of the working mechanism of ESIC in delivering various services as mandated by ESI Act. More specifically, the objective of this paper is-

a. To study the level of awareness of the IPs about EI Court and Grievances Redress Cell.
b. To examine the numbers of cases registered by the IPs in EI Court and Grievances Redress Cell.

c. To study the level of satisfaction of IPs in the Working of EI Courts and Grievances Redress Cell.
d. To study the reasons for dissatisfaction of IPs in the working of EI Courts and Grievances Redress Cell.

HYPOTHESIS (H01)

There is no difference in the level of satisfaction in the working of the machinery (EI Court & Grievances Redressel Cell) for the administration of the ESI Scheme among the beneficiaries, i.e. the insured persons (IPs).

METHODOLOGY

The study is primarily a descriptive and analytical. The study is undertaken on the functioning of ESIC in Assam Region.

Sample Size:

In Assam there are altogether **85102** insured , a sample of **382** has been selected by applying the formula for selecting the sample size is one by Krejcie & Morgan (1970);which are selected randomly consist of factory organisation and other establishments.

Source of Data:

Primary data are collected from the sample insured persons working in different establishment/factories and registered under the Branch Offices of ESIC on 31-03-2016 through questionnaire. Discussions with the officials of ESI Corporation, leaders of various trade unions and office bearers are also done.

Secondary data are collected from Library work, Visiting dispensaries and offices, collecting information from internet sources, consulting persons of related matters etc.

Analysis of Data

The collected data has been analyzed with the help of five point scale from strongly satisfied to strongly dis-satisfy and hypotheses are tested by applying chi-square test. The Study Period is from 2005- 2015, i.e. of 10 years period.

RESULTS AND DISCUSSION:

AWARENESS ABOUT EI COURTS (IPs)

EI Courts is one such medium through which the insured persons can avail justice, if any wrong or discrimination is done to them. Therefore, the insured persons should be well aware about the EI Court. However, during the study the awareness level regarding the EI Court was not found so encouraging. The awareness regarding the EI Court as perceived by IPs is shown in the following **Table 1-**

Table 1. Awareness about EI Courts (Insured Persons)

Awareness of EI Courts as Perceived by the IPs	Enterprises where the IPs work					
	Factory		Establishment		Total	
	No.	Percent	No.	Percent	No.	Percent
Aware	51	22	63	41	114	30
Not Aware	178	78	90	59	268	70
Total	229	100	153	100	382	100

[2]International Labour Organization of Social Security-Great Britain, ILO, Geneva, 1957.
[3]Employees' State Insurance Scheme Golden Jubilee Celebration, 2002, New Delhi.
[4]Addressing the National Conclave at Guwahati on 23-06-2011, on the occasion of celebrating The Diamond Jubilee of the ESI Corporation.

Table 1. reveals that most of the insured persons both in factory and establishment (70%) were not aware of the EI Courts. Those who were aware came to only 30%. This indicates a poor level of awareness among the IPs regarding the awareness of the EI Court.

CASES FILED IN EI COURTS (IPs)

Majority of the insured persons did not filed cases in the EI Court. Again, those who have filed cases in the EI Court, they replied that, it took a long official formalities in filing the case. The following **Table 2** shows the numbers of cases filed in EI Court by the IPs

[5]Krejcie, R.V., &Morgan, D.W. (*1970*), "Determining Sample Size for Research Activities", *Educational and Psychological Measurement*, Vol.30, pp. 607-610.

2 reveals that a large majority of the insured persons (84%) have not filed any case in EI Courts. Only 16% of the insured persons had filed cases in the EI Court. It seems that due to the poor awareness of the insured persons regarding the operations of the EI Court, most of them could not file any cases in the EI Court.

LEVEL OF SATISFACTION IN THE WORKING OF EI COURTS (IPs)

It was observed that out of the total sample IPs (382), only 63 no. of IPs have field cases in the EI Court, which is very less. So, among these insured persons only an attempt was made to know about their satisfaction level regarding the EI Courts. The Level of Satisfaction in the Working of EI Court as perceived by the IPs is shown below in **Table 3- Source:** Field Study

Table 2. Responses of the Insured Persons as to the Cases Filed in EI Courts

Responses of the IPs as to the Cases Filed in Employees' Insurance (EI) Courts	Enterprises where the IPs work					
	Factory		Establishment		Total	
	No.	Percent	No.	Percent	No.	Percent
Cases filed	36	16	27	18	63	16
Cases Not filed	193	84	126	82	319	84
Total	229	100	153	100	382	100

Table 3. Level of Satisfaction in the Working of EI Courts

Level of Satisfaction in the Working of the EI Courts (IPs)	Factory		Establishment		Total	
	No.	Percent	No.	Percent	No.	Percent
Strongly Satisfied	05	13	03	13	08	13
Satisfied	06	15	03	13	09	14
Neither satisfied nor dissatisfied	03	07	02	09	05	08
Dis-Satisfied	21	52	10	43	31	49
Strongly Dis-Satisfied	05	13	05	22	10	16
Total	40	100	23	100	63	100

Source: Field Study

Calculated Value of X^2 (Chi-square) at 4 df is:**1.096**
Table value at 0.05 level:**9.488**
Result/Conclusion: **Not Significant**

A large majority of the insured persons (49%) reported that they were dis-satisfied with the working of the EI Courts and another 16% were strongly dis-satisfied. The insured person who was satisfied came to 14% and strongly satisfied 13% only. Again there is no significant difference in the level of satisfaction among the insured persons of the factories and the establishments in the working of the EI Courts as shown by the Chi-square test in **Table 3**.

REASONS FOR DISSATISFACTION IN THE WORKING OF EI COURTS (IPs):

The researcher also tried to found the causes of dissatisfaction regarding the operation of the EI Courts among the insured persons. The reasons for dissatisfaction in the working of EI Courts as told by the IPs is shown below in **Table 4-**

Table 4 reveals that the insured persons opined that 'high delay' in getting responses from the EI Court end was the prime reason for dissatisfaction. It stood for 71%. Lengthy official formalities, which were 29%, were one another reasons for the insured persons for their dissatisfaction in the workings of the EI Court.

AWARENESS OF THE GRIEVANCES REDRESS CELL (IPs)

The enquiry made among the insured persons to find out their awareness of the Grievances Redress Cell reveals the poor picture of awareness. The awareness of the Grievances Redress Cell as told by the IPs shown below in **Table 5-**

4 Table. Reasons for Dis-satisfaction in the Working of EI Courts

Reasons for Dis-satisfaction among IPs in the Working of the EI Courts	Enterprises where the IPs work					
	Factory		Establishment		Total	
	No.	Percent	No.	Percent	No.	Percent
Lengthy Official Formalities	7	30	5	28	12	29
Delay in getting response	16	70	13	72	29	71
Others*	-	-	-	-	-	-
Total	23	100	18	100	41	100

Source: Field Study others* - lack of proper documentation, inconveniences etc.

Table 5. Awareness of Grievances Redress Cell as Perceived by the Insured Persons

Awareness of EI Courts as Perceived by the IPs	Enterprises where the IPs work					
	Factory		Establishment		Total	
	No.	Percent	No.	Percent	No.	Percent
Aware	56	24	68	44	124	32
Not Aware	173	76	85	56	258	68
Total	229	100	153	100	382	100

Source: Field Study

The table reveals that 32% of the insured persons were aware of the Grievances Redress Cell**.** However, most of the insured persons were not aware about the Grievances Redress Cell and it came to 68%. Therefore it can be conclude that most of the insured persons were not aware about their rights which can be a great help to them in their working environment.

GRIEVANCES LODGED IN THE GRIEVANCES REDRESSEL CELL (IPs)

From the study it was found that most of the insured persons did not lodged grievances or most often they are reluctant to lodge any grievances. It was also observed that most of them were not fully aware about the Grievances Redressel Cell. The following **Table 6** below shows the details-

Table 6 reveals that a large majority of the insured person (89%) were not lodged any complain or grievances in the Grievances Redress Cell. Those who have lodged grievances came only to 11%. Again, most of them have lodged grievances regarding their salary matters, non-payments of arrears, bonus etc.

LEVEL OF SATISFACTION IN THE WORKING OF GRIEVANCES REDRESS CELL

Observation was also made regarding the satisfaction level of the insured persons on the functioning of the Grievances Redress Cell. Regarding the level of satisfaction in the working of Grievances Redress Cell it was observed that most of them were not satisfied. It is explain below with the help of **Table 7-**

Table 6. Responses of the Insured Persons as to the Grievances Lodged

Responses of the Insured Persons as to the Grievances Lodged	Factory		Establishment		Total	
	No.	Percent	No.	Percent	No.	Percent
Grievances Lodged	26	10	19	15	45	11
Grievances not lodged	233	90	104	85	337	89
Total	259	100	123	100	382	100

Source: Field Study

Table 7. Level of satisfaction in the Working of Grievances Redress Cell (Insured Persons)

Level of Satisfaction among the Insured Persons in the Working of Grievances Redress Cell	Factory		Establishment		Total	
	No.	Percent	No.	Percent	No.	Percent
Strongly Satisfied	05	19	01	05	06	13
Satisfied	04	16	03	16	07	16
Neither satisfied nor dissatisfied	05	19	02	10	07	16
Dis-Satisfied	10	38	10	53	20	44
Strongly Dis-Satisfied	02	08	03	16	05	11
Total	26	100	19	100	45	100

Source: Field Study

Calculated Value of χ^2 (Chi-square) at 4 df is :3.286
Table value at 0.05 level: 9.4888
Result/Conclusion: Not Significant

Table 7- reveals that a majority of insured persons, 44%, reported that they were dis-satisfied in the working of the Grievances Redress Cell and another 11% were strongly dis-satisfied. 16% were neither satisfied nor dis-satisfied. The satisfaction level came to 16% and strongly satisfied came to 13% only. Lengthy Official Formalities Delay, non-response etc. is some of the important reasons for their dissatisfaction. However, the Chi-square test shows that there is no significant difference in the level of satisfaction among the insured persons in the working of Grievances Redress Cell.

Hence, it may be inferred that no significant difference in the ***level of satisfaction*** to the working of the **EI Courts** and to the working of the **Grievances Redress Cell** as shown by the chi-square test. Thus, **Ho1,** stating that there is no difference in the ***level of satisfaction*** in the working of the machinery (EI Court & Grievances Redress Cell) for the administration of the ESI Scheme among the insured persons or the beneficiaries stands accepted.

RESULTS AND DISCUSSION

The findings of the study are present below:
A large number of cases were pending in EI Courts for most of the years. The average for the period of 10 years shows that in Assam region only 60% of the cases filed were disposed of in EI Courts in the year itself and the remaining 40% were pending.

1. It seems that in case of the insured persons the awareness regarding the EI Court is poor. Most of the insured persons both in factory and establishment (70%) were not aware of the EI Courts. Those who were aware came to only 30%.
2. A large majority of the insured persons (84%) have not filed any case in EI Courts. Only 16% of the insured persons had filed cases in the EI Court. It seems that due to

the poor awareness of the insured persons regarding the operations of the EI Court, most of them could not file any cases in the EI Court. Out of the total sample IPs (382), only 63 no. of IPs have field cases in the EI Court, which is very less.

3. 3. A large majority of the insured persons (49%) reported that they were Dis-satisfied with the working of the EI Courts and another 16% were strongly Dis-satisfied. The insured persons who were satisfied came to 14% and strongly satisfied 13% only. The insured persons opined that 'high delay' in getting responses from the EI Court end was the prime reason for dis-satisfaction.
4. An enquiry made among the insured persons to find out their awareness of the Grievances Redress Cell revealed that 32% of the insured persons were aware of the Grievances Redress Cell. However, most of the insured persons were not aware of the Grievances Redress Cell and it came to 68%.
5. It was found that most of the insured persons did not lodge grievances or most often they were reluctant to lodge any griev ances. A large majority of the insured persons (89%) did not lodge any complaintor grievances in the Grievances Redress Cell. Those who have lodged grievances came only to 11%. Again, most of them have lodged grievances regarding their salary matters, non-payments of arrears, bonus etc.
6. Majority of insured persons, 44%, reported that they were dis-satisfied in the working of the Grievances Redress Cell and another 11% were strongly dis-satisfied. 16% were neither satisfied nor dis-satisfied. The satisfaction level came to 16% and strongly satisfied came to 13% only. Lengthy Official Formalities Delay, non-response etc. is some of the important reasons for their dissatisfaction. Most of the insured persons opined that there was a 'very high delay' in the disposal of the grievances.

RECOMMENDATIONS

Since ESI Scheme is a Social Security Scheme whose aim is to create a healthy workforce to augment the Nation Building and to march ahead the whole hearted participation in the Scheme by this region is utmost important. Hence, based on study and findings, the following suggestions are put forwarded:

1. The IPs should avail the facilities of 'Employees Insurance Court' and the 'Grievances Redress Cell' for any kind of disturbance they are getting from the employers as well as from some other sources.
2. The employers should disseminate full information of the scheme and the associated benefits that can be availed by the insured persons (IPs) and their families by taking orientations classes, organizing seminars, workshops etc. within their organizations or establishments. In this case the employers may seek help from the official of the corporation for providing them full and adequate information.
3. Formulation of a registered trade/labour/ workers union, under which the interest of the IPs should be to protect and promote. It will lead to enhance their bargaining power, thereby more earnings.
4. Prompt Grievances Redressal machineries should be set up at all levels.
5. Prompt disposal of the claims, reimbursement bills should also be ensured.
6. The Corporation should also make sure that all the insured persons and the employers covered under the ESI Scheme are getting the printed educational material about the Scheme in a language Known to them. Besides the print media, the Corporation can

also consider press publicity, electronic media, seminars and workshops in this regard.

7. Online submission of challans, payment of contribution etc., should also be availed by the employers for a hassle free transaction as well as payment of long-term benefits should be made through Electronic Clearing System.

CONCLUSION

Tertiary care, especially privately provided care can be extremely expensive and can lead to serious medicalisation of health care leading to unsustainable cost-escalation. For long-term fiscal sustainability, strengthening public health system appears to be the only option for the governments. However, a robust regulatory system for quality and price control, supported by periodic technical and social audits with adequate protection policy for the insured persons (IPs) would be needed to ensure the availability of public health care facilities to the common masses.

REFERENCES

Ahuja Rajeev (2004), Health insurance for the poor, Economic and Political Weekly, Vol.39, No 28, Pp 3171-3178.

Bhatnagar D. (1984), Labour Welfare and Social Security Legislation in India, Deep and Deep Publications, New Delhi.

Malik. P. L., Employees' State Insurance, Eastern Book Company, Lucknow, 2001.

ILO, Social Security Convention, Geneva, 1984, P.83, www.ilo.org/ilolex

Vasanthagopal & Mathew (2009) The ESIC: Organization and Functioning, Abhijeet Publication, Delhi, pg 124

REPORTS:

Government of India, Report of the Employees' State insurance Scheme Review Committee, Delhi, 1966, pg 33 -62

- Annual Report (ESIC), 2008-2009
- Annual Report (ESIC), 2009-2010
- Annual Report (ESIC), 2010-2011
- ESI Act 2010

CD ROM & WEBSITES

1. Encyclopedia Britannica, Deluxe Edition, Britannica.com India Pvt. Ltd, New Delhi, 2004.
2. www.esic.com
3. rd-assam@esic.nic.in
4. http://esic.nic.in/archieved.htm
5. www.pib.nic.in/newsite/release.aspx?relid=78789

Northeast Journal of Contemporary Research, December 2019. Vol. 6 No. 1 pp.48-54
ISSN 2349-3089

Violence against Women –Safety and Security of Women: A Perpetual Study in Nagaon District, Assam

Hara Kanta Nath
Department of Commerce, Kaliabor College
Kuwaritol- 782137, Assam, India

ABSTRACT

India is well known its great tradition and culture where women have been given the most respected place in the society. It is the country where the woman was considered safe and most respected. Women were given on the Goddess place. Now, Indian women are working in all around the fields like aeronautics, space, sports, politics, banks, schools, police, business, army and many more. Through Indian women are found good respect and status in our society, but we cannot ignore some of the negative aspects where on every day some women are getting harassed, molested, assaulted and victimized at various places all over the country. Thus safety and security of women is key issue for the society. We should not blame other as it is the responsibility of each and every person especially men who need to changed their mind set towards women. To solve the problems of conflicts, care should be taken to socialize people to foster a culture of peace that upholds justice and tolerate for all. To do this, the women should be encouraged through education, training, community action, awareness programme, and youth exchange programme.

Key words: Nagaon, violence, women

INTRODUCTION

Women in fact, not only in primitive society, but also in this modern global world irrespective of rural or urban, poor or rich is treated as tool in kitchen room and toy in the hand of her husband and collaterals. Women are being treated inferior to men as if the women cannot act independently since the immemorial time one of the serious problems of human kinds in violence. All over the world, violence is one of the main causes of mortality among people with ages between 15 to 44 years. Violence against women is present all over the world and involves women of all ages, social classes, races, ethnic groups and sexual orientation. Irrespective of the type : physical sexual, psychological or related to assets, violence is associated to power and to inequality in genders relations, due to general domination by men, and it is also associated to the dominant ideology that support it.

Stages of Violence against Women:-

- **Pre Birth:** In this stages include-Sex selective abortion, effects of battering during pregnancy on birth.
- **Infancy: Female infanticide, sexual and psychological abuse.**
- **Girlhood: Child marriage, physical sexual and psychological abuse, incest, child**

*Corresponding author's Email: idolkchkn@gmail.com

prostitutions and pornography.

- **Adolescence and Adulthood: Acid throw ing, economically coerced sex, incest, sexual abuse in the work places, rape, sexual harassment, trafficking in women, partner violence, marital rape, dowry abuse and murders etc.**
- **Elderly: Forced "suicide" or homicide of windows for economic reasons, sexual, physiccal and psychological abuse.**

HISTORY OF VIOLANCE AGAINST WOMEN

Violence against women is not a new one because it has been continuing since long ago. Some of the evidence against in this regards:-

- Devadasis
- Satidah Pratha
- Purdah Pratha
- Jauha

Some of the socio-cultural and religious factors are the roots of violation of women's rights of Indian people. Here on one hand, the people worship women as goddess like Lakshmi, Durga, Kalimaa, Arnapurna, Saraswati etc., on the other hand in the same household she is tortured, beaten, rape and burnt to death. In Ramayana, Sita has to undergo "agnipariksha" to prove her satittwa i.e. purity and again she was exiled by Ramachandra (husband of Sita and God of Hindus) under especial compulsion even when she was pregnant. Again in Mahabharata, Pandava lost their wife in a game of dice and finally could not protect her from the trauma of Vastraharana. In the time Muslim rule in India, the customs of paardah, child marriage, keeping Haren by rich persons were human rights. During the time of Manu, a woman was nothing but a domestic slave. In satidah pratha, after the death of husband, a wife has no meaning of her life, so she was forced to die with husband dead body. These are the examples and clear pictures of violation of women's rights in ancient India.

Assam continues to be unsafe for women, with at least 3009 rape cases and 17106 cases of violence against women registered since the Honorable Chief Minister Sarbanandra Sonowal government took charges in 2016. The Table no: 1, which is given below shows the cases of dowry deaths in India and Assam during 2008 to 2012. The Table 2, which is given below shows the numbers of rape cases in India and Assam during 2008-2012.

Table 1. Numbers of Dowry deaths in India and Assam

Year	Nos. of Death in India	Nos. of Death in Assaam
2008	8172	103
2009	8383	170
2010	8391	175
2011	8618	125
2012	8233	140

Source: National Crime Report Burea, 2014

Table 2. Numbers of Rape Cases in India and Assam

Year	Nos. of Rape Cases in India	Nos. of Rape Cases in Assam
2008	21467	1419
2009	21397	1264
2010	22172	1721
2011	24206	2011
2012	24923	1716

Source: National Crime Report Burea, 2014

The safety and security of women is key issue of nowadays and everyone has to play important role to make female aware around you about their safety and security.

OBJECTIVES OF THE STUDY

- To know the importance of Women Safety and Security.
- To Understand the Strategies adopted for women Self-Safety.

METHODOLOGY

In this study, an attempt has been made to know about safety and security of women of Nagaon District in Assam. The study is mostly based on primary and secondary data. For collection of primary data, a Likert type five point's scale is adopted to the questions as per applicability. The questionnaire was distributed to the selected women's of the district. It was also collected personally from them. After collection of data, it was analyses, interpreted and tabulated. Finally, a simple percentage technique is applied to make data meaningful and give significance to the values in Pie diagrams and bar diagrams.

RESULT AND DISCUSSION

Table: 3 reveals that only 72 percent of women feel that there is no safety and security in their life when they are going to outsides from their residence. Only 11 percent of women feel importance of safety and security in their life. 15 percent of women have no responds in regards of safety and security in their life.

Table 3. Respondents Feeling in Regards of Safety and Security of their Life
(Figures in Percentage)

	Very High	High	Neutral	Low	Very Low	NR
How much is important women safety and security in your life	4	7	2	25	47	15

Source: Primary data. (NR=No Responds)

Figure 1. Respondents Feelings in Regards of Safety and Security (Source:- Primary Data)

Table 4. Strategies Adopted For Self Safety and Security

Types of Strategies Adopted	Always	Often	Sometimes	Rarely	Never	NR
Keeping Cell Phone	71	26	3	-	-	-
Keep Alert about Surrounding Activities	50	27.5	12.5	4	-	6
Down Loaded Apps in mobile	5	10	8	42	30	5
Moves in groups & Relatives	27	25.5	17.5	16	3	11

Source: Primary Data

Table:4, shows that 71 percent of women always keep mobile phone with them and 50 percent of them are always alert about the surrounding activities. Very few numbers of respondents (5%) are using and have download security apps in their mobiles. It is also observed that about 27 percent of women move outsides in groups and relatives when they were leaving their residence.

Table 5. Avoid Situation

Types of Situations	Always	Often	Some Times	Rarely	Never	NR
Isolated & Dangerous Places	52.5	23.5	15	4	-	5
Waking in Odd Hours Alone	35	18	16	5	14	12
Hidden and Lonely Place	38	12	28	7.5	9.5	15
Dangers/Bluff/Cheat Women/Bed Elements	41	13	13	14	10	-

Source: Primary Data

Table 5, reflects that 52.5 percent of women always avoid isolated places and dangerous locations. Even 35 percent of respondents never do walking in odd hours alone. It is also found that a good numbers of women (38 %) avoid to room at hidden and lonely places and moreover 41 percent of women avoid dangerous, bluff and bad elements.

Table 6, observed that women are not satisfied to Government and Administrative system with their infrastructural facilities available in their locality. 60 percent of women never satisfied about the police patrolling in their areas and 62 percent women feel that there is no female security staff with police persons in patrolling duty. More than 57 percent of respondents said that there are no proper lighting facilities during night, avoid remote isolated places.

Table 6. Expectation of Safety from Government and Administrative

Types of Expectation	Highly Adequate	Moderate Adequate	Adequate	Less Adequate	Inadequate
Sufficient Police Patrolling	2	7	13	18	60
Proper Lighting at Night	8	12.5	21.5	40	18
Proper Lighting in Remote Area	7	13	23	38	19
Female Staff in patrolling	3	8	12	15	62

Source: Primary Data

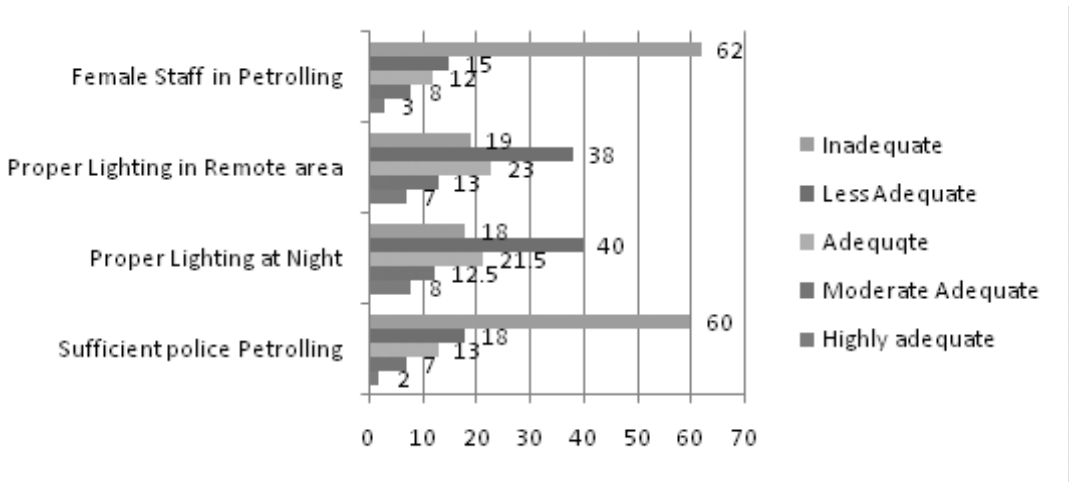


Figure 2. Expectation of Safety from Government and Administrative (Sources: Primary Data)

Table 7. Satisfaction of Women, the efforts are being made by Government and Administration

Satisfaction Scale- ->	Highly Satisfied	Moderate Satisfied	Satisfied	Less Satisfied	Dissatisfied
Percentage of satisfaction	-	12.5	23.5	25	49

Source: Primary Data

Table 6, observed that only 23.5 percent women are satisfied, 12.5 percent women are moderately satisfied and 49 percent women are not satisfied in efforts being made by the Government and Administration in totality for satisfy and security of women.

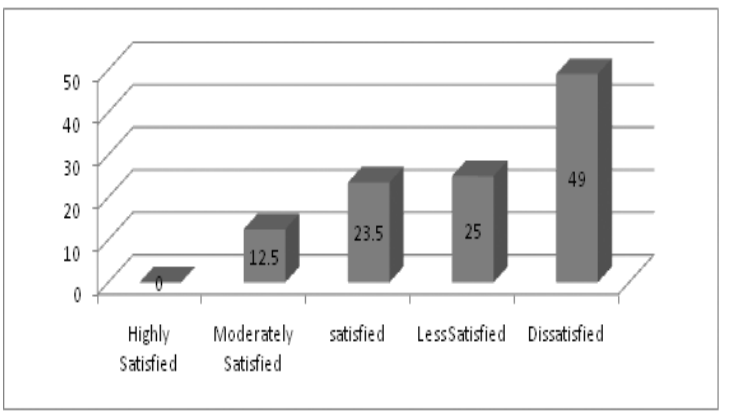


Figure 3. Satisfaction of Women, the efforts are being made by Government and Administration (Source: Primary Data)

FINDINGS

From the discussion, it is found that 72 percent of women feel that there is no safety and security in their life. 71 percent of women always keep mobile phone with them and most of them always alert about the activities happening around them. It is also observed that a good number of women are always movement with their groups and relatives.

Many women always avoid isolated places, hidden places and dangerous locations. 41 percent of women avoid taking with strangers dangerous, bluff and bed elements 35 percent of women avoid walking in odd hours alone.

From the discussion it is also found that most of the women feel that there is inadequately in respect of efforts made by Government and administration for safety and security of the women in the district. Most of the women in the district are not satisfied with the infrastructural facilities available in the district such as improper lighting at night and remote areas.

In nutshell 74 percent of women are not satisfied and only 12.5 percent of women are moderately satisfied in efforts being made by the Government and administration for safety and security of their life.

SUGGESTION AND CONCLUSION

Safety and Security of women is very essential both in and outside the home. Despite the formation of various rules and regulations by the

central as well as state government to control the crimes against women, the numbers and frequently of crimes is against women are increasing day by day. Women are doubtful about their safety and security while going anywhere outside their home. Actually, we the people should not blame the government because women safety is not only the responsibility of each and every citizen especially men who need to exchange their mind set for women.

Women safety and security is a big social issue which needs to be solved urgently by the efforts of all. In order to improve the condition of women regarding safety and security, the following suggestions are given in the state with special reference to the Nagaon district.

1. To increase the educational status of the women because most of the women belongs to low educational status.
2. To increase the awareness level of the women about their rights and provisions that is included in the Indian Constitution as well as different Acts.
3. Train girl child in self-defense techniques and also focus on gender discrimination and sensitization programmed in rural and urban areas.
4. Establishment of toll free help Numbers (24/7 days) for receiving and attending complains, counseling, police help etc.
5. Extent equal treatment by parents from childhood to make girl child also physically strong.
6. Immediately give punishment and take disciplinary action in case of crime against women.
7. Provide proper lighting facilities in night time, in remote areas and isolated areas.
8. Introduce police patrolling with female police regularly.
9. Introduce CCTV cameras on the streets.

Thus Safety and Security of women is key issue for the society. We should not blame others as it is the responsibility of all citizens especially men who need to change their mind set towards women.

REFERENCES

Clinton, H. (5th September,1995) " Women's rights are Human Rights".

Gautam Priyadrashini: Women and Human Rights, New Delhi, Swastik Publications, 2014, Print.

Jain, R- Human Rights, law and practice third edition, Universal Publication.

www. Business dictionary.com/definition/ safety.html

https:/www.safetyrisk.net/what-is-safety

htpps:// en. Wikipedia. Org/wiki/safety.

Northeast Journal of Contemporary Research, December 2019. Vol. 6 No. 1, pp. 55-68
ISSN 2349-3089

Women entrepreneurship and area of interest - A case study of Sonitpur district of Assam

Mala Mahanta, Parbin Sultana
School of Business Science, University of Science and Technology (USTM), Meghalaya - 793101, India

ABSTRACT

In the North bank of Brahmaputra river of Assam, among all of the effective sectors, agriculture makes the very best contribution to the home sectors and employs 70 percent of the workforce. Infrastructure facilities for the development of entrepreneurial activities aren't good enough and also not up-to-the mark in this region. Yet women entrepreneurs are moving ahead in all of the spheres of the advertising dabbing each possibility to whatever volume they can. This study covers especially Sonitpur district of Assam which is situated in the north bank of Brahmaputra river. Most of the women entrepreneurs in the study are interested by the conventional businesses. The first-generation women entrepreneurs are interested in the non-conventional business activities. A few of them are inquisitive about sporting out the traditional gadgets in modern looks – blending with market demands. This paper explores the interest of women entrepreneurs towards the traditional as well as non-traditional areas and barriers of women entrepreneurship.

Key words: Entrepreneurship, infrastructure, development, contribution, conventional

INTRODUCTION

Entrepreneurship is regarded as the engine of economic growth. All over the world, a revolution is driving by means of marketers in transforming and renewing economies. Now-a-days self-employment has notable significance in India due to growing populace together with jobless growth. Rani (1986) revealed that majority of women were not able to sincerely pick out the undertaking they would like to set up. Deshpande & Sethi (2009) discovered that the biggest demanding situations of women marketers are male ruled society, lesser chance and shortage of self-confidence. Jaiswal (1993) studied that despite better educational qualification and relatively good own family background, women entrepreneurs do not keep the identical socio-monetary status, job placement, work allotment as enjoyed by male in the same conditions.

Assam is a state of full of natural and precious resources. Presently Assam is amongst the industrially backward states of India. The industrial scenario of Assam is confined within the growth of employment orientated SSIs sector comprising of the processing and manufacturing units. In Assam, women entrepreneurship started in 1980. Sonitpur district of Assam is situated in the north bank of Brahmaputra river. This district is also confined within the growth of small scale enterprises. The handloom sector is the second largest sector after agriculture which employs large section of people. This sector is almost handled by women in the study area. The hand-

*Corresponding author's Email: malamahanta47@gmail.com

loom sector now supplies special varieties of traditional clothes for women and some for social and religious purposes. Women entrepreneurs of Sonitpur district are engaged mainly in the traditional activities of handloom and handicrafts like weaving, embroidery, tailoring, cutting, knitting, jam jelly making, pickle making, different spices powder, traditional food items like tilor-ladu, til-pitha, coconut-ladoo, etc. Srivastava and Syngkon (2008), examine in most of the North Eastern states, awareness and growth of SSI sports is higher in rural areas than in urban regions. This study brings to light the rising number of ladies and tribal marketers within the location in traditional fields. Al-Hossienie (2011) analysed that women entrepreneurs generally brings a positive amendment in perspective and behaviour of members of the family and society towards them. The present study is relevant in the context of Micro and Small entrepreneurs in whose actual importance in Sonitpur district is yet to be assessed. It is a backward region characterised by agrarian economy and about 80 percent of total population (2011) is dependent on agricultural sector. During field study, it was noticed that there has been a gradual increase in the participation of women in small business indicating the immense potential for entrepreneurial development among women. No doubt the range of women entrepreneurs has been increasing but due to untapped entrepreneurial capacity of women in the study area, having resources and potentials, the Sonitpur district is not growing with the pace of main stream line. Chakravarty's (2013) findings highlight that majority of the women respondents see inequality in rights, financial limitations, education, marketing and communication as barriers to new business. The beliefs of Gender-stereotypical regarding entrepreneurship are influential factor.

This study attempts to recognition on the interest of women entrepreneurs (conventional as well as non-traditional sectors) alongside micro and macro elements which hinder women for their entrepreneurial activities.

Significance of the study

In recent years, women entrepreneurs are increasing significantly because of a rise of Self-Help Groups (SHGs) underneath the Swarna Jayanti Gram Swarozgar Yojana (1999). Culturally, this district is stuffed with diversity. Due to the existence of doctrine ethnic teams, there's a prospect of women entrepreneurship in numerous areas- traditional as well as non-traditional areas reminiscent of handloom, handicraft, Assamese cuisine, boutique, hobby classes, beauty parlour, money consultancy, café, and so on. The hidden entrepreneurial qualities of female are changing in society with the growing sensitivity to the role and economic status. Since Fifth Five Year Plan onward because of implementation of varied schemes of poverty eradication and self-employment, growing urbanisation, enlargement of non-agricultural activities, people's financial position has been increasing. This social modification helps to extend entrepreneurships among women each in traditional and non-traditional sectors. The significance of this study lies in the fact that all the women entrepreneurs that listed as respondents were subjected to an in-depth interview. Therefore, it's substantially essential to understand the interest of women entrepreneurs in traditional as well as non-traditional areas. Since this district has not been endowed with various facilities for development of entrepreneurship among women compare with other districts of Assam, therefore this study tries to focus on micro and macro factors which hinder women for undertaking their own enterprises.

The major objectives of the study are:

1. To find out the socio-economic condition and motivating factors of women entrepreneurs
2. To find out the interest of women entrepre neurs in traditional as well as non-traditional areas
3. To find out the barriers of women entrepreneurs

METHODOLOGY

Study area: The area of study is three blocks out of seven blocks in Sonitpur district namely, Gabharu, Balipara and Bihaguri blocks. Descriptive survey method is used to study. Both primary and secondary data are used in this study. Random sampling method is used to collect data from primary sources. Primary data are collected through well-structured questionnaires. The researcher has selected both registered and non-registered women entrepreneurs for the present study so that the overall picture and status of women entrepreneurs reveal. Total sample size is 120.

Statistical tools:

The collected data is analyzed to find out the demographic profile of the women entrepreneurs and to draw inferences by applying simple statistical techniques like percentage, tables, graphs, etc.

RESULTS AND DISCUSSION

First objective:

1.1 To find the socio-economic condition of women entrepreneurs in the study area

In Sonitpur district, the various entrepreneurial activities among women lead to their entrepreneurial development are determined by the demographic and personal variables. These variables are basically age, marital status, caste, occupation, family structure and size, educational standards, involvement and work experience, family income from entrepreneurial and allied activities. These are discussed below in the following table.

Table1.1 Socio-economic condition of women entrepreneur

Variables	Category	Number of respondents	Percentage (%)
Age	20-30	25	20.83
	30-40	55	45.83
	Above 40	40	33.33
Educational qualification	10^{th} standard	18	15
	12^{th} standard	57	47.5
	B.A.	40	33.33
	M.A.	05	4.17
Marital Status	Married	55	45.83
	Unmarried	40	33.33
	Widow	25	20.83
Family structure	Nuclear	75	62.5
	Joint family	45	37.5
Number of dependent members in family	3	57	47.5
	4-6	63	52.5
Monthly income	Up to Rs. 10,000	35	29.17
	Rs.10,000-30,000	55	45.83
	Rs.30,000-50,000	25	20.83
	Above Rs. 50,000	05	4.17
Location enterprise	Home based	72	60
	Rented Premises	48	40

Sources of finance	Self	62	51.67
	Relatives, friends	39	32.5
	Financial institutions	19	15.83
Size of enterprises	Small	120	120
	Medium	00	0
	Big	00	0
Legal structure of enterprises	Registered	35	29.17
	Non-registered	85	70.83
Origin of business	Self-created	68	56.67
	Bought	28	23.33
	Inherited	24	20
Community of women entrepreneur	SC	35	29.17
	ST	24	20
	OBC	20	16.67
	General	41	34.17

Source: Primary data

Table – 1.1 reveals the socio-economic condition of women entrepreneurs. The highest number (45.83 percent) of women entrepreneurs is belong to 30-40 age groups; followed by above 40 years of age group (33.33 percent). Investigation shows that highly qualified women were not interested in entrepreneurial activities. They were interested on public and private sector jobs. 47.5 percent women entrepreneurs were 12^{th} standard, 33.33 percent were graduate, 4.17 percent were Master degree and 15 percent were 10^{th} standard. During field study it came to know that number of married women entrepreneur (45.83 percent) was more than unmarried (33.33 percent) women and 20.83 percent were widow. Widows were compelled to join in entrepreneurial activities to cope up financial crisis. Number of women belonging to joint family system (37.5 percent) is less than nuclear family (62.5 percent). Because women entrepreneur from nuclear family has to do more to earn money mainly to meet the day to day cost in urban area. As the economy of Sonitpur district is backward and is based on agriculture, therefore monthly income of women entrepreneur is not so high. Majority of respondents (45.83 percent) income fall in the range of Rs. 10,000 to Rs. 30,000. Above Rs, 50,000 is earned by only 4.17 percent women entrepreneur. Lack of sufficient infrastructure facility, training facility, scarcity of funds, insufficient market, etc. are responsible for low income of women entrepreneurs. Due to procedural complicacy, most of the respondents did not take financial help from banks. Majority of respondents (61.37 percent) source of finance was self. Only 15.83 percent respondents have taken loans from financial institutions. Due to shortage of funds, required investment is not enough which ham-

pers the development of entrepreneurship among women in the study area. Moreover, due to absence of big and medium enterprises, all women enterprises 100 percent are small. Number of registered women entrepreneurs was only 29.17 percent and non-registered was 58.33 percent. Due to illiteracy, procedural complicacy in registration, and the ignorance about the advantages of registration, the number of non-registered women entrepreneur was more than registered. Self-created women enterprise is 56.67 percent. Inherited ventures were only 20 percent. Women entrepreneur belonging to SC was 29.17 percent which was more than OBC and ST (which are 16.67 and 20 percent respectively). Since economically, SC community is very poor, they were compelled to enter the entrepreneurial activities for survival of their family. 34.17 percent women entrepreneurs were general.

1.2 To find out the motivating factors of women entrepreneurs in the study area

In Sonitpur district, employment opportunities in organised sectors is absolutely discouraging. Employment in government sector is gradually diminishing, investment is very low due to lack of resources and skilled man power in the study area. Therefore, self-employment is the best and last resort which is gradually increasing among all sections of the society. With the increase of female literacy (60.73 percent, 2011), urbanisation, and Self-Help Groups (SHGs), entrepreneurial activities on traditional and non-traditional sectors are increasing day by day among women. Following table shows the motivating factors of women entrepreneurs in the study area.

Table-1.2 Percentage distribution of respondents based on motivating factors

Sl. No.	Variables	Total	
		No.	%
1	Earning money	25	20.83
2	Unemployment	16	13.33
3	To be independent	14	11.67
4	Interest in entrepreneurial activities	10	8.33
5	Responsibility due to death of close relatives	13	10.83
6	Existence of business culture in the family	08	6.67
7	Time management and business-family balance	11	9.17
8	Dissatisfaction with current jobs	10	8.33
9	Being entrepreneur was a lifelong goal	07	5.83
10	Lack of mobility	06	5
	Total	**120**	**100**

Source: Primary data

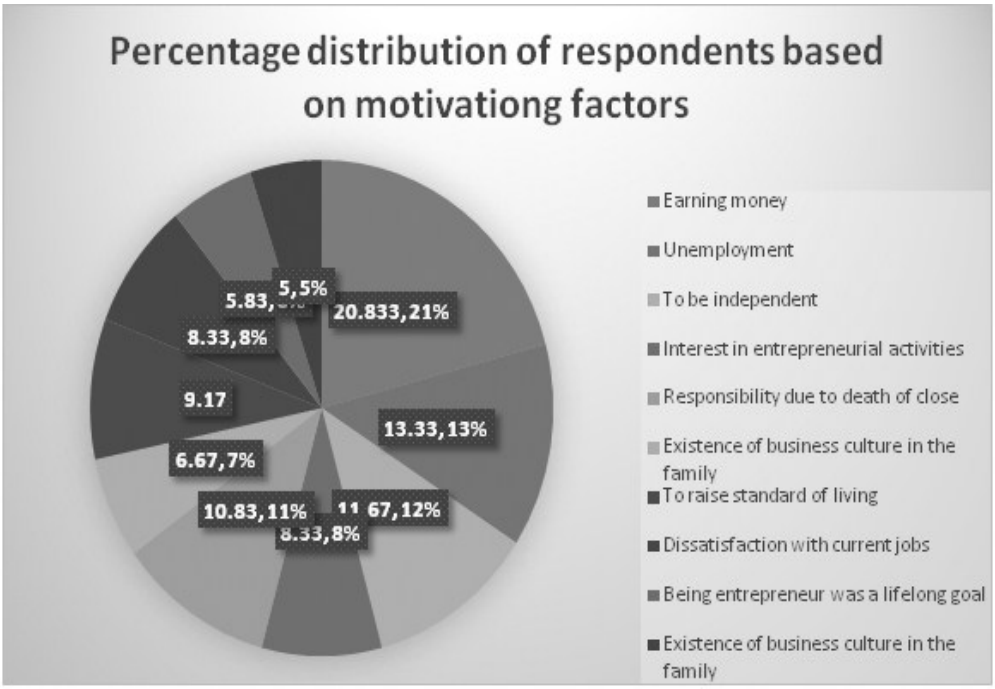


Figure 1. Motivating factors of women entrepreneurs

The above 1.2 and fig- 1 show the various motivating factors. Since this district is in the bank of Brahmaputra river, it is agriculture based and also underdeveloped. A large section of the people (80 percent) directly depend on agricultural sector. Moreover, due to the absence of big industries, entrepreneurship development in the study area is low. Field study reveals that the main motivating factor is to earn money to raise their standard of living. Unemployment is also another motivating factor followed by to be independent, responsibility due to death of close relatives, Time management and business-family balance, dissatisfaction with current jobs, interest in entrepreneurial activities, existence of business culture in the family, being entrepreneur was a lifelong goal and existence of business culture in the family.

2. Second objective:

To find out the interest of women entrepreneurs in traditional as well as non-traditional fields

Women within the study area aren't solely venturing into the traditional business plan however conjointly, they're able to explore in varied non-traditional areas and prove their best capability. While during field study, it absolutely was quite encouraging to watch that against the varied odds (like improper provide of the resources, as well as inadequate business premises, scarceness of funds, inadequacy of business competencies and lack of skills particularly in rural areas, issue in maintaining balance between business and family, shortage of power provide, low profit ratio, etc.,) entrepreneurship among women is moving towards in a very posi-

tive direction. The entrepreneurship ventures have crawled into a spread of activities thanks to the increased rate of literacy rate among female (60.73 percent, 2011); awareness of people; growth of urban areas; increasing tendency of self-employment through SHGs (Self facilitate Groups), increase of per capita financial gain (Rs. 17041, 2011), implementation of varied schemes like MGNREGS, DDUAY, NCS, PMGAY, PMAY, PMJDY, RAY, SGRY, NRLM, NULM, PMKVY, stand up India etc. that increase the financial gain and customary of the folks. Investigation shows that customer's demand has been dynamical from traditional items to non-traditional items. This case is prevailing a lot of in urban area than rural areas. However, at the same time, it was observed that traditional items have also high demand in fashionable appearance in urban areas.

During the sector study, within the rural areas, most of the respondents (68 percent) explicit that they were curious about the production of traditional items like handloom and handicrafts, tailoring, embroidery, Assamese cooking (traditional food items), etc. with the assistance of a primitive methods, that is additional contribution. Moreover, the cost of production of traditional items is relatively under non-traditional items because of the plentiful accessibility of raw materials, that build the worth of raw materials low cost, be it for the greens, fish, meat, and flowers. Therefore, rural women entrepreneurs are in the main curious about traditional items like native snacks (til pitha, tailor luddoo, Narikolor luddoo, etc.), weaving, tailoring, and embroidery, and other different food items such as pickle, jam-jelly, rice, jeera, turmeric powder, etc. Urban women entrepreneurs, on the other hand, have an interest in each traditional as well as non-traditional items. Just in case of non-traditional things, they're curious about the ventures of beauty parlour, crèche, hobby categories (yoga, music, dancing, art etc.), financial consultant, cafe, restaurant, doll making, gift shop, etc. Urban women businessperson conjointly curious about traditional items with fashionable sounds like a dress shop, Assamese cooking, etc. They used new technology in their professions, e.g. just in case of embroidery (traditional item), a couple of respondents (1.5 percent) used digital swing machines, for creating women purse special machines are used to provide totally different shapes with vibrant styles and patterns, etc. Different traditional items that are listed principally by women entrepreneurs are essentially handicraft items like written textiles, pen stands, stone carving, decorated merchandise and imitation jewellery, ornamental candles, dry fruits boxes, stuffed toys, wood ware, wood style, scarf as art ware, are a number of the things that make up the bracket of seasonal demand or seasonal market. Generally, they're in demand throughout festivals. The urban women do this sort of labour throughout the year because it is long and conjointly, they're prepared with a bulk of stock once in demand. They prepare for exhibitions, fairs/ trade fairs at different places to sell their handicraft and handloom merchandise. A couple of women have loom machines and weavers at their homes or at different places for weaving garments, which, now-a-days, have high demand within the festivals and wedding seasons. They typically manufacture traditional item (like Gamusa, mekhela chaddar shirt, etc.) consistent with the demand of the purchasers. Presently, traditional items with fashionable sounds like mekhela chaddar and loom pants shirt piece, muga shawl, men's shirt, etc. have the best demand within the market. However, the issues of entrepreneurs during this sector are the high cost of production; the scarceness of funds, lack of well-arranged room; shortage of weavers and power offer. In India, handicraft and handloom production could be a major sort of employment next to agriculture and constitutes a big a part of the export impact economy.

In the case of boutiques, differing types of dresses and accessories are obtainable per the style styleer's design supported the customer's alternative. In jewellery sectors conjointly, traditional styles are employed in fashionable shapes like ornaments of kesa gold (Joon Biri, Loka para,

Table 2. Percentage distribution of respondents based on the specialisation of products (Traditional items / non-traditional items)

S.N.	Items	Total	
		Nos.	%
1	Traditional items	72	60
2	Non-traditional items	48	40
3	Total	120	100

Source: Primary data

dug dugi, gum kharu, etc.) and special ornaments of Barpeta (district of province), etc. Most of the respondents each in urban and rural areas run restaurants with traditional strategies. For instance, cooking in baanhar sungat (bamboo tubes/ hollows). There are some herbs (medicinal plants) like mani-muni, bhedailota, norasingha, etc., that are simply obtainable in rural areas than in urban areas. In some restaurants, these herbs are used to cook traditional dishes. Normally, Assamese culinary art holds several unimaginable recipes associated with fish (masor tenga), meat (duck curry, chicken, and bamboo shoots curry, mutton, pork, etc.,), aloo pitika, khar, ouu khatta, dekaliter kosu xaak, among others (Til Pitha, Tilor laddoo, Narikor laddoo, Gooror payash, Mango delight, etc.). At present, this type of traditional dishes has high demand.

Interpretation

Table- 2 reveals that the majority of the respondents was interested totally on traditional items (72 percent) than non-traditional items (48 percent). This can be principally attributable to the low price of production, availableness of raw materials, and mostly, they'll run their entrepreneurial activities from their homes. Field study reveals that just in case of non-traditional items, urban women enterpriser (65.45 percent) was additional inquisitive about the non-traditional items than traditional items (34.55 percent). Thanks to the prevailing higher demand and market opportunities, urban women entrepreneurs were inquisitive about non-traditional items. Moreover, trained women entrepreneurs in urban areas tries to explore new innovations, therefore, they were interested essentially in non -traditional and additionally on traditional items. Fields study reveals that the rural women entrepreneurs (80 percent) were largely engaged in traditional items. Most of the respondents (35 percent) were concerned in the handloom sector followed by cutting, and embroidery (17 percent), handicrafts (9 percent), indigenous snack (7 percent), curry powder and Assamese cuisine (6 percent each). This is mainly due to the supply of raw materials, required less trained and primitive strategies of production. Moreover, they'll run entrepreneurial activities from their own homes. On the other hand, rural women entrepreneur's (20 percent) interest in non-traditional items is relatively below than traditional items. The explanation behind is that lack of adequate marketplace for such product, high price of production, absence of adequately trained personals and also the dearth of funds. 10 percent respondent was performing on beauty parlour followed by restaurants/dhaba (3 percent), financial consultant (2 percent), hobby teaching (3 percent), and restaurant (2 percent). Throughout the investigation, no crèche was found within the rural areas. Recently in India, production of non-traditional merchandise creat-

ed by women enterpriser has been bit by bit increasing. It is an encouraging fact that the market for the traditional items in modern looks are increasing as it shows hopes of the preservation of authentic identifications of the places. Field study shows that the trend of women enterpriser on each traditional and non-traditional item is positive and additionally encouraging in the study areas despite the existence of some odds**.**

Third objective:
To find out the problems of women entrepreneurs

Being women is a mission in itself, then comes the most important undertaking of maintaining or surviving as a woman as hurdles keep coming in the shape of stereotyping, hypocrisy, societal frame of conducts and much more than that can be expressed in words. In this kind of scenario, a woman entering into entrepreneurship is difficult and a tough act. Women marketers face a wide array of demanding situations, so that they can increase their efforts to further develop and enlarge the firms they have established. These demanding situations and possibilities are developing rapidly. Though in India, women constitute 48.2 (Census, 2011) percent of the total population, however the entrepreneurial interest appears to be a male-dominated zone. This exhibits that women entrepreneurs aren't capable of run their firms successfully because of some (major) problems. The high-level growth in India will be possible if all sections of the society, particularly women become equal components in the development process. it's a widely known indisputable fact that the societies, that discriminate on the idea of gender tend to expertise lower economic development and reduction of financial condition, than the societies that exercise equality among men and women. Despite the constitutional provisions, there's a discrimination against women.

According to Ghose and Roy (1997), Indian women have more apprehensions/ inhibitions regarding the idea of enterprising as compared to the Western nations. In the competitive and first-changing and fast-paced globalized era, women entrepreneurs are confronted with several challenges for which they could not move to develop their entrepreneurial activities. The growth of the genre of women entrepreneurship is restricted and inhibited by challenges and constraints.

In India, the laws and rules associated with women employment are discriminatory. The foremost vital nevertheless common issues of the women entrepreneurs are: the dearth of adequate finance; lack of proper business knowledge; stiff competition; lack of knowledge regarding the govt policies; social and cultural problems; lack of sufficient training facility; lack of family support; lack of self-confidence; gender biases; etc. Investigation indicates that women (on their personal front as individuals) are less probably to understand themselves as entrepreneurs and avoid supporting systems like coaching and courses targeted at the "entrepreneurs". The impact of family life and kid care (on their personal front), the lack of high-profile role models are other limiting factors within the study areas. Women's ancient "care-giver" roles; difference within the sharing of those roles between men and women, yet as our perceptions of what are acceptable roles for women and men (stereotyping and hypocrisy) each at the house from and outdoors the home, still function the key constraints to women entrepreneurs in the study areas.

Table 3. Classification of respondents based on problems during the running of enterprises

Sl. No.	Problems	Total	
		No.	%
1	Finance	20	16.67
2	Stiff competition	18	15
3	Cultural and social	13	10.83
4	Problem of marketing	10	8.33
5	Pricing problem	06	5
6	Gender bias	09	7.5
7	Lack of proper business knowledge	5.83	
8	Lack of role model	5	
9	Lack of self-confidence	5.83	
10	Lack of mobility	6.67	
11	Time management and business-family balance	5.83	
12	Low risk-bearing ability	1.67	
13	Lack of awareness about Government policies and schemes	5.83	
14	Total	120	100

Source: Primary data

The above table shows that the main problems of most of the respondents (16.67 percent) are finance followed by stiff competition, cultural and social, problem of marketing, gender bias, lack of mobility, etc.

Progress on these challenges will herald a true distinction to confirm equality and direction for women in Sonitpur, and it will ultimately facilitate in building sustainable economies through the event of women entrepreneurship.

Impact of women entrepreneurship in income and employment generation in the study area:

Field study reveals that income and employment generation of women entrepreneurship is not satisfactory. All respondents run small enterprises (SSIs) and handled by themselves. Investigation shows that 70 percent enterprises were run by single entrepreneur, this is basically due to lack of adequate money; women were running business with their family members and not with hire labour. Nineteen percent ventures employ 2 or 3 persons (e.g. beauty parlour, boutiques, grocery shop, financial consultant, etc.) and eleven percent ventures employ 4 to 5 persons in running restaurants, café, creche, conducting hobby classes like music and dance, furniture of bamboo and cane, etc.

In case of income generation, investigation states that 29.17 percent respondents earn monthly around Rs. 10,000, 45.83 percent respondents (highest) earn between Rs. 10,000 to Rs. 30,000, and only 4.17 percent respondents earn above Rs. 50,000. The picture of income generation is not satisfactory.

Moreover, non-registered respondents were more (70.83 percent) than registered wom-

en entrepreneurs (29.17 percent). Due to illiteracy, lack of knowledge and awareness about government facilities which are available for registered entrepreneurs, the number of registered respondents is less than non-registered respondents. Field study also reveals that number of

Renowned Women Entrepreneurs:

Generally, entrepreneurship has been a male-dominated pursuit, but nowadays most memorable and inspirational entrepreneurs are women. Some of the most influential entrepreneurial women past and present are-

In International perspective

registered respondents were more in urban area (85 percent) than rural area (15 percent).

Debbi Fields**,** at age 20, was a housewife with no business experience. She has a great chocolate chip cookie recipe and a dream. At present, her Cookies is one of the world's most recognizable dessert franchises. It has over 600 stores in the U.S. and ten other countries.

Jenna Jameson turned the business model in her industry on its head before diversifying into a wide range of other products. For entrepreneurs in any industry, the story of Jenna, her powerful branding, tightly controlled distribution and multiple streams of passive income contains very fruitful lessons.

In National perspective

Dr. Kiran Mazumdar Shaw**,** Chairperson and Managing Director of Biocon Ltd., became the richest women in India in 2004 (an estimated Rs. 2100 crore). She received her education at Mount Carmel College in Bangalore. She established the Biocon India with a capital of Rs. 10,000 in her garage in 1978. Her first operation was to extract an enzyme from papaya**.** At that time bank rejected her application form of loans on three grounds. Firstly, at that time biotechnology was a new concept. Secondly, the company did not have sufficient assets. Thirdly women entrepreneurs were still a rare thing. Now her company is the most prominent biopharmaceutical firm in India.

In North Eastern perspective

Abokali Jimomi is the founder of Organic Nagaland, which came into existence in the year 2011. The main objective of this organization is empowering local growers and training the local Naga women and men with the latest technologies of agriculture. It has been revolutionized the Nagaland agriculture, owing all this to the constant efforts of Abokali.

Leena Saikia is the founder of the food production company called "Frontal Agritech Private Limited." The main produce of this company is Bhoot Jalakia (King / Naga Chilli), among the spiciest chillis in the world (ranked as No.2). With 99 percent of the produce being exported to 22 countries around the world.

Lakhimi Baruah is the founder of a cooperative bank for women called Konoklota Mahila Urban Cooperative Bank (KMUCB) in the year 1998. This bank has female employees and has reached out too many women in the Northeast. KMUCB has helped women to manage their finances effectively.

Lalita Devi Jain (1994), created her own brand "Madhushree" and has marched her method forward to carve a distinct segment in the world market. She started with (in ancient area) 5 looms and over the amount of last more twenty-five years, she has designed up fifty looms. Almost two hundred women are utilized and all of them became a part of the family to form the brand of Madhushree in Gauhati, Assam. The Madhushree brand provides examples that with facilitate of dedication and positive attitude, entrepreneurship development among girls will possible.

Sanjukta Dutta, an engineer turned designer, from Nagaon district of Assam has successfully made Assam's traditional dress 'Mekhela Chadar earn national and international acclaim. In 2012, she started her weaving unit. Since then her weaving unit has earned name and fame all over the world. No, looking back!

Findings:

- The proportion of women entrepreneurs within the range of 30-40 is highest (48.14 percent) in the study area. The more women enterpriser in this age group is specially to support their family in terms of money and this age group of respondents can maintain a balance between family and business.
- In Sonitpur district, women entrepreneurs having post graduate or holding higher skilled qualification, was terribly nominal. Extremely educated women in the study area showed no fascinated by doing business.
- During investigation, it was found that an outsized section of women entrepreneurs has availed no training (65.58 percent) to formulate their thinking and aspirations. Only 34.42 percent respondents have undergone training. Due to lack of proper training, most of the respondents haven't skills to manage a venture.
- Most of the respondents are belonging to nuclear family. Due to gradual increase of urbanisation and to maintain a high standard of living, women in urban areas are forced to try and do entrepreneurial activities to satisfy their day to day wants.
- Investigation reveals that in urban areas most of the respondents (53 percent) have an interest to try and do their business in non-traditional areas (like financial consultant, café, running hobby classes, beauty parlour, creche, boutique, etc.) due to high demand. On the other hand, in rural areas, majority of respondents have an interest in traditional areas (like handloom, handicrafts, tailoring, embroidery, etc.). This is mainly due to low cost of production, handiness of raw materials, use of primitive strategies, etc.
- Self- created women entrepreneurs were quite heritable and acquired. Throughout the study area, it came to know that 1st generation women enterpriser (self-created) were interested to try and do entrepreneurial activities on non-traditional things.
- Investigation revealed that due to lack of awareness and education, complicacy in procedural formalities, lack of transparency and not obtaining advantages on time from government policies and schemes, etc., are some important factors that produce major issues for the event and enlargement of women entrepreneurship in the study area.
- Study shows another vital drawback that was the delay in implementation of policies that discourages women to manoeuvre one step ahead in beginning and running enterprises.

Suggestions:

- Training facilities and financial assistance should be increased more both in rural and urban areas instead of giving centrally in one area (district-wise). To attract more women in entrepreneurial activities training should be provided with stipend and training on different sectors should be changed from time to time according to the changing demand of customer.
- Marketing facilities such as sales, purchases and other required support for timely start of an enterprise, etc. are necessary for respondents which should be easily available. Government/NGOs should give emphasis on that. At present online marketing is popular and respondent should be trained for that.
- Since education opens many ventures for qualified women in various fields, steps should be taken by the government to explore their talents.
- More commercial as well as industrial estates should be set up in various places (Block wise) of the study area.
- Necessary raw material should be available at concessional rate and raw material hub should be set up in both urban and rural

areas.

- Workshop should be arranged in different places with the help of successful and renowned women entrepreneurs on traditional as well as non-traditional sectors.
- Corruption and malpractices, which act as a major challenge for availing loan and other facilities from the respective agencies should be abolished by launching appropriate credit delivery-based incentive schemes for all the employees of that particular organisation. Strict vigilance is important for that.
- A stronger coordinated role of government, monetary establishments, NGOs and academic institutions with Associate in Nursing integrated approach is required to enlarge the participation of women in small enterprises. Easy credit system, low rate of interest, collateral free and adequate promoting facilities ought to be available.
- Women need encouragement and support not only from the family members but also from the society, financial institutions, and government; that atmosphere are very essential.
- To speed up female entrepreneurial activities, the first-generation women entrepreneurs ought to publicize their work and experiences. They should share their success stories within the newspaper, magazine, journals, e-journals, etc.
-

Outcome of the study:

This study reveals the interest of women entrepreneurs. First generation women entrepreneurs are interested in non-traditional sector. Moreover, rural respondents are interested in traditional and urban respondents are interested in both traditional as well as non-traditional sectors. Present study shows the causes of slow development of women entrepreneurship. This study provides a picture that in spite of opportunities, the main challenges of women entrepreneurs are: raising funds, social and cultural problem, lack of infrastructural facilities, gender biases, absence of entrepreneurial aptitude, fear of success, lack of education and lack of motivation, stiff competition, running capital, pricing problem, marketing problem, lack of mobility, scarcity of raw materials, time management on business and family, low-risk bearing abilities and day to day problem, lack of awareness about government schemes and policies, use of new technology related problems followed by repayment of loans and selection of location

This study will help government and NGOs to take adequate and active policies and measures regarding the promotions of entrepreneurial activities among women. The students belonging to under graduate academia level and above that may find the significance of the study for understanding the various aspects of women entrepreneurs.

CONCLUSION

Field study shows that women are interested in doing business both in traditional and non-traditional items irrespective of the categories of areas (urban and rural). Generally, the traditional businesses of women entrepreneur focus on the preservation of the handlooms and handicraft works. Study shows that rural women entrepreneurs enter into the business to help their family financially. On the other hand, most of the urban women entrepreneurs enter in entrepreneurial activities mainly to keep them busy. In this case, if the government intervenes with a promise to provide more training facilities, financial and marketing assistance, then definitely it would be able to increase the entrepreneurship development among women. There is a need for more training facilities and financial assistance from government and NGOs for the development of traditional and non-traditional sectors. Therefore, government must lay emphasis on publicizing the various schemes and policies announced from time to time to encourage and attract more women in entrepreneurial activities.

REFERENCES

Ai-Hossienie C.A (2010), ‘‘Socio-Economic Impact of Women Entrepreneurship in Sylhet City, Bangladesh’’[http://www.bangladeshstudies.org/files/WPS_no12.pdf]

Chakravasrty, E. (2013), The Rural Women entrepreneurial edge, JORS Journal of Humanisties and Social Science, 10, pp 33-36

Deshpande Sunil & Sethi Sunita (2009) “Women Entrepreneurship in India (Problems, Solutions & Future Prospects of Development)”, Shodh, Samiksha aur Mulyankan (International Research Journal)—ISSN-0974-2832 Vol. II, Issue-9-10 (Oct.-Nov.-2009)

Economic Survey of India, 2010-11

Ghosh, R.N. and Roy, K.C. (1997), "The changing status of women in India: impact of urbanization and development", International Journal of Social Economics, Vol. 24 No.7-9, pp.902-917

Rani, C. (1986) “Potential women entrepreneurs.: A study” SEDME, Vol. 13, No. 3:13-32

Srivastava Nirankar & Syngkon Rickey A. J (2008), “Emergence of Small-Scale Industries and Entrepreneurship in the Rural Areas of North eastern States of India: An Analytical.” The Icfai University Journal of Entrepreneurship Development, Vol. V, No. 2, pp. 6-22.

Northeast Journal of Contemporary Research, December 2019. Vol. 6 No. 1, pp. 69-73
ISSN 2349-3089

Deep Ecology in the Philosophy of Spinoza

Juthika Das
Department of of Philosopy, Sibsagar College,
Joysagar, Sivasagar-785665, Assam, India

ABSTRACT

Ecology is the study of relation between organisms and their environment**.** Deep Ecology is a contemporary environmental philosophy. It emphasizes on the inherent worth of every living being regardless of their instrumental use for human benefits and wills. Deep Ecology is a contemporary environmental philosophy. It emphasizes on the inherent worth of every living being regardless of their instrumental use for human benefits and wills. Spinoza is against the man-centered perception of universe. He goes against the view that man has any privileged place in the universe. Spinoza said that ultimate goal, good and joy of human beings laid in the contemplative understanding of Nature. Another aspect of Spinoza's ecocentric environmental philosophy involves his notion of 'conatus'. It means each living being is in itself and endeavors to preserve in its own being.

Key words: ecology, deep ecology, Spinoza, Arne Neass, conatus, ecocentrism, anthropocentrism

INTRODUCTION

Deep Ecology is that aspect of environmental philosophy which is closely connected with ecocentrism which believes that like human beings, the objects of universe both living and non-living has same intrinsic value. Deep Ecology tries to explain the environmental issues in more deeper sense. Deep Ecology tries to explain environmental issues and problems not from human point of view but from environment itself. Though Deep Ecology is an aspect of contemporary environmental philosophy associated with famous environmentalist Arne Naess but the thoughts of this aspect are found in the philosophy of famous modern philosopher Spinoza.

Spinoza is one of the most important and original thinkers of modern philosophy. His philosophy covers almost every area of philosophical discourses including metaphysics, epistemology, philosophy of mind and philosophy of science. Among the modern philosophers Spinoza is best known for his Ethics, where he presents an ethical vision unfolding out of a monistic metaphysics in which God and nature are identified. The environmental philosophy of Spinoza is basically based on his monistic metaphysics.

METHODOLOGY

This study is completely based on secondary data collected from the books and journals. The methodology that is followed in this study is analytic and descriptive.

Statement of the problem-

Ecology is 'the scientific study of the

*Corresponding author's Email: jutikads@gmail.com

interrelationship among organisms and between organisms, and between all aspects, living and non-living of the environment.' (Michael, A. 1998) Etymologically the word ecology derives from the Greek word 'oikos' means 'household, home or place of live'. This term was coined by German zoologist Ernest Haeckel in reference to the relationship between an animal and its 'organic or inorganic environment'. Ecology is thus the study of the relationship between organisms and their environment.

On September 3, 1972 at the third World Future Research Conference in Bucharest, Romania, the Norwegian philosopher Arne Naess coined the term *Deep Ecology* by differentiating between what he called 'shallow' and 'deep' ecological views. Deep Ecology was born after the result of discussion between Naess and his colleagues Sigmand Kvaloy and Nils Faarlund. Deep Ecology is a movement calling for a deeper questioning and a deep set of answer to our environmental concerns. Deep Ecology calls human to live more simply. Its main slogan is 'Simple in Means, Rich in Ends'. Arne Naess, famous article as published in *Inquiry* named *The Shallow and the Deep, Long Range Ecological Movement: A Summary* very elaborately discussed about the ecocentric nature of environment.

Deep Ecology locates the origin of ecological crisis in belief system. They may religious or philosophical. Most particularly Christianity and the scientific worldview as fostering a mindset that seeks to 'dominant nature'. Deep ecologists believe that human centeredness or anthropocentrism is generative cause of ecological crisis. So, it advances the concept of 'ecocentrism' which attributes equal intrinsic moral worth to human and non-human life forms and even to ecosystems. Deep ecology is concerned with the richness and intrinsic value of the nature. Intrinsic value implies in Deep Ecology a sense of value objectivism. Value objectivism posits positive and negative value as independent of the human subjects. As Neass said,

Animals have value in themselves, not only as resources for humans.
Animals have right to live even if of no use to humans.
We have no right to destroy the natural features of this planet.
Nature does not belong to man.

A wilderness area has a value independent of whether humans have access to it. (Pojman, L. P. 2001)

These statements mean that A is said to have a value independent of whether A has a value for B. The value of A must therefore be said to have a value inherent in A. A has intrinsic value. This does not imply that A has value for B.

Deep Ecology is a contemporary environmental philosophy. It emphasizes on the inherent worth of every living being regardless of their instrumental use for human benefits and wills. Deep Ecology argues that the natural world is a balance of complex interrelationship where existence of each living organism depends on the existence of others within the ecosystem. The core principle of deep ecological movement is the belief that the living environment has certain inalienable rights i.e. rights that cannot be taken away from them to live and flourish regardless of their instrumental benefits for human use. It describes itself as 'deep' because it regards itself as looking more deeply into the actual reality of humanity's relationship with the natural world arriving at philosophically more profound conclusion. The deep ecological movement endorses 'biospheric egalitarianism'. The biosphere is the sum total of all ecosystems. Biosphere also includes the relationship between human beings with other components of the ecosystems. Egalitarianism is a trend of thought which implies equality of all. Biospherical egalitarianism implies that all components within the biosphere are equal. According to Naess, biospherical egalitarianism holds that all human as well as non-human life has equal right to live and flourish. In this principle

all living beings acquire respect in their own forms of lives. Deep Ecology maintains that all living things are alike in having value in their own right, independent of their usefulness to others.

Deep Ecology is concerned with the environmental problems and other issues in more deeper sense. In Deep Ecology pollution is evaluated from a biospheric point of view, focusing its effects not only human health but the life conditions of every species. So, the priority is to fight against the deep causes of pollution not merely the superficial short range effects. Increasing pollution is not only the crime against humanity but against the life in general. But in shallow ecology resources is observed as belong to those who have the capacities to use them or who know the technology to exploit them. Here the plants, animals and natural objects are valuable only as resources for humans. If no human knows how to use it, it does not matter if they are destroyed. In contradictory of this thought, in Deep Ecology no natural object is conceived as a resource. This leads to a critical evaluation of human production and evaluation. Deep Ecology is concerned here with resources and habitats for all life-forms for their own sake. It emphasizes upon the whole ecosystem rather than the consideration merely of human life-form.

The movement of Deep Ecology has sketch vital place in ecocentric environmental philosophy. Generally when we discuss about the Deep Ecology, first name that comes to mind is the philosopher Arne Naess. But Spinoza is appreciated as a philosophical forefather of Deep Ecology. Though, Deep Ecology is a contemporary environmental philosophy but the thoughts of its found in the philosophy of Spinoza. In Spinoza's environmental philosophy, there is a clear sketch of ecocentric approach. Spinoza when discussed about nature, he used capital 'N' for the word 'nature' (Nature). Nature with capital N is intuitively conceived as perfect in a sense. Nature is perfect 'in itself'. Nature is not something passive, dead or value-neutral. Rather Nature is all inclusive, creative (as natura naturans), infinitely diverse and alive in the broad sense. There are three aspects of environmental philosophy of Spinoza. These are his metaphysical monism, his pantheism and the democracy of virtue (power in value).

Rejecting Baconian and Cartesian division of mind and body, man and nature he offers a monotheistic and pantheistic philosophy, where Nature/God is regarded as one and only substance which is in all things irrespective of any difference. The two aspects- extension and thought are both complete aspects of one single reality. Nature is absolutely all-embracing reality. Spinoza collapses the substantive dualism of mind and body. The instrumental value is considered to be inadequate for the protection of natural environment. So, nature is valued intrinsically, and in more objective sense and in non-anthropocentric aspect. Regarding intrinsic value Spinoza does not say that things are good or have value or have rights independent of the human being. Rather by intrinsic value Spinoza means, 'It is good for a man to perceive things as independent of himself. It is good for man, that is, to perceive things as they really are. It is good for man to perceive things truly. (Callicott, J. B. and Palmer, C. 2005)

Spinoza is against the man-centered perception of universe. He goes against the view that man has any privileged place in the universe. So, the celebrated ontology of Spinoza 'is his insistence that man has no privileged position in nature.' (Callicott, J. B. and Palmer, C. 2005) In his environmental ethics, Spinoza said that ultimate goal, good and joy of human beings laid in the contemplative understanding of Nature.

Secondly, Spinoza brings down God from transcendent Jedeo- Christian position. God is impersonal and infinite. It is neither human will nor intellect can pertain to the nature of

God. *Dues Sive Nature* i.e. Spinoza's God is all things and thus impartial to all things. So, pantheism of Spinoza provides a strong foundation of holistic environmental philosophy where human being is not superior to nature. As Hampshire reports-

"Spinoza thought of human as greatly limited in their powers to grasp and survey the natural order which must outrun their powers of perception and understanding. His philosophy is by implication is a polemic against anthropocentrism. He does represent human intelligence as a unnatural….elaboration of structures found elsewhere in nature; and he always insists that our perceptual apparatus and our intelligence cannot exhaust the infinite variety and extent of nature." (Session, G. 1977)

Another aspect of Spinoza's ecocentric environmental philosophy involves his notion of 'conatus'. It means each living being is in itself and endeavors to preserve in its own being. Arne Naess suggests that it can be applied to all living beings. Regarding Spinoza's 'conatus' Hampshire said,

'The notion of conatus, of which there is no equivalent in Descartes or in purely mechanical and atomistic cosmologies, is exactly the concept which biologists have often demanded as essential to the understanding of organic and living systems.' (Hampshire, S. 1962)

Rejecting Baconian and Cartesian division of mind and body, man and nature he offers a monotheistic and pantheistic philosophy, where Nature/God is regarded as one and only substance which is in all things irrespective of any difference. The instrumental value is considered to be inadequate for the protection of natural environment. Discussing three aspects of Spinoza's philosophy deep ecologist Sessions comments "Spinoza makes it clear that all beings exist for their own sakes, for their own particular and individual forms of completion and self-realization and not for the sake of anything else." (Callicott, J. B. and Palmer, C. 2005)

So, nature is valued intrinsically, in more objective sense and in non-anthropocentric aspect. He is against the man-centered perception of universe As Lloyd said, 'Spinoza sets himself firmly against a man-centered perception of the universe; against the view that man has any privileged place in the universe'.(Genevieve, L. 1980)

The philosophy of Deep Ecology is specially criticized by ecofeminist philosophers. Val Palmwood criticized the Deep Ecology of Arne Naess. Generally Deep Ecology rejects boundaries between self and nature on the principle of indistinguishability account. The indistinguishability account states that humans are said to be just one strand in the biotic web. Human beings cannot be distinguished from nature. It essentially belongs to the biotic web. It rejects man as source and ground of all values. By a 'unifying process' Deep Ecology invokes an ontological unbroken wholeness and rejects nature as separate existing parts. In this indistinguishability thesis Deep Ecology fails to recognize distinct feature and independent status and individuality of things of nature. Jean Grimshaw says that the thesis of indistinguishability hinders the personal development.

CONCLUSION

In the deep ecology of Spinoza the metaphysical monism and pantheism are seen to be solidarity in an objective non-anthropocentrism. Inspite of that there are two particular passages in Spinoza's *Ethics* which could be taken as firmly conclusive evidence of anthropocentric morality where man is regarded as the centre of universe and the environment has only instrumental value as means that fulfils the need of human beings.

"It is plain that the law against the slaughtering of animals is founded rather on vain superstition and womanish pity than on sound reason. The rational quest of what is use-

ful to us further teaches us the necessity of associating ourselves with our fellowmen, but not with beasts, or things, whose nature is different from our own; we have same right in respect to them as they have respect to us. Nay, as everyone's right over beasts than beasts have over men. Still I do not deny that beasts feel: what I deny is, that we may not consult our own advantage and use them as we please, treating them in the way which best suits us; for their nature is not like ours, and their emotions are naturally different from human emotion" (Callicott, J. B. and Palmer, C. 2005)

Again Spinoza in *Ethics* said

'There is no individual thing in universe more advantageous to man than a man who lives by the guidance of reason' (Callicott, J. B. and Palmer, C. 2005)

These statements seem to run directly against the grain of the environmentalist sympathy stated above. Again Spinoza seems to be limiting the moral community entirely to our own kind, who can live under the guidance of reason. So we can say that Spinoza accepts anthropocentric approach of environmental philosophy from the back door.

REFERENCES

Michael, A. 1998. *Oxford University Dictionary of Ecology.* Oxford University Press, New York, p-136.

Pojman, L. P. 2001. *Environmental Ethics: Reading in Theory and Application,* (3rd ed.). Wadsworth. USA. p-156.

Callicott, J. B. and Palmer, C. 2005. *Environmental Philosophy: Critical Concepts in the Environment,* (Vol. V 'History and Culture), (ed.). Routledge. London and New York. p-65.

Callicott, J. B. and Palmer, C. 2005. *Environmental Philosophy: Critical Concepts in the Environment,* (Vol. V 'History and Culture), (ed.). Routledge. London and New York. p-65.

Session, G. 1977. *Sinoza and Jefferson man in nature,* in Inquiry, Vol-20, Issue-1-4. p-524.

Hampshire, S. 1962. *Spinoza.* Pelican Books. UK. p-71.

Callicott, J. B. and Palmer, C. 2005. *Environmental Philosophy: Critical Concepts in the Environment,* (Vol. V 'History and Culture), (ed.). Routledge. London and New York. p- 73.

Genevieve, L. 1980. *Spinoza's environmental ethics,* in Inquiry. Vol-23. Issue-3. p-295.

Callicott, J. B. and Palmer, C. 2005. *Environmental Philosophy: Critical Concepts in the Environment,* (Vol. V 'History and Culture). (ed.). Routledge. London and New York. p-74.

Callicott, J. B. and Palmer, C. 2005. *Environmental Philosophy: Critical Concepts in the Environment,* (Vol. V 'History and Culture), (ed.). Routledge. London and New York. p-74.

Northeast Journal of Contemporary Research, December 2019. Vol. 6 No. 1, pp. 74-80
ISSN 2349-3089

Growth Analysis of NSDP at Constant Prices: A case study for the state of Orissa for the period 1991-2014

Nishibrata Hazarika
Department of Economics, Gauhati University,
Guwahati-784014, Assam, India

ABSTRACT

The idea of 'economic development' is such that it attempts to give a picture of the social and economic health of any particular geographical unit. Economic development is a multi-dimensional concept unfolding in a series of events. 'Economic growth' is the fulcrum in the prism of this wide spectrum of activities that is economic development. Economic growth is the most significant benchmark that is to be attained in order to comprehend the economic progress or development of any particular economy. Alternatively, it can be understood as an economy's ability to produce goods and services. The growth rate of real GDP of a country is often used as an apt indicator of the general health of the economy whereby an increase in real GDP is interpreted as a sign that the economy is doing well. When talked about State specific growth, the NSDP data is considered to be the required indicator. The paper attempts at analyzing the growth trend of NSDP at constant prices for the period 1991-2014 for the State of Orissa which is known to be one of the fastest growing economies in India.

Key words: Economic Development, Economic Growth, real GDP, NSDP, Growth trend

INTRODUCTION

'Growth' is an important subset for economic development in any nation. It is considered to be a significant indicator as it indicates the growth in economic output irrespective of how it is measured, by GDP, GNP, GVA or any other. Growth however does not occur in isolation and can be positive or negative. Positive economic growth leads to rise in national income, national output and total expenditure, which also eventually enables rise in consumption of goods and services and higher standards of living. In economics, growth is indicated by an outward shift in its production possibility curve (PPC).

More specifically, when talked about the State Domestic Product (SDP) be it Net State Domestic Product (NDSP) or Gross State Domestic Product (GSDP) to study trend in growth, it means the total value of goods and services produced during any financial year within the geographical boundaries of a State. The GSDP is arrived at by adding the consumption of fixed capital and NSDP is arrived at by deducting the consumption of fixed capital. These however can be measured in current prices or constant prices. The former makes no adjustment for inflation and uses actual prices in the respective financial years as a measure. The latter however, enables us to measure the actual changes in output where the effects of inflation are taken care of by using a base year for measurement.

*Corresponding author's Email: nishibratahazarika@yahoo.in

SCOPE OF THE PAPER

The paper is aimed at analyzing the trend in growth of NSDP at constant prices using econometric tools. The idea is to make an observation as to how a mere trend of ever increasing GDP figure(s) may not necessarily imply accelerating patterns of growth, but can also indicate deceleration, or both.

The area of the study is confined to the State of Orissa which is pronounced to be one of the fastest growing economies among the Indian States since several years and till date. Data sources have infact also revealed that the State's economy had witnessed high growth rates between 2011-12 and 2017-18 where the NSDP expanded at a compound annual growth rate of 10.08%. An important point to be noted here is that, the paper is primarily focused at examining the post economic reforms trend in NSDP (in Rs. Lakh) measured at constant prices of 2004-05. This is why data since 1991-2014 is taken into consideration. Post 2014 trend is beyond the purview of the scope of the paper because data with the same constant prices since 1991 till recent years could not be availed. The study is moreover based on constant prices because it allows measuring the actual changes in output and not just an increase in output due to effects of inflation which seems deceptive.

METHODOLOGY

The study is primarily based on secondary data. For the purpose of the analysis, econometric tools (like linear trend model) and software (STATA) have been used. The NSDP data for the period 1991-2014 in 2004-05 constant prices for the state of Orissa is collected from the website of the Directorate of Economics and Statistics, Govt. of Orissa.

RESULTS AND DISCUSSION

NSDP of Orissa from 1991-2014

The center of the present paper is to conduct a growth analysis of the state of Orissa based on its NSDP figures (in lakh) over time from 1991-2014 (a time series analysis) measured at constant prices of 2004-05 and see trend in growth. For this purpose, its annual compound rate of growth is traced from the NSDP data which is observed to have shown an exponential trend. This trend in the time series has been represented by the figure as given below (figure 1) where it can be seen that, on an average throughout time (1991-2014), the growth in NSDP shows an 'increasing trend'.

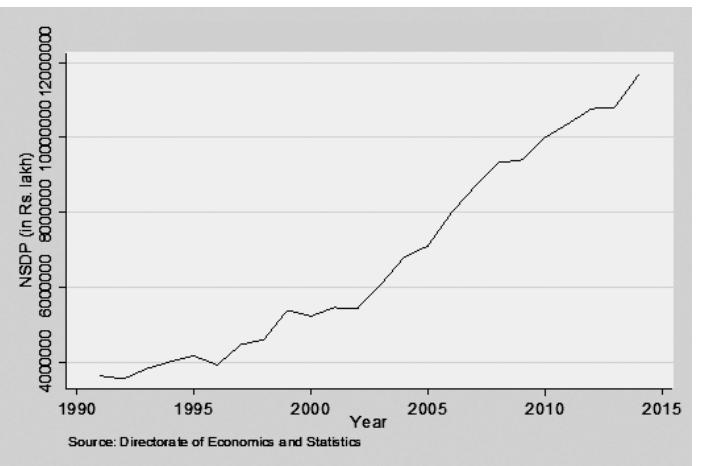


Figure 1. NSDP of Orissa from 1991-2014

So, it can be concluded that the graph indicates an increasing NSDP over the years (1991-2014). But whether it implies acceleration in growth of the economy of Orissa that can be examined in the following paragraphs.

For this purpose, an econometric model has been formulated and the necessary estimation(s) are thereafter made.

Model and Estimation Procedure

The understanding with regard to the model formation and estimation procedure has been developed from the 'Basic Econometrics' textbook by D. Gujarati. The econometric model formulation and further estimation is done using the following data set:

YEAR	NSDP (Rs. Lakh) at 2004-05 prices
1991-92	3625338.561
1992-93	3539942.879
1993-94	3816406.368
1994-95	4009160.233
1995-96	4164616.21
1996-97	3913537.968
1997-98	4464812.756
1998-99	4592378.835
1990-00	5372881.252
2000-01	5223399.849
2001-02	5448027.982
2002-03	5432170.895
2003-04	6078415.181
2004-05	6798702
2005-06	7100496.987
2006-07	7984484.274
2007-08	8669191.296
2008-09	9320665.324
2009-10	9395723
2010-11	9987971.508
2011-12(3rd R)	10362763.18
2012-13(2nd R)	10766374.65
2013-14(1st R)	10808071.8
2014-15 (AE)	11656558.32

Source: Directorate of Economics and Statistics, Govt. of Orissa

The exponential trend in growth of NSDP is to be captured by the natural logarithmic function of the NSDP series in the proposed model.

The general exponential growth function can be written as

$\mathbf{Y_t = Y_0 (1 + r)^t}$, where the value of $\mathbf{Y_t}$ for a given **t** (time) can be derived only if the growth rate **r** is known. The growth rate (r) can be estimated, but a logarithmic transformation must be used to estimate the model using Ordinary Least Square (OLS) estimation. Moreover, the original model in our study isn't linear in parameters, but a logarithmic transformation of the model can generate the desired linearity. The model formulation is described in the following lines:

To begin with an exponential growth model as

$$\mathbf{Y_t = Y_0 (1 + r)^t}$$

Taking log of both sides,

$\mathbf{\ln Y_t = \ln Y_0 + t \ln (1+r)}$ **------ (1)**

Here, let,

$\boldsymbol{\alpha = \ln Y_0}$

$\boldsymbol{\beta = \ln (1+r)}$

$\mathbf{r = e^{\beta} - 1}$

where, **β –** exponential growth rate

r – annual compound growth rate

Therefore equation (1) can be re-written as follows,

$$\mathbf{\ln Y_t = \alpha + \beta t}$$

Adding the disturbance term the model obtained is,

$\mathbf{\ln Y_t = \alpha + \beta t + U_t}$ **---- (2)**

Therefore, equation (2) is the proposed regression model after the semi-log transformation.

Here,

α = intercept term (instantaneous growth)

β = the slope coefficient measuring the constant, proportional or relative change in Y (in this case $\ln Y_t$) for a given absolute change in the value of the regressor (in this case the variable t)

$\mathbf{U_t}$ = disturbance or error term with standard OLS assumptions

Variable Description

Table 1.

Variable (s)	Description
$\mathbf{\ln Y_t}$ (dependent variable)	Natural log of NSDP of Orissa at constant prices (2004-05)
t (independent variable)	Time period (1, 2, 3, …, 24)

Data Description

Table 2.

Variable (s)	Observation	Mean	Std. Dev.	Min	Max
$\mathbf{Y_t}$ **(NSDP)**	24	6772170	2702993	3539943	11656558
$\mathbf{\ln Y_t}$ **(lnNSDP)**	24	15.65123	0.4022999	15.07962	16.27138

Interpretation of Results

As the proposed regression model is derived at, the next step is to estimate the model. The estimation is done using the computer software STATA and the results are summarized as follows in Table 3 and 4.

Regressing $\mathbf{\ln Y_t}$ on **t** gives the following results:

Table 3.

No. of observations	F(1, 22)	Prob > F	R-square	Adj R-square
24	1092.17	0.0000***	0.9803	0.9794

Note: *** shows statistically significant at 1% level

Table 4.

Variables	Coefficient	Standard error	t values	$p > \lvert t \rvert$
T	0.0563293	.0017045	33.05	0.000***
Constant	14.94712	.0243546	613.73	0.000***

Note: *** shows statistically significant at 1% level

- From table 3, it is seen that R-square is significantly high denoting the fact that the model explains almost all the variability of the response data around its mean.
- From table 3, it can also be observed that the F value is statistically significant at 1% level as the *p* value of F is sufficiently small (i.e., 0.000). This implies that the regressor have significant impact on the regressand.
- From table 4, it is to be noted that, the coefficient of t (i.e., **β)** is .0563293 which implies that over the period 1990-91 to 2014-15, the NSDP has shown an increase which is at the rate of 5.63 percent(yearly), and the annual compound growth rate is 5.79 percent ($e^{0.0563293}$ -1 =0.0579).
- Since the constant (i.e., **α**) is lnNSDP at the beginning of the period 1, so Rs. 3100642.791 lakh is obtained as NSDP in 1989 in constant prices 2004-05.
- In the model, $\mathbf{U_t}$ obtained is equal to 0.073501947.

From the above calculated values, the estimated regression equation can be re-written as follows,

$$\widehat{Y_t} = \mathbf{14.947+0.0563t}$$

Now in order to capture the trend of growth (whether accelerating or decelerating), the following quadratic model is used,

$$\mathbf{\ln Y_t = \alpha + \beta_1 t + \beta_2 t^2 + U_t}$$

Here, if, $\beta_2 > 0$ and significant then it signifies an accelerating trend and if $\beta_2 < 0$ and significant it signifies a decelerating trend.

After running regression, the obtained results are summarized as follows in Table 5.

Here, it can be observed that the coefficient of t^2 (i.e. β_2) is insignificant as the *p* value is significantly large, so it can be inferred that the growth trend of Orissa shows neither accel-

Table 5.

Variables	Coefficient	Standard error	t values	$p > \lvert t \rvert$
t	0.0463753	0.0069225	6.70	0.000
t^2	0.0003982	0.0002688	1.48	0.153
Constant	14.99025	0.0375596	399.11	0.000

eration nor deceleration in growth, even if the NSDP figures for the period 1991-2014 showed to have an increasing trend.

CONCLUSION

The present paper has attempted to conduct a time-series analysis on the growth trend of NSDP (in Rs. Lakh) for the state of Orissa throughout the years from 1991-92 to 2014-15. In the analysis, time is taken to be the factor to describe how NSDP is growing throughout time. From the above analysis, in conclusion it can be stated that, the NSDP growth trend of Orissa neither shows acceleration nor deceleration.

Therefore, we can conclude that simple observation of NSDP figures does not tell us the reality about the trend in growth, whether it implies acceleration, deceleration, both or none. Hence, an in-depth analysis is quite essential.

REFERENCES

Agarwal R.C. (2015) *Economics of Development and Planning* , Lakshmi Narain Agarwal Educational Publishers, pp. 1-32

Gujarati, D.N., Porter, D.C & Gunasekar, S (2012) *Basic Econometrics* , McGraw Hill Education (India) Pvt. Ltd., pp. 159-178

Gupta, S.P. (2014) *Statistical Methods* , Sultan Chand & Sons, pp- 881-929

NSDP data, Directorate of Economics and Statistics, Govt. of Orissa Retrieved from: http://www.desorissa.nic.in/state-income.html .Accessed on: 28 Feb 2020. Keywords: NSDP, GSDP Retrieved from: http://data.gov.in/ keywords/ Accessed on: 22 Feb 2020.

Puri, V.K. & Misra, S.K. (2014) *Economics of Development and Planning (Theory and Practice* , Himalaya Publishing House, pp. 19-35

Northeast Journal of Contemporary Research (NeJCR)

INSTRUCTION TO AUTHORS

Manuscript preparation

Authors should aim to communicate ideas and information clearly and concisely, in language suitable for the moderate specialist. Experimental paper should contain sufficient detail and references to public sources of information to permit others to repeat the work. Authors should cite publications that have been influential in determining the nature of the reported work. Information obtained privately, as in conversation, correspondence, or discussion with third parties should not be used or reported without explicit permission from the investigator with whom the information originated. When a paper has joint authorship, one author must accept responsibility for all correspondence with the full postal address, telephone and fax numbers, and e-mail address of the author who is to check proofs should be provided.
Papers should conform to the following general layout:

Title page
This should include title, authors, affiliations, email, telephone and fax numbers.

Abstract
This must be on a separate page. It should be about 100-200 words long and should summarize the content of the paper. The abstract should be followed by up to six keywords additional to those in the title identifying the subject matter for retrieval systems. Section headings First−, second−, third−, and fourth− order headings should be clearly distinguishable butnot numbered.

References
In the text, references should be in the following forms:

(Singh, 1988); (Prasad & Yadav, 2006). When papers are by three authors, use all names on the first mention and thereafter abbreviate to the first name et al. For papers by four or more authors, use et al. throughout. The list of references must include all publications cited in the text.

Khan, I. A., Prasad, S.N. and Mathur, P. K. 1993. Manipur brow-antlered deer Cervus eldi eldi: its future conservation through rehabilitation. International Zoo Yearbook 32: 39-44.

Badola, H. K. 1994. Bud phenological studies as an aid to forestry research: an overview. Pp. 163-169. In Forestry Research and Education. (eds Dogra, P. D. and Dhiman, R. C.), Diamond Jubilee Publication, Indian National Science Academy, New Delhi.

Prater, S. H. 1948. The Book of Indian Animals. Bombay Natural History Society. Mumbai.

Smith, J. and Brown, B. (eds). 2001. The demise of modern genomics. Blackwell, London.

Zowghi, D. *et al.* 1996. A framework for reasoning about requirements in evolution. In Foo, N. and Goebel, R. (eds) PRICAI'96: topics in artificial intelligence. 4th Pacific Rim conference on artificial intelligence, Cairns, August 1996. Lecture notes in computer science (Lecture notes in artificial intelligence), vol 1114. Springer, Berlin Heidelberg New York, p 157.

Chung, S-T., Morris, R. L. 1978. Isolation and character-ization of plasmid deoxyribonucleic acid from Streptomyces fradiae. In: Abstracts of the 3rd international symposium on the genetics of industrial microorganisms, University of Wisconsin, Madison, 4-9 June 1978.

Healthwise Knowledgebase (1998) US Pharmacopeia, Rockville. www.healthwise.org. Cited 21 Sept 1998.

Figures
All photographs, graphs and diagrams should be referred to as a 'Figure' and they should be numbered consecutively (1, 2, etc.). Photographs should be of minimum resolution of 800 dpi and supplied in TIFF format. Please note that JPEG, Power Point and doc files are not suitable for publication. Authors will get coloured reprints on request with charges (according to number of figures).

Tables
Each table should be numbered consecutively.

Proofs
Proofs will be sent to the corresponding author. The corrected proof along with the edited manuscript should be returned to the Publisher within three days of receipt by email.

Copyright
Authors will be asked, upon acceptance of an article, to transfer copyright of the article to the Publisher. This will ensure the widest possible dissemination of information under copyright laws.

Permissions
Responsibility of the author to obtain written permission for a quotation from unpublished material, or for all quotations in excess of 250 words in one extract or 500 words in total from any work still in copyright, and for the reprinting of figures, or tables from unpublished or copyrighted material.

Article Submission
Manuscript should be submitted online in word format (MS Word) to :

Editor-in-Chief
Northeast Journal of Contemporary Research (NeJCR)
Darrang College, Tezpur-784001, Assam, India
E-mail: *nejcr.darrangcollege@gmail.com*

Manuscripts submitted by other methods will not be considered. Submission of manuscript implies that the submitted work has not been published, not accepted or is not under consideration for publication elsewhere.

Northeast Journal of Contemporary Research (NeJCR)
A multidisciplinary research journal

Vol. 6 No. 1
December 2019

Published by Darrang College, Tezpur, Assam (India) and Printed at TICOL STYLE TRACK, Kumargaon, Tezpur, Assam