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Contents

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EFFECT OF *Polygonum hydropiper* Linn. METHANOLIC ROOT EXTRACT ON THE LIPID PROFILE IN FEMALE ALBINO MICE DURING EARLY GESTATIONAL PERIOD

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ABSTRACT :

Human beings have been dependent on mother nature from ancient times for food, shelter, medicine, and other necessities. From prehistoric to modern days, many people have been procuring medicines from different plant sources. *Polygonum hydropiper* is a plant of that kind that has been used for various food and medicinal purposes. It is traditionally used for contraception in Assam. Popular hormonal contraceptives are known to increase the risk of cardiovascular diseases in females. Therefore, the present study was designed to analyze the functional groups present in the extract and their effect on the lipid profile. Qualitative functional group analysis detected the presence of flavonoids, saponins, phytosterols, tannins, and triterpenoids. Lipid profiles were analyzed in an Erba Biochemical Analyzer using the manufacturer's protocol. The extract increased the total cholesterol and HDL cholesterol level and decreased the LDL cholesterol level significantly. There was an improvement in the LDL: HDL ratio which is crucial in the treatment of cardiovascular diseases. Therefore, the *P. hydropiper* root extract can be considered a safer and better option compared to hormonal contraceptives.

Keywords: *Polygonum hydropiper*; Functional groups; Lipid profile; Total cholesterol; HDL; LDL

1. INTRODUCTION :

Cardiovascular diseases are considered to be one of the major causes of death irrespective of the sexes all over the world [1]. They are characterized by progressive narrowing of the arteries leading to the complete obstruction of them [2]. A linear relationship between high cholesterol levels and cardiovascular risks has already been established [3]. Coronary heart diseases are associated with elevated levels of serum total cholesterol, low-density lipoprotein cholesterol (LDL), and sometimes of serum triglycerides (TAG) and decreased levels of high-density lipoprotein cholesterol (HDL) [4].

The root causes of cardiovascular diseases converge on factors like unhealthy diets, consequent dyslipidemia, hypertension, obesity, diabetes, sedentary lifestyle, stress, and smoking [2]. The use of oral contraceptive pills also shows the likelihood of developing dyslipidemia in women by increasing the serum total cholesterol level, LDL cholesterol level, and triglyceride level [5]. This is of great concern as oral contraceptives are the most popular means of birth control in many countries [6].

The world health organization (WHO) has already emphasized the studies on the traditional medicinal practices to avoid the side effects of steroidal contraceptives [7]. There is a growing interest in the traditionally used plants over the years globally [8]. One such widely used medicinal plant is *Polygonum hydropiper* which is used by the tribal women of Assam to prevent unwanted pregnancy [9]. Its antifertility property is well-known in the Indian, Chinese, and European medicinal systems too [10-12]. Therefore, using this plant extract or any functional compound from it for fertility regulation will be proven better compared to the steroidal contraceptives with dyslipidemic effects. However, an evaluation of the functional groups present in the root extract of this plant and the effect of the same on the lipid profile is of utmost importance. Thus, the study is designed to assess the functional groups present in the *P. hydropiper* root extract and its effect on the lipid profile of pregnant and ovariectomized female albino mice.

2. MATERIALS AND METHODS :

2.1 Collection of the Plant Material and Preparation of the Extract

The plants were collected from the paddy fields of Nagaon, Assam (26.3464^0 N, 92.6840^0 E) from February to May, 2018. The specimen was identified by the botanists of the Department of Botany, Chaiduar College. A voucher specimen was submitted to the Department of Botany, Chaiduar College, with a Voucher No.- CDC/BOT/2018-0167. The roots were separated from the rest of the plant parts, washed properly, and allowed to shade dry. The dried roots are then chopped into pieces and powdered using a mixer grinder. The root powder was strained with a strainer of 60 mesh size. The powder was soaked in methanol for 72 hours at a ratio of 1:3 and then filtered. The filtrate was concentrated under vacuum and kept at -20^0C for further use. The extract was reconstituted using water to perform functional group analysis unless otherwise mentioned in individual tests as well as for treatment in mice.

2.2 Functional group analysis of the methanolic root extract of Polygonum hydropiper

The preliminary phytochemical studies (qualitative) were performed to determine the presence or absence of certain functional groups (viz., alkaloids, flavonoids, saponins, phytosterols,

triterpenoids, and tannins) following various methods described by Tiwari *et al.,* [13].

2.3 Experimental Animals

Adult cyclic females of age 60 days and 25±5 g body weights were selected for the study. The animals were housed in the Animal House Facility of Chaiduar College, Gohpur. Uniform husbandry conditions and natural light and temperature were maintained. The animals were kept in polypropylene cages with a bed of paddy husk in each of the latter and fed with a routine diet of Bengal gram and water ad libitum.

2.4 Experimental Design

A total of 12 groups (A_c, B_c, C_c, D_c, E_c, F_c, A_t, B_t, C_t, D_t, E_t, and F_t) were made, each comprising of normal cyclic females. Six of them were selected for treatment, while the other 6 groups were kept as control. The treated group females were treated between 9-10 AM with the threshold dose of extract after confirmed positive mating. The study used one ovariectomized vehicle-treated control female group and an ovariectomized extract-treated group. Ovariectomy was performed according to the protocol of Hogan *et al.* [14] and has been described elsewhere [15]. The individuals of the treated group A_t were sacrificed on Day 1 of positive mating, group B_t on Day 2, group C_t on Day 3, Group D_t on Day 4, Group E_t on Day 5, and group F_t on Day 6. Likewise, mice of the control groups A_c, B_c, C_c, D_c, E_c, and F_c were sacrificed at Day1, Day 2, Day 3, Day 4, Day 5, and Day 6 respectively. Both the vehicle-treated and extract-treated ovariectomized females were sacrificed on the 6th day of continuous treatment. All the groups were anesthetized by the intraperitoneal treatment of pentobarbital and then sacrificed. Blood was taken from the anesthetized animals by cardiac puncture before sacrificing.

All the experiments were performed according to the Good Laboratory Practice Guidelines and Applicable Animal Welfare Legislation [16].

2.5 Study of Estrous Cycle and Detection of Pregnancy

The females' estrous cycle was studied according to the method described by Montes and Luque [17]. Briefly, the vaginal fluid was collected with the help of a fine dropper and a smear was prepared on a clean slide. The smear was fixed with methanol, stained with May-Grunwald's stain for 15 minutes, and then with 10% Giemsa stain for 10 minutes. Finally, the slides were washed in tap water and allowed to dry. After natural drying, the slides were observed under the microscope.

Cyclic females were allowed to mate with males of proven fertility at a ratio of 2:1. Detection of a copulatory plug in the morning confirmed positive mating.

2.6 Determination of Serum Total Cholesterol, Low-Density Lipoprotein (LDL), and High-Density Lipoprotein Level

The quantitative *in vitro* determination of total cholesterol was carried out according to Roeschlau's method [18] with some modifications. Again, the quantitative *in vitro* determination of HDL cholesterol was done by the method of Burstein *et. al* [19]. The serum LDL level was determined using the Erba LDL-Direct kit following the manufacturer's protocol.

2.7 Statistical Analysis

All the data were expressed in mean values and standard error of the mean and were analyzed statistically using the SPSS software (SPSS 16.0). The student's t-test was used to detect differences between the control and extract-treated groups. In both ovary-intact and ovariectomized (OVX) groups, the data of extract-treated groups were compared to that of their control counterparts. If the double-tailed (paired) probability (P) was <0. 05, then a difference was considered significant.

3. RESULTS :

3.1 Functional Group Analysis of the Extract

The qualitative analysis of functional groups showed the presence of flavonoids, saponins, phytosterols, tannins, and triterpenoids (Table 1).

Table 1: Qualitative Analysis of Functional Groups Present in the Methanolic Root Extract of *P. hydropiper*

Sl. No.	Functional Group	Present (+)/Absent (-)
1	Flavonoids	+
2	Saponins	+
3	Phytosterols	+
4	Tannins	+
5	Triterpenoids	+

3.2 Determination of the Total Serum Cholesterol Level

The serum cholesterol level showed an increase in the treated groups in comparison to the control ones in ovariectomized and pregnant females (Table 2; Fig. 1). The cholesterol level was highest in the treated group on day 1 of pregnancy. However, all the values of total serum cholesterol levels were found within the normal range.

Table:2 Comparison between total serum cholesterol levels of control and CRE treated female albino mice

Pregnancy Duration	Control (in mg/dl)(n= 10)	Treated (in mg/dl)(n=10)
Day 1*	67.91±1.98	147.53±3.20
Day 2*	78.76±2.04	103.26±2.34
Day 3*	53.93±1.52	114.41±2.41
Day 4*	44.73±1.76	121.71±2.25
Day 5*	57.24±4.46	124.30±1.76
Day 6*	61.59±1.24	127.24±1.78
OVX*	65.79±1.76	121.43±2.20

* Values are expressed as mean±SEM

* Values are significant at 95% confidence level ($p < 0.05$)

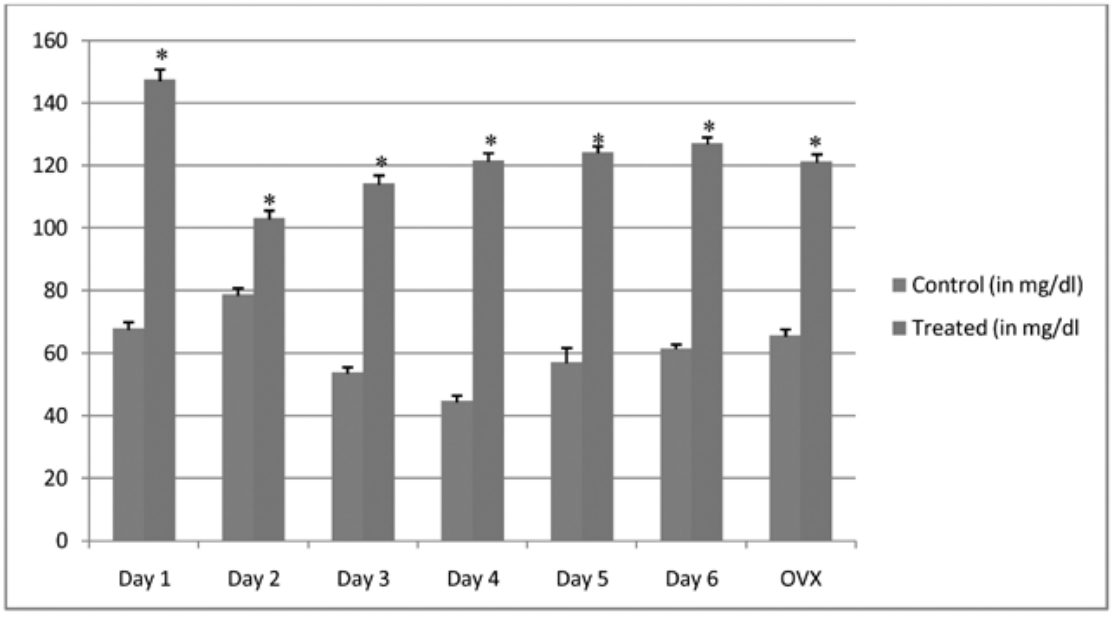

Fig. 1: Comparison of serum cholesterol levels among the control and CRE treated groups of pregnant and ovariectomized mice

3.3 Determination of Serum High-Density Lipoprotein Level:

The concentration of high-density lipoproteins in the serum in the treated animals showed a significant rise compared to the control ones except in the case of the Day 1 treated group (Table 3; Fig. 2). The increase was highest in the Day 4 pregnant females and lowest in the Day 2 treated group.

Table 3: Comparison between HDL cholesterol levels of control and CRE treated female albino mice

Pregnancy Duration	Control (in mg/dl)(n= 10)	Treated (in mg/dl)(n= 10)
Day 1	24.19±0.31	49.13±0.86
Day 2*	29.89±0.11	44.34±0.08
Day 3*	24.18±0.09	48.28±0.11
Day 4*	23.68±0.11	49.18±0.10
Day 5*	25.64±0.11	50.14±0.09
Day 6*	26.68±0.08	50.54±0.07
OVX*	27.28±0.11	49.25±0.08

* Values are expressed as mean±SEM

*Values are significant at 95% confidence level ($p < 0.05$)

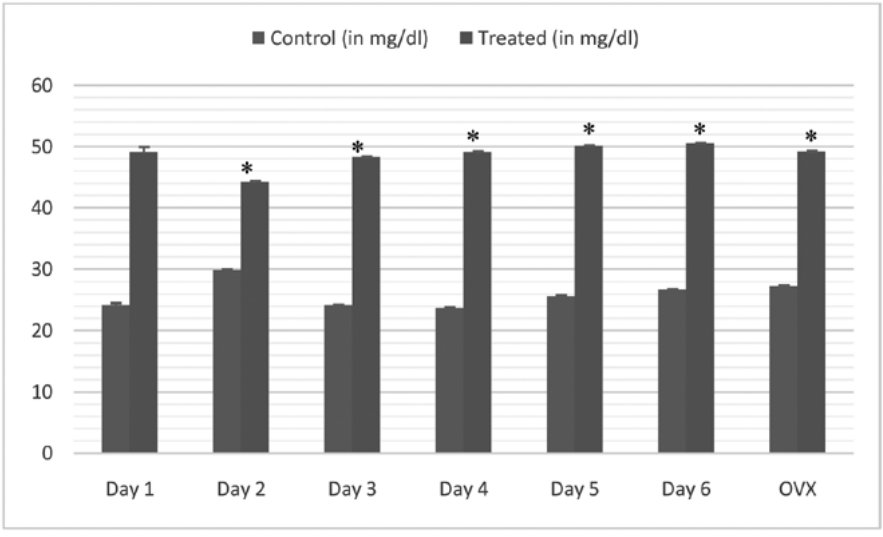

Fig. 2: Comparison of serum HDL levels among the control and CRE treated groups of pregnant and ovariectomized mice

3.4 Determination of Serum Low-Density Lipoprotein Level:

There was a significant decline in the serum low-density lipoprotein level in the treated groups in comparison with the control ones except in the Day 1, Day 2, and OVX treated females (Table 4; Fig 3). However, the rate of decline is very low with the highest value in the Day 5 group and the lowest in Day 6 pregnancy mice groups.

Table 4 : Comparison between LDL cholesterol levels of control and CRE treated female albino mice

Pregnancy Duration	Control (in mg/dl)(n= 10)	Treated (in mg/dl)(n= 10)
Day 1	30.29±1.19	28.84±0.92
Day 2	32.05±0.92	30.46±0.75
Day 3*	25.25±0.11	24.72±0.08
Day 4*	22.29±0.11	21.71±0.09
Day 5*	23.57±0.06	22.6±0.03
Day 6*	24.73±0.08	24.16±0.13
OVX	26.59±1.00	25.28±0.88

* Values are expressed as mean±SEM

*Values are significant at 95% confidence level ($p < 0.05$)

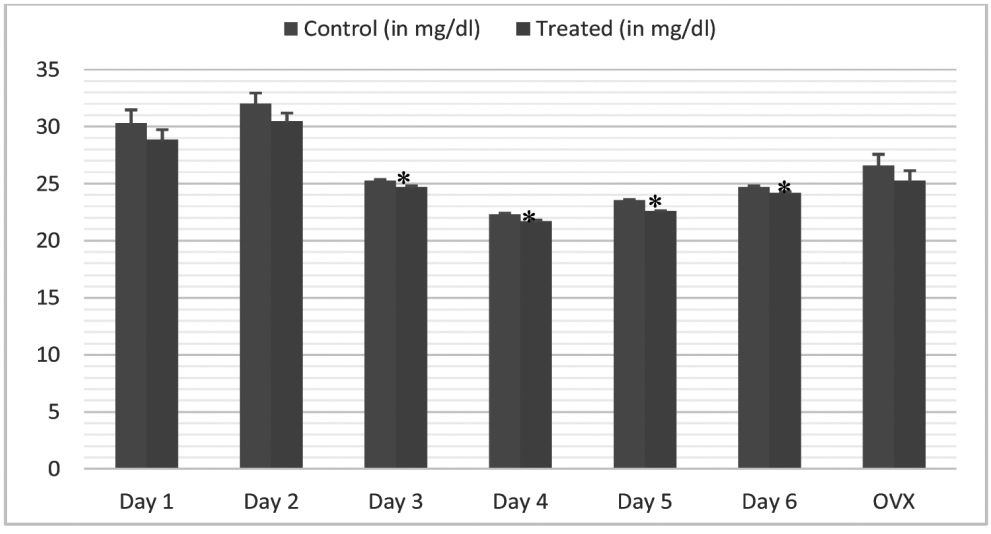

Fig. 3: Comparison of serum LDL levels among the control and CRE treated groups of pregnant and ovariectomized mice

4. DISCUSSION :

The current study analyses the functional groups present in the *P. hydropiper* methanolic root extract. It also investigates the effect of the extract on the serum total cholesterol, high-density lipoprotein, and low-density lipoprotein in pregnant female albino mice.

Analysis of the chemicals present in plant extract is very useful for any kind of activity study exhibited by it by identification of the bioactive compounds [20]. In the present study, functional group analysis confirmed the presence of flavonoids, saponins, steroids, tannins, and triterpenoids. Also, the extract showed a gradual increase in the serum total cholesterol level with progressive pregnancy days and a significant increase of the same in the treated animals. The level of cholesterol increases naturally during pregnancy to aid in the process of fetal development by the formation of the cell membrane and maintaining the integrity of the membrane and the membrane-associated cascade [21]. The gradual increase in total cholesterol level may be due to the increasing maternal estrogen level [22]. The significant increase in the total cholesterol level in the treated groups may be the result of the combined action of the maternal estrogen as well as the estrogenic compounds found in the extract. The highest estrogen level is seen during the estrous phase which shows the probability of the highest cholesterol level in the day 1 treated females [23]. The presence of some cholesterol-based compounds in the extract may also aid in the rise in the total cholesterol level in the treated groups.

There was a significant increase in the high-density lipoprotein level and a decrease in low-density lipoprotein level in the treated animals. Similar HDL elevating and LDL lowering properties were seen with the treatment of *Phyllanthus reticulatus* in rats [8]. Leaf extract of the Nigerian *Piliostigma thonningii* also lowered the total cholesterol and low-density lipoprotein and increased high-density lipoprotein concentration in rats [1]. *Azadirachta indica* leaf extract showed similar effects in diabetic rats [24]. The HDL increasing effect was exhibited by the tea preparation of *Hibiscus sabdariffa* too in humans [25]. The presence of flavonoids, alkaloids, and tannins plays a major role in protection from lipid peroxidation and cardiovascular diseases [26]. Here, in the present investigation, flavonoids and tannins were detected. These compounds may have exerted an LDL lowering and HDL elevating effect in the treated mice groups. The LDL lowering effect may be brought about by stimulation of the receptor-mediated LDL catabolism and the uptake of lipid from the bloodstream by the liver [27]. It is assumed that there may be upregulation of the mRNA encoding some molecules related to lipid transport such as the VLDL receptor, lipin 1, lipoprotein lipase (LPL), peroxisome proliferator-activated receptor-α (PPARα), acetyl CoA acyl transferases (Acaa1a and Acaa1b) and carnitine palmitoyltransferase 1A (Cpt1a); PPARα can

modulate the production of the apolipoproteins ApoA-1 and ApoA-2, which may be related to the HDL concentration[2].

The ratio between LDL and HDL is an important indicator of the development of cardiovascular diseases [1]. Reduction in the serum HDL level is an indicator of the development of dyslipidemia and increased LDL levels are associated with cardiovascular diseases. As the introduction of the *P. hydropiper* root extract elevated the serum HDL level and lowered the serum LDL level, and most importantly altered the LDL: HDL ratio, therefore, it may be considered a potential candidate for the treatment of cardiovascular diseases.

5. CONCLUSION :

The plant *P. hydropiper* is known to have lots of pharmacological properties and therefore has been used by many communities as traditional medicines. For a clear understanding of the pharmacological properties, there is a need for at least a qualitative analysis of the chemicals present in that plant extract that has been used for medicinal purposes. In the present study, the presence of flavonoids, saponins, phytosterols, tannins, and triterpenoids was confirmed. This extract was able to alter the lipid profile of the treated pregnant mice groups also. It was able to elevate the HDL cholesterol levels and reduce the LDL cholesterol levels significantly in the sera of treated mice, which is considered beneficial. However, there was a significant increase in the total serum cholesterol level in the treated groups, which may be a matter of concern. This elevation may be due to the summation of maternal estrogen and phytoestrogen actions, as a mild increase in cholesterol level is common in pregnant individuals. On the other hand, the HDL level elevation and LDL level decline are supposed to occur due to the action of the phytosterols and/or some other functional groups present in the extract. Moreover, the effects brought about by the extract on the lipid profile are more beneficial than those by the popularly used hormonal contraceptives. Therefore, the *P. hydropiper* methanolic root extract can be considered safer from the viewpoint of cardiovascular risks and therefore a better candidate for pregnancy regulation.

ETHICAL APPROVAL :

Approval was obtained from the Institutional Animal Ethical Committee of Gauhati University (Ethical Approval No.-IEAC/2021-22/03). All the experiments with animals were carried on according to the international rules on the use and care of the laboratory animals.

CONFLICT OF INTEREST :

The authors declare no conflict of interest.

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FATTY ACID COMPOSITIONS OF FIVE EDIBLE MACRO-INVERTEBRATES

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ABSTRACT :

Evaluation of Fatty acid compositions of five non-conventional edible macro-invertebrates viz., *Lethocerus indicus, Sartoriana spinigera, Brotia costula, Bellamya bengalensis* and *Pila globosa* collected from different aquatic bodies of the Dhemaji district of Assam have revealed a good source of fatty acids including Omega fatty acids such as Stearidonic acid, Gadoleic acid and Myristoleic acid. The maximum numbers of dietary fatty acids were found in *Pila globosa* (13 fatty acids) followed by *Lethocerus indicus* (12 fatty acids) and *Sartoriana spinigera* (11 fatty acids) whereas; *Brotia costula* and *Bellamya bengalensis* each found to contain nine fatty acids. All five macro-invertebrate species were found to contain monounsaturated fatty acids (MUFAs), polyunsaturated fatty acids (PUFAs), medium-chain fatty acids (MCFAs) and long-chain saturated fatty acids (LCFAs) with certain variations among the species. Information of the nutritional content may provide an essential guidance for macro-invertebrate consumptions and human health protection. In our study we have focused on the non-conventional source of food materials that are seasonal in the study area and not normally consumed regularly and are not commercially available, for instance, mollusc species, *Lethocerus indicus* (Insecta) and *Sartoriana spinigera* (crab).

Keywords*: Fatty Acids, Macro-invertebrates, Molluscs, Cardio-vascular Disease, Bio-resources.*

1. INTRODUCTION :

The exploration of alternative bio-resources, rich in nutrients remains a perpetual event in human civilization as the population growth of humans is ever-increasing and dynamic. The escalating population driving up the need for nutrient-rich food; the concomitant decline in land for food production is one of the main reasons. To compensate for the nutrient deficiencies, unexploited alternative bio-resources have now been focused in different parts of the world as one of the militating determinants against nutrient insufficiency. The consumption of selected macro-invertebrates such as insects, molluscs, decapods (crab) etc. is a positive aspect of this imperative. For example, Bodenheimer [1] highlighted the significant utilization of insects in different parts of the world such as in Asia, Africa and Latin America. However, they constitute only a small fraction of the bulk of the human diet and are considered to be beneficial in compensating for the nutritional deficiencies that are prevailing in many marginalized societies [2]. Many macro-

invertebrates such as insects have reported that they are rich in protein compared to other conventional protein sources, varying between 13 and 77% [3]. In addition, many studies have reported that they provide fats, minerals, vitamins and high levels of energy [4]. The fats content, especially in the larval and pupa stages, varies between 8 and 70%, where the fatty acid contents are almost similar or higher than that of the other meat sources [5]. The study carried out by Fontaneto et. al. [6] on the fatty acid composition of some terrestrial and aquatic insects has reported that they are a rich source of certain omega-6 fatty acids that play important roles in normal growth and development and brain functioning.

Apart from insects, other macro-invertebrates such as crabs are also consumed in many parts of the world, including indigenous communities of Asian countries [7,8]. Freshwater molluscs have become culinary delicacies in different regions of the world [9,10]. Several species of molluscs such as *Bellamya, Pila, Parreysia, Lamellidens* are quite popular among the ethnic people of north-east India. The Indian pond mussels (*Lamellidens* spp.) are often harvested for human consumption in Nepal and Bangladesh [11,12]. Many bivalves and gastropods are preferred by ethnic communities of the upper Assam due to their availability in the natural water bodies of the region and high meat content. Depending on certain aspects such as seasonal availability, delicacy, tradition and culture, socio-economic conditions some of the aquatic macro-invertebrates are more or less frequently consumed by the ethnic communities such as Bodos, Mishing, Kachary, Ahom of the study area. However, information on the nutritional composition especially the fatty acid contents of the edible macro-invertebrate species in the study area has not been carried out so far. Realizing the paucity of nutritional information the present study was aimed to analyse the fatty acid profile of the selected macro-invertebrate species, which may benefit the society in terms of the ideal quality and quantity of aquatic macro-invertebrates intake.

2. MATERIALS AND METHODS :

2.1 Sample collection

Macro-invertebrate samples were collected from the aquatic bodies of the Dhemaji district and local markets around the area. After properly cleaning, the samples were collected in separate poly packs and stored in a deep freeze in the Department of Life Sciences at Dibrugarh University for further analysis.

2.2 Sample processing and preparation

For fatty acid analysis in the edible tissue of the macro-invertebrate species first, the sample organisms were dissected and the body appendages such as wings, antennae, legs and exoskeletons were removed and washed thoroughly with tap water. The excess water was soaked with tissue paper and kept in deep freeze to reduce autolysis. All samples were analysed within one week of collection. The chemicals and solvents used for the analysis were of analytical grade.

2.3 Extraction of Crude lipids

The crude lipids of the tissue samples were extracted following Folch [13] and Bligh and Dyer method [14]. Briefly, 5.0g of tissue was taken in a mortar and 10 ml of chloroform and methanol (1:2) were added. The sample was then ground and homogenized to fine past further for 10-15 min. 50 µl of BHT (2%) was added to the mixture during homogenization to reduce the auto-oxidation of fatty acid components. After that 10 ml of distilled water was added and homogenized further for 10-15 min. After allowing the sample for a few min for phase separation the lower 90% chloroform part was collected and again added 30 ml of chloroform-methanol-water in a 2:1:1 ratio. The sample was then vortexed for 2 min and allowed to settle for two hrs. Finally, the lower 90% chloroform part was collected in a pre-weighed conical flask and evaporated the sample up to dryness with a dry nitrogen evaporator at 35°C.

2.4 Preparation of fatty acid methyl esters (FAMEs)

The FAMEs for Gas chromatography (GC) analysis were prepared by following the method of Metcalfe and Schmitz [15]. Briefly**,** 100 mg of dried lipid was taken in a glass vial and added 3.0 ml of 14% methanolic BF_3. The mixture was heated for 10 min at 86°C and cooled to room temperature.1.0 ml of hexane was added and vortexes for 15 seconds and kept for separation of the hexane layer. The separated upper part of the hexane layer was carefully collected in a separate vial. The collected hexane fraction was mixed with 4.0 ml of saturated NaCl. Finally, the hexane layer was collected with anhydrous Na_2SO_4 for GC analysis. FAMEs were analysed by using Clarus 680 GC and Clarus 600C MS, PerkinElmer, USA Library Software: Turbomass NIST 2008.

2.5 Identification and quantification of FAMEs

FAMEs were identified by GC/GC-Mass spectra (GC-MS) of the FAMEs of standards with the help of Library Software: Turbomass, NIST 2008. For the percentage composition of the mixture, all peak areas were added, for calculation of individual FAME, the total area was divided by each FAME area and multiplied by 100. The results were expressed based on the peak area of each FAME to the percentage of total FAMEs (Mean ± Standard Deviation).

3. RESULTS :

3.1 Fatty acid compositions

The GC chromatograms of fatty acid methyl esters are presented in Figure 3, 4, 5, 6, 7 and the fatty acid composition of the selected macro-invertebrate species are listed in Table 1. A total of 17 different fatty acids were detected from five macro-invertebrate species with a variation in their quantity and quality among the species. The maximum numbers of dietary fatty acids were

found in *Pila globosa* (13 fatty acids) followed by *Lethocerus indicus* (12 fatty acids) and *Sartoriana spinigera* (11 fatty acids) whereas; *Brotia costula* and *Bellamya bengalensis* each found to contain nine fatty acids. The occurrence and the percentage composition of different fatty acids in the macro-invertebrate species are depicted in Figure 2. All five macro-invertebrate species were found to contain monounsaturated fatty acids (MUFAs), polyunsaturated fatty acids (PUFAs), medium-chain fatty acids (MCFAs), and long-chain saturated fatty acids (LCFAs) with certain variations (Table 1). Some of the mass spectra of the dietary essential fatty acids are shown in Figure 8, 9, 10. During the analysis, it was found that PUFAs were dominated by arachidonic acid (ω-6, 3 to 16.76% of the total fatty acid count) followed by DHA or Cervonic acid (ω-3, 6.41 to 12.98%) and Stearidonic acid (ω-3, 4.32 to 9.68%). Among the MUFAs, 5-eicosenoic acid (20:1) and Myristoleic acid (C14:1, ω-5) were the dominant fatty acids accounting for 6.15 to 16.18% and 4.01 to 16.68% respectively. Gadolic acid (20:1, ω-11) accounts for 9.21 to 15.05%. Myristoleic acid (C14:1, ω-5) was not detected in *Lethocerus indicus* and *Pila globosa*. Likewise, 13 octadecenoic acid (18:1) in *Brotia costula* and *Bellamya bengalensis*. Gadolic acid (20:1, ω-11) in *Lethocerus indicus* and *Brotia costula*. The 5-eicosenoic acid was also not detected in *Bellamya bengalensis* and *Pila globosa* (Table 1). During the analysis, a single MCFA was found in *Lethocerus indicus, Brotia costula* and *Pila globosa,* which accounts for 6.18 to 15.11% of the total fatty acids counts. Altogether nine LCFAs were found in the analysed macro-invertebrate species they are Tridecanoic acid (13: 0), Isomyristic acid (14: 0; branched chain), Pentadecanoic acid (15: 0), Palmitic acid (16: 0), Margaric acid (17: 0), Isostearic acid ((18: 0), Dihydrosterculic acid (19: 0), Carboceric acid (27: 0) and Octacosanoic acid (28:0).

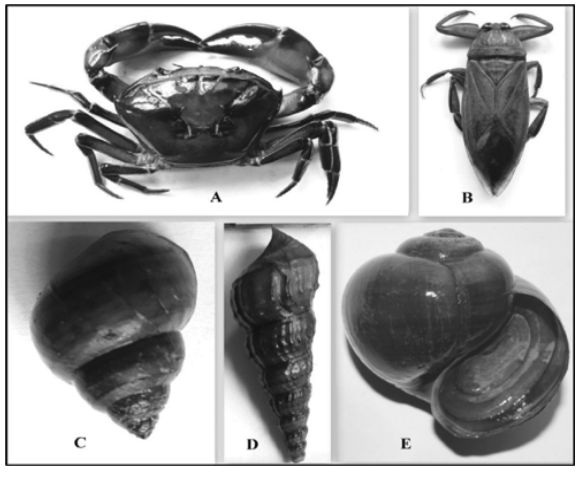

Fig. 1. Photograph of the studied macro-invertebrates A: *Sartoriana spinigera*, B: *Lethocerus indicus,* C: *Bellamya bengalensis*, D: *Brotia costula*, E: *Pila globosa.*

Table 1: List of fatty acids/fatty acid methyl esters of selected macro-invertebrate species after GC/GC-MS analysis. (+ and – indicate the presence or absence of fatty acids)

SL	Fatty acids/Fatty acids methyl esters			Macro-invertebrate species				
NO	IUPAC name	Common name	C: D	LI	SS	BC	BB	PG
1.	Undecanoic acid	Undecanoic acid	11:0	+	-	+	-	+
2.	Tridecanoic acid	Tridecanoic acid	13:0	+	+	-	-	+
3.	12-methyltridecanoic acid	Isomyristic acid (branched chain)	14:0	+	-	+	+	-
4.	Pentadecanoic acid	Pentadecanoic acid	15:0	-	+	+	+	+
5.	Hexadecanoic acid	Palmitic acid	16:0	+	+	-	+	+
6.	Heptadecanoic acid	Margaric acid	17:0	+	-	-	-	+
7.	16-methyl heptadecanoic acid	Isostearic acid	18:0	-	+	+	-	+
8.	9,10-methylene octadecanoic acid	Dihydrosterculic acid	19:0	+	-	-	+	-
9.	Heptacosanoic acid	Carboceric acid	27:0	+	-	-	+	+
10.	Octacosanoic acid	Octacosanoic acid	28:0	+	+	+	-	+
11.	(Z)-tetradec-9-enoic acid	Myristoleic acid	14:1 (ω - 5)	-	+	+	+	-
12.	Octadec-13-enoic acid	13-octadecenoic acid	18 : 1	+	+	-	-	+
13.	(9Z)-9-Icosenoic acid	Gadoleic acid	20:1 (ω -11)	-	+	-	+	+
14.	Icosa-5-enoic acid	5-Eicosenoic acid	20 : 1	+	+	+	-	-
15.	6,9,12,15-Octadecatetraenoic acid	Stearidonic acid	18:4 (ω -3)	-	+	-	+	+
16.	(4Z,7Z,13Z,16Z,19Z)-docosa 4,7,13,16,19- hexaenoic acid	DHA or Cervonic acid	21: 6 (ω – 3)	+	-	+	-	+
17.	Icosa-5,8,11,14-tetraenoic acid	Arachidonic acid	20:4 (ω -6)	+	+	+	+	+

* C=Carbon Number D= No of double bond; LI-*Lethocerus indicus,* SS-*Sartoriana spinigera,* BC-*Brotia costula,* BB-*Bellamya bengalensis,* PG-*Pila globosa*

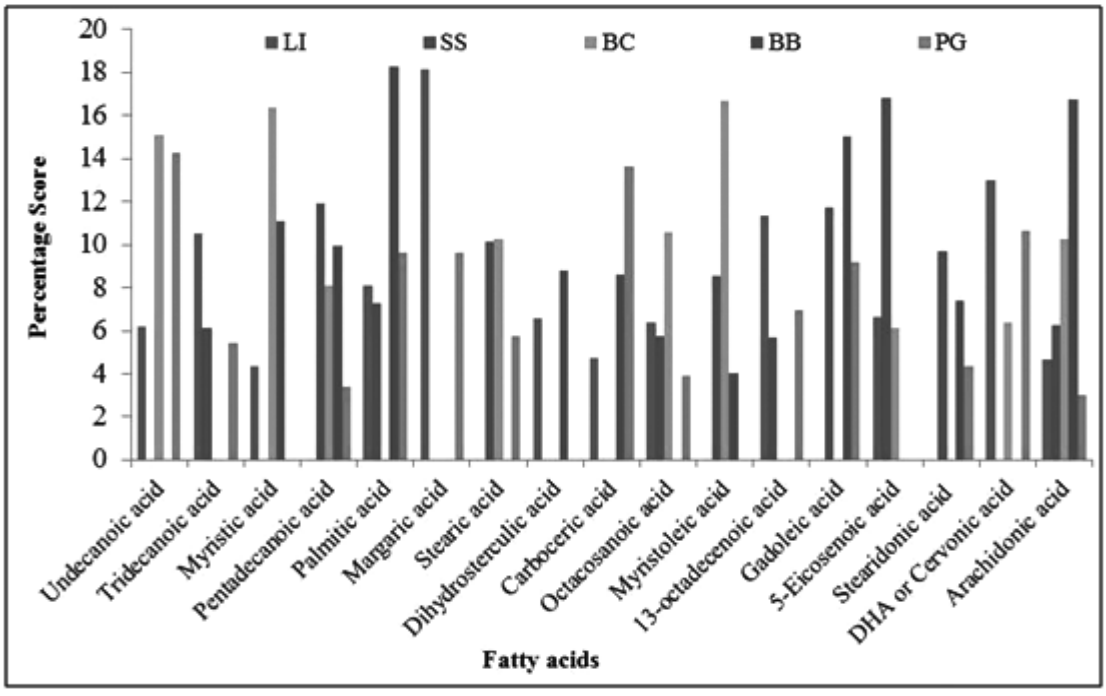

Fig. 2: Composition of different fatty acids found in the selected macro-invertebrate species *LI-*Lethocerus indicus*, SS-*Sartoriana spinigera*, BC-*Brotia costula*, BB-*Bellamya bengalensis,* PG-*Pila globosa*

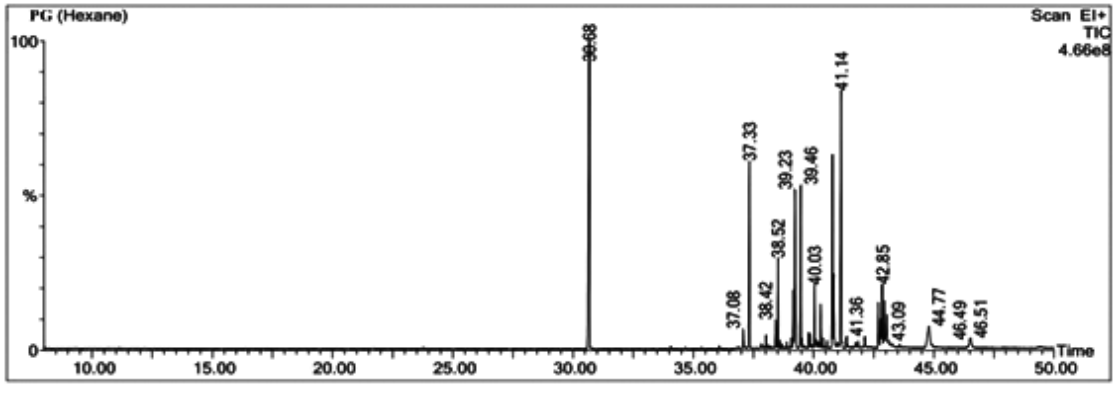

Fig. 3 : Total ion chromatogram (extended) of fatty acid methyl esters of *Pila globosa*

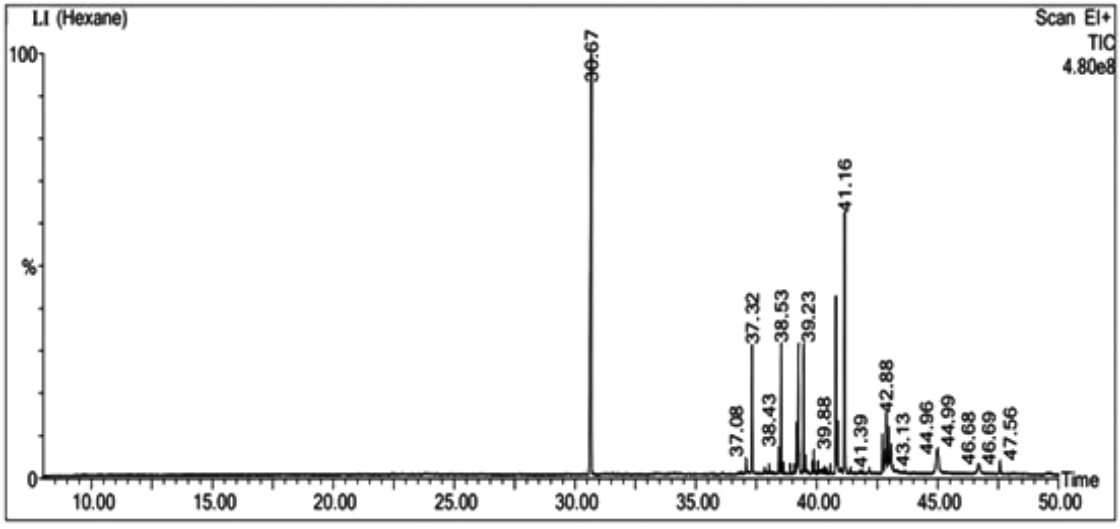

Fig. 4: Total ion chromatogram (extended) of fatty acid methyl esters of *Lethocerus indicus*

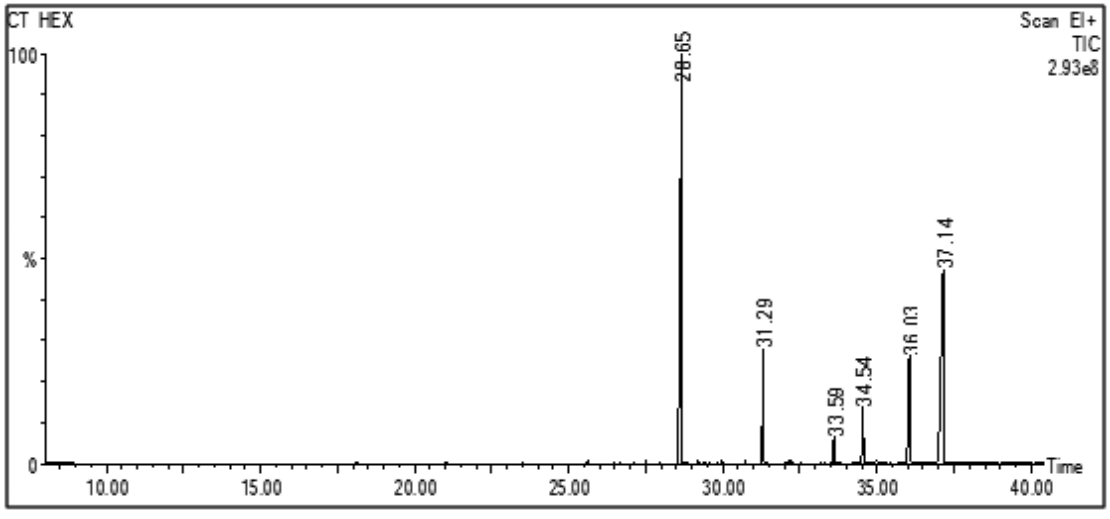

Fig. 5: Total ion chromatogram (extended) of fatty acid methyl esters of *Bellamya bengalensis*

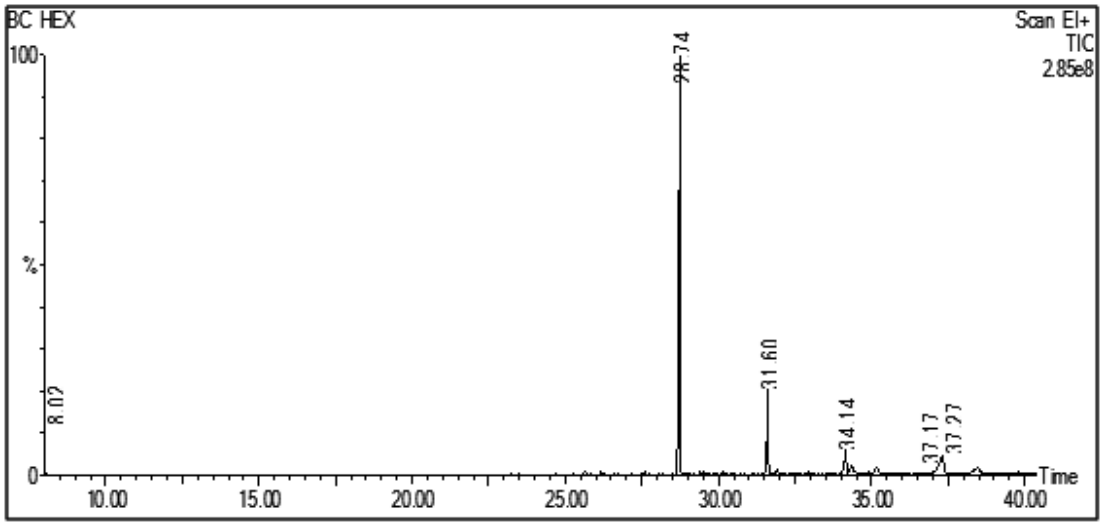

Fig. 6: Total ion chromatogram (extended) of fatty acid methyl esters of *Brotia costula*

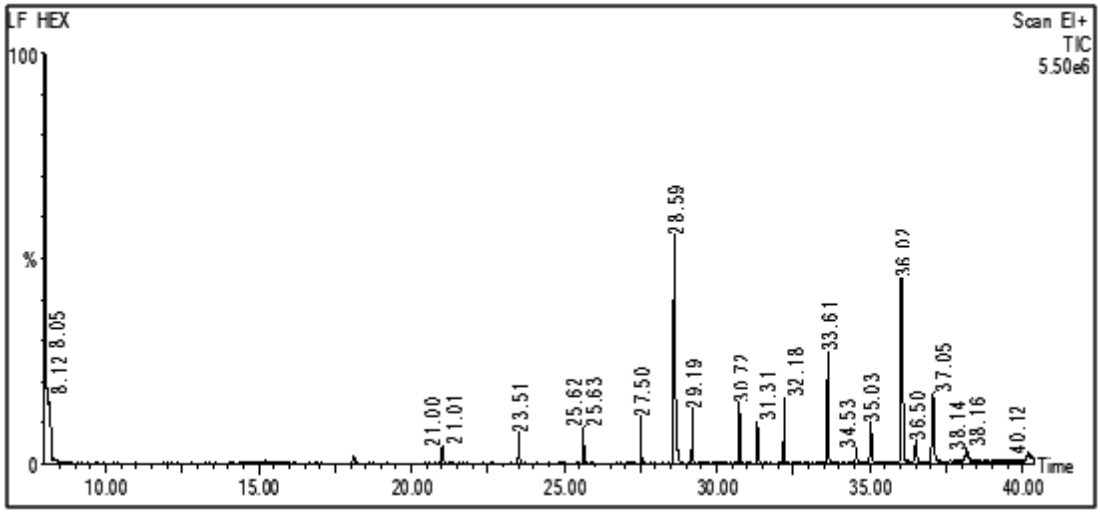

Fig. 7: Total ion chromatogram (extended) of fatty acid methyl esters of *Sartoriana spinigera*

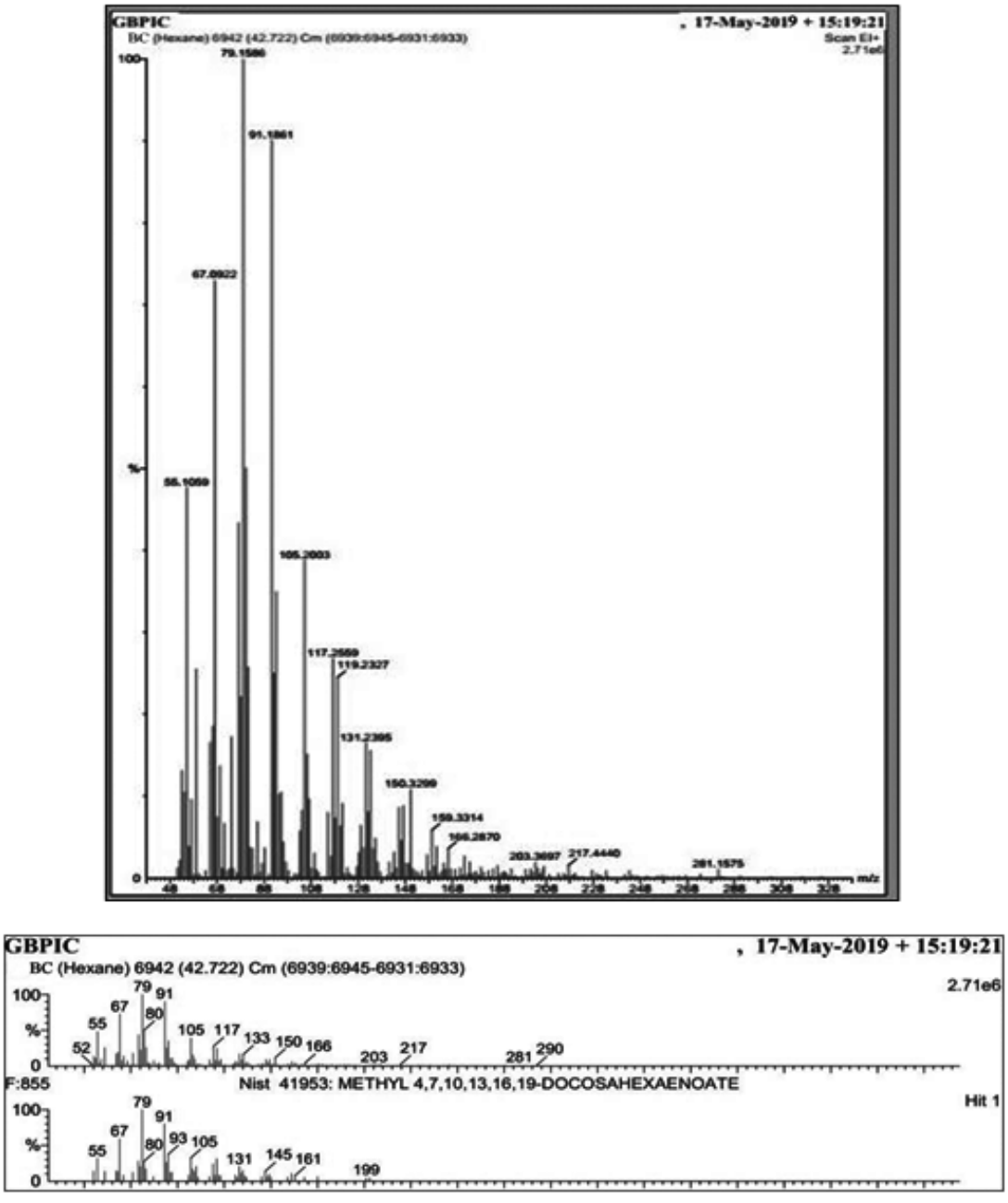

Fig. 8: Mass Spectrum of DHA or Cervonic acid

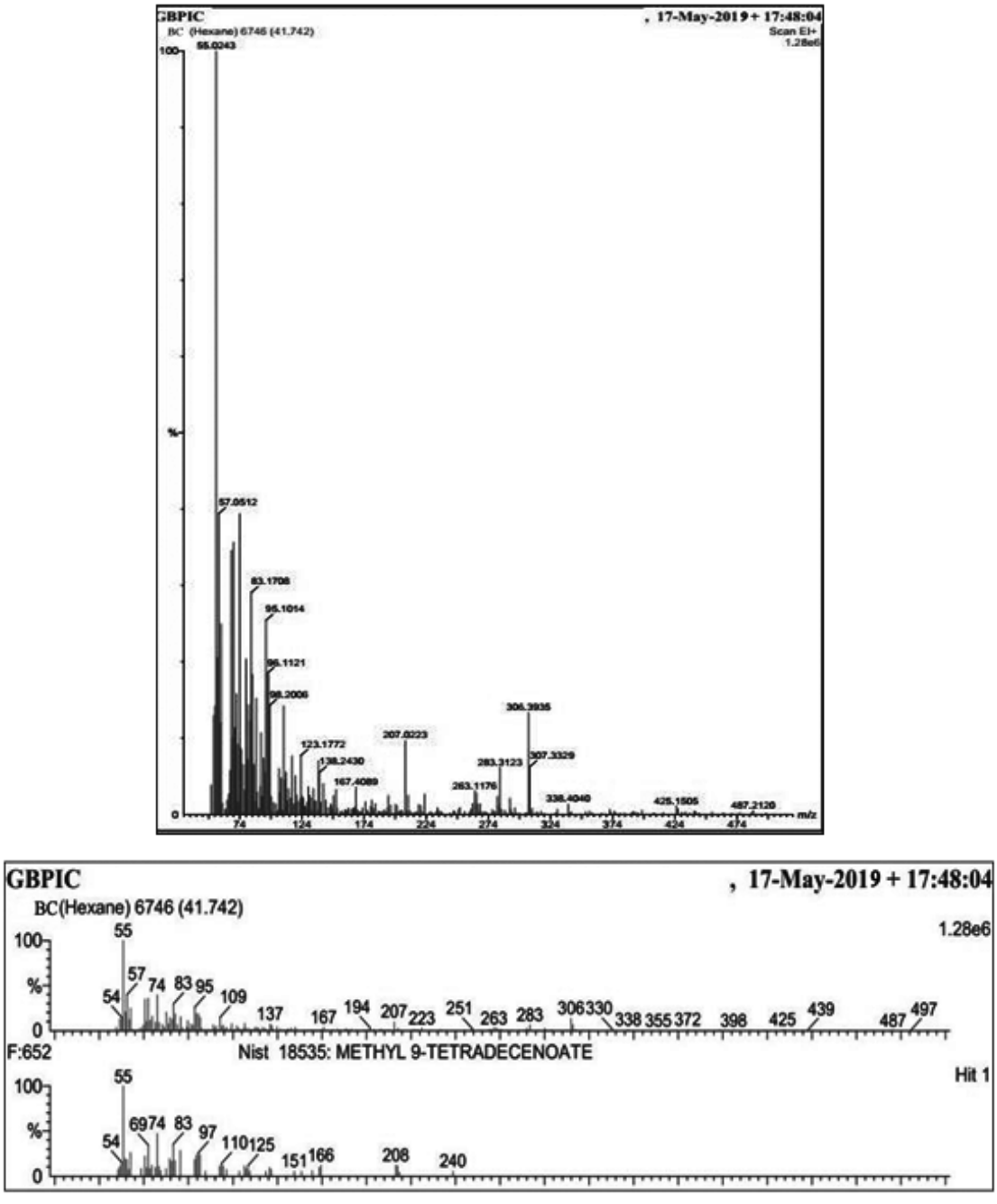

Fig. 9 : Mass Spectrum of Myristoleic acid

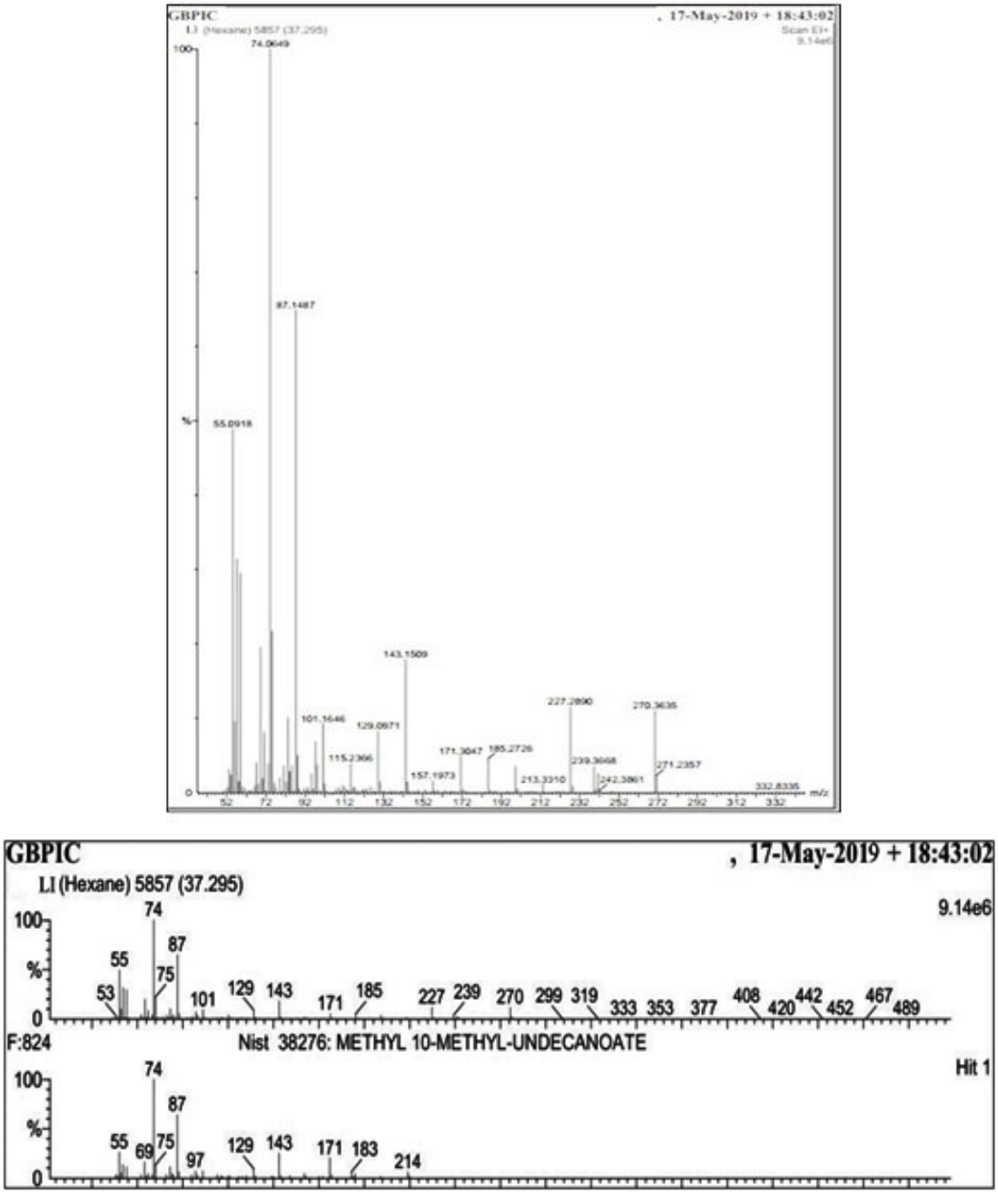

Fig. 10 : Mass Spectrum of undecanoic acid

From the fatty acid analysis, it was found that the total of MUFA, PUFA and MCFA was lower than that of LCFSA in the selected macro-invertebrate species (Table 2). The ΣPUFA was found highest in Bellamya bengalensis (24.16±0.54%) followed by Pila globosa (17.99±0.37), Lethocerus indicus (17.55±0.95) and Brotia costula (16.68±0.93) whereas, Sartoriana spinigera has the lowest percentage value (Table 2). The ?MUFA was found in the range between 16.19±0.64% (Pila globosa) to 42.82±0.73% (Sartoriana spinigera). Similarly, the ΣLCFA was found in the range between 41.22±1.50% to 58.44±1.20% where the highest amount was found in Lethocerus indicus and lowest in the crab species Sartoriana spinigera. During the analysis, no MCFA was detected in Sartoriana spinigera and Bellamya bengalensis whereas, the highest amount of ΣMCFA was found in Brotia costula (15.11±0.30%) followed by Pila globosa (14.31±0.65%) and lowest in the giant water bug Lethocerus indicus (6.14±0.24%)

Table 2: Fatty acids composition of selected macro-invertebrate species. Values are expressed as Mean % ± SD (N=3)

Fatty acids	*Lethocerus indicus*	*Sartoriana spinigera*	*Brotia costula*	*Bellamya bengalensis*	*Pila globosa*
∑PUFA	17.55±0.95	**15.95±0.26**	16.68±0.93	**24.16**±0.54	17.99±0.37
∑MUFA	17.84±0.87	**42.82**±0.73	22.83±0.77	19.07±0.85	**16.19**±0.64
∑LCSFA	**58.44**±1.20	**41.22**±1.50	45.35±1.29	56.76±0.47	51.50±0.98
∑MCFA	6.14±0.24	ND	**15.11**±0.30	ND	14.31±0.65
∑ ω-6/∑ ω-3	0.36	0.64	**1.06**	2.26	0.20

*ND – not detected

4. DISCUSSION :

A fatty acid is a carboxylic acid with a long hydrocarbon chain that is either unsaturated or saturated based on the presence or absence of a double bond. Mostly the naturally occurring fatty acids have an unbranched chain with an even number of carbon atoms from 4 to 28 [16]. Usually, the fatty acids are not found in free forms, rather they are found as three main classes of esters:

phospholipids, triglycerides and cholesteryl esters. In all of these forms, fatty acids are an important dietary source of fuels and also important structural components of cells.

Saturated fatty acids are further divided into four groups:

(i) Short Chain Fatty Acids (SCFA): fatty acid with aliphatic tails of 3 to 5 carbon atoms
(ii) Medium Chain Fatty Acids (MCFA): fatty acid with aliphatic tails of 6 to 12 carbon atoms
(iii) Long-Chain Fatty Acids (LCFA): fatty acid with aliphatic tails of 13 to 21 carbon atoms
(iv) Very Long-Chain Fatty Acids (VLCFA): fatty acid with aliphatic tails of 22 or more carbons.

Unsaturated fatty acids are divided into two groups based on the number of double bonds present in the chain. They are:-

(i) Monounsaturated fatty acids (MUFAs) with one double bond and
(ii) Polyunsaturated fatty acids (PUFAs) with more than one double bond.

The double bond(s) present in PUFAs and MUFAs are either in cis or trans configurations with respect to the plane of the acyl chain. Usually, the nutritionally essential PUFAs and MUFAs have double bonds in the cis configuration. Further, the PUFAs are grouped into different series based on the position of the double bond with the methyl end that is located at C3 (ω -3), C5 (ω -5), C6 (ω -6), C9 (ω -9), C11 (ω -11) position etc.

Fatty acids have important biological functions that can be grouped as regulating cell membrane structure and functions, transcription factor activity and gene expression, regulating intracellular and intercellular signalling pathways, regulating the production of bioactive lipid mediators. Although fatty acids are sometimes considered as one of the major causes of cardiovascular disease, it is now apparent that fatty acids can affect many other diseases such as inflammatory diseases, metabolic diseases for instance type 2 diabetes and cancer [17].

From the present investigation, it was found that all the studied macro-invertebrate species shows a good number of fatty acids viz., MUFAs, PUFAs, MCFAs and LCFAs with some variations between species (Figure 2 and Table 1). Usually, the variations in fatty acids are attributed to the availability of food, size and age groups, gender, life stages and alternations in the environmental and habitat conditions [18,19]. Similar variations in fatty acids can also be observed in other aquatic organisms such as fish, for example, where the above-mentioned factors can influence the lipid content and the fatty acid compositions of the organisms [20]. From the present investigation, it was also observed that the PUFAs ranged from 15.95 to 24.16% of the total fatty acids count

(Table 2). In general, humans can synthesize SFAs and MUFAs but are unable to synthesize the parental PUFAs, and therefore must be obtained through different types of diet. The PUFAs, for instance, ω -3 and ω -6 are reported to be responsible for different biological functions and largely to modulate various physiological processes at their absolute level [21]. In the analysed macro-invertebrate species among the PUFAs, arachidonic acid (20:4, ω -6) was found to be dominant in the gastropods Bellamya bengalensis and Brotia costula (Figure 2). This ω -6 fatty acid is considered an "essential" fatty acid that is required for the synthesis of membrane phospholipids and eicosanoids formation, an important intracellular messengers. It plays a crucial role in the regulation of intracellular signal transduction enmeshed in pain and inflammatory responses [22].

The arachidonic acid is followed by docosahexaenoic acid (DHA) or cervonic acid a long-chain, unsaturated omega-3 (n-3) fatty acid. DHA was reported to contribute about 18% of fatty acids to adult human brain grey matters [23]. It contributes about 50 to 70% of the fatty acids that are present in the rod outer segments of the retina of the human eye [24]. The amount of DHA in the brain increases dramatically during the brain growth spurt which occurs approximately at the beginning of the third trimester of pregnancy to 18 months after birth. During this period weight of the human brain increases from about 100 g at 30 weeks of gestation period to about 1,100 g at 18 months of age [25]. This is also regarded as the most active period of brain cell division. Thus, it is thought that a sufficient supply of DHA during this period is very important for the proper growth, neurological and visual development and functions [26]. Besides this, it is also involved in the membrane protein function, lipid mediator production, cell signalling, reduction of inflammations, lower the risk of insulin resistance, hyperlipidemia and cardiovascular diseases [27].

The DHA was followed by Stearidonic acid (SDA) (Figure 2), a dietary essential ω -3 fatty acid that has various physiological functions in the human body [28]. Studies on the animal model have found that SDA reduces tumour number by about >46% [29]. SDA may act as a sustainable alternative for ω -3 PUFAs and may have therapeutic efficacy concerning the development of Type 2 Diabetes Mellitus. It has the potential to augment health promotion and mimic disease reductions that are usually observed with (n-3) long-chain PUFA [30]. Typically SDA is found in marine-derived foods especially in fishes that ranged from 0.9 to 3%, depending on the type of fish species (mackerel, salmon, herring, sardine, cod and menhaden etc.). A very little amount of SDA is also reported from certain plant and algae [31]. In the present studies, the amount of SDA was found in the range between 4.32 to 9.68 % of the total fatty acid count in the edible tissue of macro-invertebrate species (except Lethocerus indicus and Brotia costula) which is much higher than the above-mentioned food sources and can easily fulfil the requirement of the consumers.

The ω -3 and ω -6 fatty acids are reported to have various health benefits. The recommended dietary ratio of ω -6 to ω -3 fatty acids is approximately 1 as reported in certain studies [32, 33]. It is noteworthy that a balanced ratio between the ω -6 and ω -3 fatty acids is more influential in terms of gene expression [34], cytokine production [35] and eicosanoid metabolism. An increase in dietary intake of ω -6 fatty acids usually changes the physiological environment into a pro-constrictive, prothrombotic and proinflammatory condition [32]. In our present investigation, it was found that the ratio of ω -6 to ω -3 ($\sum$ ω -6/$\sum$ ω -3) for Sartoriana spinigera and Brotia costula is 0.64 and 1.06 respectively (Table 2). Similarly, the amount of $\sum$ ω -3 of the total fatty acids count was found in the range between 6.41 to 14.98% which is higher than some Indian major carps and indigenous fishes of India [36]. Therefore, our investigation on nutritional aspects of the macro-invertebrate species revealed that they are a good source of PUFAs with nearly a balance ratio of ω -6/ω -3 fatty acids especially in Sartoriana spinigera and Brotia costula.

Among the MUFAs, myristolic acid (14:1, ω -5) and gadoleic acid (C20:1, ω -11) accounted for 4.01 to16.68% and 9.21 to15.05 % of the total fatty acid count respectively (Figure 2). These fatty acids usually supplement the human diet and most favourably alter the lipoprotein profile in situations of cardiovascular disease risk [37]. Myristoleic acid is uncommon in nature and the cytotoxic and apoptosis inducer activity of this fatty acid could be used for the treatment of necrosis of human prostatic LNCaP cells and prostate cancer [38]. Reports from the studies on mammals also suggest that myristoleic acid can play a significant role in flank organ growth by inhibiting the 5a-reductase enzyme [39]. Besides, myristoleic acid is also reported to be a new therapeutic agent for osteoporosis and other bone-lytic conditions [40]. During the nutritional analysis, a single MCFA (undecanoic acid) was found in the tissues of macro-invertebrate species that accounts for 6.18 to 15.11% (Figure 2 and Table 1). MCFAs are more rapidly broken down and absorbed into the body due to the shorter chain lengths compared to LCFAs. Thus, they are becoming a quick energy source. The MCFAs in the human diet also reduces body weight and also have a suppressing effect on body fat that accumulates in the body [41]. Studies on the mammalian animal model also reported the replacement of dietary lipids that contain LCFAs with lipids containing MCFAs can largely decrease the ability of alcohol to produce fatty liver [42].

5. CONCLUSION :

Observation on the results of the present investigation it was found that the ratio of ω -6 to ω -3 ($\sum$ω -6/$\sum$ω -3) for Sartoriana spinigera and Brotia costula is 0.64 and 1.06 respectively. Similarly, the amount of $\sum$ω -3 of the total fatty acids count was found in the range between 6.41 to 14.98% which is higher than some Indian major carps and indigenous fishes of India. Therefore,

from the present investigation on nutritional aspects of the macro-invertebrate it is revealed that they are a good source of PUFAs and it is also evident that certain macro-invertebrate species particularly Sartoriana spinigera and Brotia costula have nearly a balance ratio of ω -6/ω -3 fatty acids. Among the MUFAs, myristolic acid (14:1, ω -5) and gadoleic acid (C20:1, ω -11) accounting for 4.01 to16.68% and 9.21 to15.05 % respectively. These fatty acids usually supplement the human diet and most favourably alter the lipoprotein profile in situations of cardiovascular disease risk.

However, it should be noted that the nutritional benefits of the studied macro-invertebrate species stem not only from their fatty acid profiles, but also from the richness in essential and nutritious compounds such as digestible proteins, polysaccharides and vitamins. Furthermore, other than cardiovascular disease prevention, variety of other health-promoting properties might also be significantly related with macro-invertebrate consumption. Therefore, further deep studies are needed in order to make a comprehensive evaluation of the nutritional qualities of the macro-invertebrate species from the region.

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CONFLICT OF INTEREST: The authors declare that there is no conflict of interest.

ABBREVIATIONS :

MUFA: Monounsaturated fatty acid, **PUFA:** Polyunsaturated fatty acid, **MCFA:** Medium-chain fatty acid, **LCFA:** long-chain saturated fatty acid, **spp.:** Species, ml: millilitre, **°C:** Degree Celsius, **GC:** Gas chromatography, **FAME:** Fatty acid methyl esters, **Na_2SO_4**: Sodium sulphate, **SD:** Standard deviation, **SFAs:** Saturated fatty acids, **DHA:** docosahexaenoic acid, **SDA:** Stearidonic acid, **NaCl:** Sodium chloride.

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INDUCTION OF DIFFERENT TYPES OF CALLUS AND SOMATIC EMBRYOGENESIS IN VARIOUS EXPLANTS OF *Aristolochia tagala* Cham. A RARE ENDEMIC MEDICINAL PLANT OF ASSAM, INDIA

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ABSTRACT :

To explore the potential for in vitro rapid regeneration of Aristolochia tagala Cham. different concentrations of N6-(2-isopentenyl) adenine, 6-Benzylaminopurine (BAP) alone and in combinations with Naphthaleneacetic acid (NAA) were evaluated for their effects on the induction of callus and somatic embryos from leaf and nodal explants. Explants were cultured on MS medium supplemented with various concentrations of each kind of hormone. Callus induction percentage, fresh weight, color and texture of the callus were assessed after 28 days of culture. The combination of 3.0 mg/L of BAP and 1.0 mg/L of NAA showed best result in terms of callus induction from leaf explants. Nodal explants showed direct somatic embryogenesis in various concentrations and combinations of 2iP, BAP and NAA. Here the highest percent regeneration was observed in combination of 3.0 mg/L of BAP and 1.0 mg/L of NAA. Results of mean comparison showed that combination of BAP and NAA were more effective on different explants. Under microscopic observations, the different developmental stages of the embryos (globular and pre embryonic) were revealed in callus cells, indicating that the most tested hormone combinations were effective for somatic embryogenesis formation in this species. The developed protocol established the production of different callus types and induction of somatic embryos from leaf and nodal explants.

Keywords: *Aristolochia tagala, callus induction, somatic embryogenesis, N6-(2-isopentenyl) adenine, 6-Benzylaminopurine, 1-naphthaleneacetic acid,.*

1. INTRODUCTION :

From the time immemorial, plants have been widely used as curative agents in traditional medicines for variety of ailments. In India about 2,500 plants species belongs to more than 1000 genera are being used in the indigenous system of medicine [1]. Northeast India including Assam is represented by about 130 different tribes out of total 427 of India having their own traditional practices. Many herbal remedies individually or in combination have been recommended for the cure of different diseases in traditional medicinal practices by the ethnic communities of Northeast India.

Aristolochia (Aristolochiaceae) is an important genus widely used in traditional medicine [2]. During the past two decades, this genus has attracted much interest and has been the subject of numerous chemical and pharmacological studies. It is a rich source of aristolochic acids, which are unique to this genus, and of terpenoids [3].

The family Aristolochiaceae comprises of 8 genera and 450-600 species. The members of the genus Aristolochia are mostly distributed in tropical, subtropical, and mediterranean regions of the world [4 - 8]. The species of Aristolochia are shrubby or perennial herbs, usually climbing.

The genus Aristolochia consists of a large number of species are cultivated as ornamentals [9] and popularly used as sources of abortifacient, emmenagogue, sedative, analgesic, anticancer, anti-inflammatory, anti-feedant, muscle relaxant, antihistaminic, and antiallergic drugs, for intestinal worms, in the treatment of cholera, stomach ache, abdominal pain, rheumatism, malaria, wounds and skin diseases, and also useful in treatment of different types of poisonous bites and stings [2, 3].

The genetic diversity of medicinal plants in the world is becoming endangered at an alarming rate because of ruinous harvesting practices and over-harvesting for production of medicines. Further, extensive destruction of the plant rich habitat as a result of forest degradation, agricultural encroachment, urbanization, etc., are also some important factors [5]. There is a strong need for proactive understanding in the conservation, cultivation and sustainable usage of important medicinal plant species for future use. Genetic improvement through transgenic technology is impended due to non-availability of efficient regeneration system in many Aristolochia species. Hence the present study was aimed to develop an effective, reproducible, simple and improved protocol for the establishment of different types of callus and induction of somatic embryos from various explants until conversion into normal plantlets of Aristolochia tagala by using different concentrations of 2iP, BAP and NAA.

2. MATERIALS AND METHODS :

2.1. Plant material

The experimental plant, Aristolochia tagala was collected from Lakhimpur district (27°27'16.8" N, 94°12'11.58" E) of Assam, India. The plant is quite glabrous, shrubby, twining leaves large cordate upper often narrow subsagittately lanceolate lower or all ovate or broadly ovate-oblong pedately 5-7 nerved, upper with the 2 principal nerves produced far beyond the middle, lower with all the nerves spreading, flowers in racemose puberulous cymes, lip of parianth villous. Quite glabrous, shrubby, twining, leaves large cordate upper often narrow subsagittately lanceolate lower

or all ovate or broadly ovate-oblong pedately 5-7 nerved, upper with the 2 principal nerves produced far beyond the middle, lower with all the nerves spreading, flowers in racemose puberulous cymes, lip of parianth villous [10].

Phenology: Flowering: April- June; Fruiting: November-January.

2.2. Sterilization of explants

Leaf and nodal segments from the source plant were used as explants. The explants were coarsely trimmed to a size of 3 cm and washed thoroughly under running tap water for 10 min and then treated with liquid detergent [5% (v/v) Tween-20] for 15 min. Later these explants were washed with double-distilled water for 10 min. The explants were then sterilized with 0.1% (w/v) mercuric chloride (HgCl2) for 5 min and washed several times with sterile ddH2O to remove all traces of HgCl2. After a final wash, the explants were spread on the pre-sterilized petridishes lined with sterile blotting paper inside a laminar airflow chamber. They were then trimmed finely to the appropriate size (1-1.5 cm). The sterilized explants were inoculated onto solid basal MS medium [11], with different concentrations and combinations of 2iP, BAP and NAA for in vitro regeneration of different types of callus and somatic embryos [12].

2.2. Culture media and growth condition

The stock solution in the required quantity was pipetted out into a standard flask containing distilled water. Sucrose 3% along with 100 mg/L myoinositol were added and dissolved in the media. All the plant growth regulators; additives for the different combinations were added before making up the media to the required volume. PH was adjusted at 5.8 using 0.1 N NaOH or 0.1 N HCl. For solidification, 0.8% w/v agar (HI-MEDIA Lab. India) was then added to the medium and mixed well. The sterilization of the culture medium was carried out in an autoclave for 20 min at 121°C and 15 psi pressure. The medium was then poured into pre-sterilized culture vessels, 15 ml was taken in culture tubes (150 × 25 mm), 50 ml was taken in culture bottles and 100 ml was taken in petri plates (150 x 20 mm) under aseptic conditions in a laminar air-flow cabinet.

leaf disc (1 cm2) and nodal segments (1 - 1.5 cm) were dissected out and all the inoculation operations were carried out under strict aseptic condition inside a Laminar Air Flow chamber, which was made sterile by the incessant exposure of germicidal UV rays for half an hour before use. All operations were carried out using pre-sterilized instruments and glassware. Explants were then aseptically introduced into culture vessels. The culture tubes were then plugged tightly with non-absorbent cotton plugs and the culture bottles and petriplates were sealed tight with sealing

film. All cultures were incubated under irradiance of 70 µmol m-2 s-1 for 16 hour photoperiod and temperature of 25±10C and with a relative humidity of 55 - 60% [12].

2.3. Induction of callus and somatic embryogenesis

Basal medium supplemented with different concentrations of 2-isopentenyl-adenine (2-iP) (1.0, 2.0, 3.0, 4.0 mg/L) and Benzylaminopurine (BAP) (1.0, 2.0, 3.0, 4.0 mg/L) individually and in combinations with Naphthaleneacetic acid (NAA) (0.5, 1.0 mg/l) was tested for the induction of callus and somatic embryogenesis from leaf and nodal explants.

Cultures were scored for callus induction at the end of the fourth week (28 days). Frequency of callus induction was computed as the ratio of the number of explants responding to that of total number of explants involved and was expressed as percentage as shown below.

$$Frequency\ of\ response\ (\%) = \frac{\text{Number of explants responding x 100}}{\text{Total no. of explants cultured}}$$

Sub-culturing was done at 14 day intervals onto fresh medium. The responses of each explant with regard to the percentage of response, induction of callus and number of shoots were recorded after 4 weeks in culture.

2.4. Parameters Measured – Fresh Weight and callus Percentage

After 11 days in maintenance medium, percentage of the callus was measured through average of 20 samples. After 28 days, most explants of leaf changed to callus. Fresh weight and callus percentage of explants were determined. For confirmation of embryogenic callus, the prepared slides were observed under microscope and assessed based on Sharma and Sharma [13] method. Different callus textures (compact and friable) were evaluated after 4 weeks.

Colors of callus were also noted. Two different stages of somatic embryogenesis were observed and photos were taken. Nodal explants produced shoots directly in various concentrations and combinations of 2iP, BAP and NAA and average of shoot number were calculated from 20 explants.

2.5. Data collection and statistical analysis

Data for the percentage of response per explants with different concentrations and combinations of cytokinins and auxins with basal MS medium (callus induction, shoot regeneration, and number of shoots) were recorded. Thus obtained data were analyzed statistically using SPSS 16.0 software (IBM Corporation SPSS, North America).

3. RESULTS :

3.1. Callus induction from leaf explants

Most of the leaf explants only grown bigger in size after 14 days. Callus initiation occurred during 28 days of culture in most of the leaf explants. The induction percentage, texture and color of callus and fresh weight were different on different media.

The concentration of 3 mg/L BAP was the first to induce callus production after 21 days with 85.3±2.8 % (Table: 3). In combination of 3 mg/L BAP and 1 mg/L NAA a remarkable increase in callus percentage was obtained after 28 days of culture (89.6±2.8 %) (Table: 4). MS media with 3 mg/l BAP alone had the highest average fresh weight of callus (0.351 gm.) and were in globular stage (Fig: 1, Table: 3). In combination of 2iP and NAA, the highest fresh weight observed in 2 mg/L 2iP and 1 mg/L NAA, with 0.249 g in pre embryonic stage (Fig: 1, Tables: 2)

The primary calluses were greenish after 11 days but grew rapidly into light green, green, compact and friable callus after 28 days of culture. Different stages of embryogenesis development were observed but the most of the calli were in the globular stage. 2iP alone showed no any significant effect.

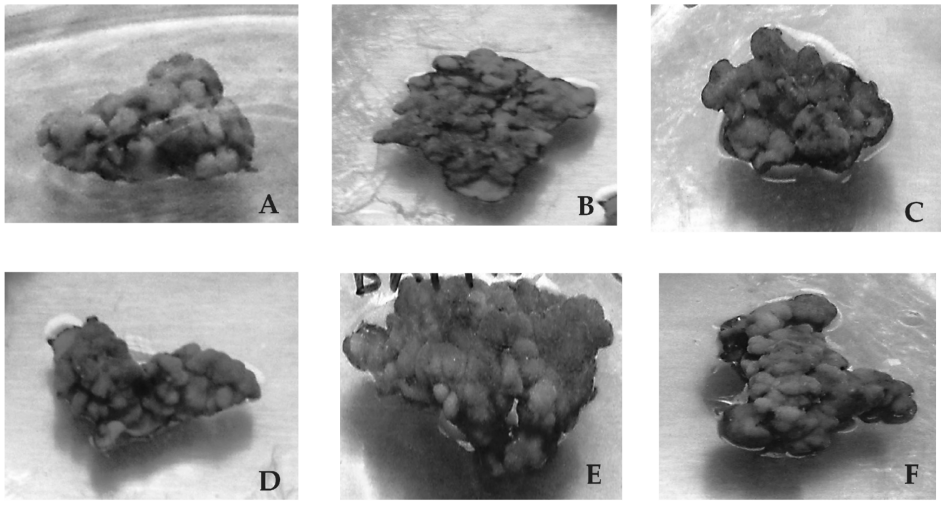

Fig. 1 Different stages of callus obtained from leaf explants of A. tagala; A= pre-embryo stage and compact callus, B= pre-embryo stage and friable callus C=globular stage and compact callus, D= globular stage and compact callus, E= globular stage and friable callus, F= globular stage and friable callus

Table 1: Effect of 2iP on induction of various colors, textures, weight and callus percentage from leaf explants of A. tagala after 28 days of culture (* CO = compact; FR = friable; PE = pre-embryonic; GL = globular)

Plant growth regulator (mg/L)	Callus (%)	Weight (g)	Color	Texture	Embryo Stage
2iP	28 Days				
1	0	0	--	--	--
2	76.6 ± 2.8	0.214	Green	FR	GL
3	58.6 ± 2.8	0.208	Light Green	CO	GL
4	43.0	0.196	Green	FR	PE

(Data mean of 3 replicates ± S.D.)

Table 2: Effect of 2iP and NAA on induction of various colors, textures, weight and callus percentage from leaf explants of A. tagala after 28 days of culture (* CO = compact; FR = friable; PE = pre-embryonic; GL = globular)

Plant growth regulators (mg/L)		Callus (%)	Weight (g)	Color	Texture	Embryo Stage
2iP	NAA	28 Days				
1	0.5	0	0	-	-	-
2	1	73.3 ± 2.8	0.249	Green	CO	PE
3	1	66.6 ± 2.8	0. 227	Green	CO	PE
4	0.5	63.3 ± 2.8	0. 214	Green	FR	GL

(Data mean of 3 replicates ± S.D.)

Table 3: Effect of BAP on induction of various colors, textures, weight and callus percentage from leaf explants of A. tagala after 28 days of culture (* CO = compact; FR = friable; PE = pre-embryonic; GL = globular)

Plant growth regulator (mg/L)	Callus (%)	Weight (g)	Color	Texture	Embryo Stage
BAP	28 Days				
1	65.0	0.164	Light G	CO	PE
2	81.3±2.8	0.251	Light G	FR	GL
3	85.3±2.8	0.351	Light G	CO	GL
4	68.3±2.8	0.250	Green	FR	GL

(Data mean of 3 replicates ± S.D.)

Table 4: Effect of BAP and NAA on induction of various colors, textures, weight and callus percentage from leaf explants of A. tagala after 28 days of culture
(*CO = compact; FR = friable; PE = pre-embryonic; GL = globular)

Plant growth regulators (mg/L)		Callus (%)	Weight (g)	Color	Texture	Embryo Stage
BAP	NAA	28 Days				
1	0.5	78.0 ± 2.8	0.178	Green	CO	PE
2	1	80.6 ± 2.8	0.233	Light Green	CO	GL
3	1	89.6 ± 2.8	0.267	Green	FR	GL
4	0.5	80.0	0.238	Green	FR	PE

(Data mean of 3 replicates ± S.D.)

3.2. Direct regeneration from nodal explants

All nodal explants cultured on MS medium supplemented with various concentrations of 2iP and BAP individually and in combination with NAA had significant influence on direct shoot regeneration (Table: 5). Nodal segment explants remained green and fresh but failed to develop multiple shoots in growth regulators free MS medium (control). Nodal explants cultured on MS

medium fortified with cytokinins alone induced multiple shoots at a lesser frequency compared to the media supplemented with combination of cytokinin and auxin (Fig. 2).

Among the various concentrations of BAP and 2iP tested, 3.0 mg/L BAP showed the highest shoot regeneration frequency of 81.6±2.8, the highest number of shoot were recorded as 1.9±0.53.

The synergistic influences of auxins with cytokinins was evident when combination of optimal concentration of each cytokinins with different concentrations of NAA (0.5 and 1.0 mg/L) were tested. Addition of NAA markedly enhanced the percent regeneration and number of shoots. Among all the cytokinin and auxin combinations, the maximum percent regeneration was found as 93.6±2.8 % and number of shoots (3.7±0.43) per explants were obtained at 3.0 mg/L BAP + 1.0 mg/L NAA (Table 5).

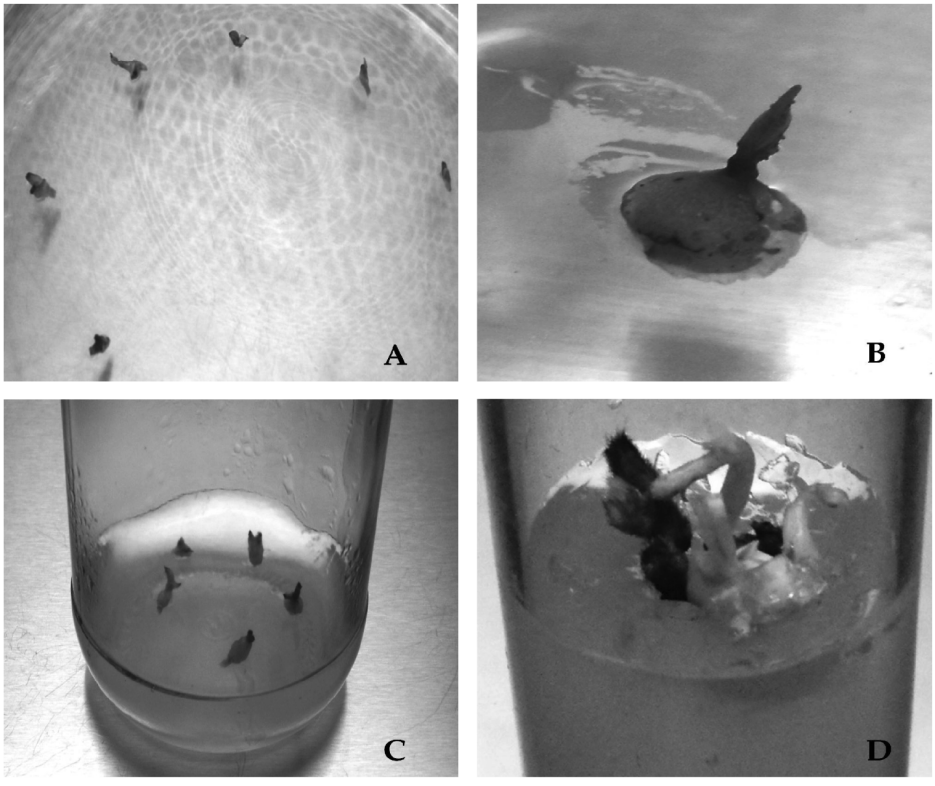

Fig. 2. Different stages of in-vitro regeneration of A. tagala from nodal explant. A = initial days after inoculation in MS medium, B, C =direct organogenesis from explant in 3:1 mg/L of BAP and NAA in MS medium, D = multiple shoot regeneration in 3:1 mg/L of BAP and NAA.

Table 5: Effect of cytokinins and auxins individually and in combinations for direct organogenesis from nodal explants of A. tagala (after 4 weeks)

Plant growth regulators (mgL-1)			Response of nodal explants (%)	Number of shoots/explant (Mean ± SD)
2iP	BAP	NAA		
Control (PGR free)			-	-
1			0	0
2			68.6±2.8	1.4±0.43
3			71.4±2.4	1.3±0.43
4			60.6±2.4	1.3±0.33
1		0.5	0	0
2		1	72.0±2.4	1.5±0.36
3		1	79.3±2.8	2.1±0.36
4		0.5	67.6±2.4	1.2±0.24
	1		81.0±2.4	1.7+±0.54
	2		72.3±2.8	1.5 ± 0.53
	3		81.6±2.8	1.9±0.53
	4		71.2±2.8	1.5±0.44
	1	0.5	89.2±2.8	2.3±0.43
	2	1	85.6±2.8	2.4±0.54
	3	1	93.6±2.8	3.7±0.43
	4	0.5	72.6±2.8	2.5±0.43

(Data mean of 3 replicates ± S.D.)

4. DISCUSSION :

Exploration, documentation and characterization of the medicinally important plants of Assam are still very limited. Northeast India in general and Assam in particular is one of the mega biodiversity hotspot which supports unique types of vegetation patterns with different flora. Plants are important source of medicines and play a key role in world health. The genus Aristolochia is an impor-

tant source of medicines. There is enormous number of reports about Aristolochia sp. that has been used in traditional medicines globally. It comprises of about 400 – 500 species, distributed mainly in tropical and subtropical regions. The species of Aristolochia occurred in Assam have already been considered as rare and endemic medicinal plants [5]. Further research in details in various aspects of this important group of plants is utmost necessary for their proper exploitation.

In vitro micropropagation of Aristolochia tagala has not been reported earlier. Genetic improvement through transgenic technology is impended due to non-availability of efficient regeneration system in many Aristolochia species. Embryogenic system offers an ideal tool for in vitro production and selection of transgenic plants [14]. The present study has established a protocol for different types of callus induction and formation of somatic embryos until conversion into normal plantlets of A. tagala. Many factors including the choice of growth regulators and explants were responsible for successful somatic embryogenesis [15]. A wide investigation with different concentrations and combinations of 2iP, BAP and NAA was carried out. Different plant species or cultivars will react differently to different hormone regime. Most researchers used 2,4-D for callus induction. Siong et al., [16] obtained embryogenic callus and somatic embryogenesis from Brassica oleraceae hypocotyls and leaf explants whereas, Ahmed et al., [17] used picloram, 2,4-D, NAA with ascorbic acid to induce somatic embryogenesis from Phyla nodiflora (L.) Greene. The concentration of 3 mg/L BAP was the first to induce callus production after 21 days with 85.3 ± 2.8 % in A. tagala. In combination of BAP and NAA a remarkable increase in callus percentage was obtained after 28 days of culture (89.6 ± 2.8%). MS media with 3 mg/l BAP alone had the highest average fresh weight of callus (0.351 gm.) and were in globular stage. In combination of 2iP and NAA, the highest fresh weight observed in 2 mg/L 2iP and 1 mg/L NAA, with 0.249 g in pre embryonic stage. All nodal explants cultured on MS medium supplemented with various concentrations of 2iP and BAP individually and in combination with NAA had significant influence on direct shoot regeneration. Induction of callus and multiple shoots from A. bracteolate using various PGRs was also reported previously [18]. Among the various concentrations of BAP and 2iP tested, 3.0 mg/L BAP showed the highest shoot regeneration frequency of 81.6±2.8 , the highest number of shoot were recorded as 1.9±0.53. Addition of NAA markedly enhanced the percent regeneration and number of shoots in A. tagala.. Among all the cytokinin and auxin combinations, the maximum percent regeneration was found as 93.6±2.8 % and number of shoots (3.7±0.43) per explants were obtained at 3.0 mg/L BAP + 1.0 mg/L NAA. The results of this study show that large numbers of shoots can be propagated from the optimization of cytokinin and auxin combinations in the media within 4-5 weeks. Furthermore, apical and axillary meristems from these shoots

can be isolated and subcultured on micropropagation medium for further shoot multiplication. Thus, desirable genotypes can be micropropagated in short period of time. The success in raising somatic embryos has opened up the possibility for large-scale clonal propagation of A. tagala. The somatic embryogenic lines have been used for genetic transformation and somatic hybridization which are the most advanced techniques for genetic improvement of varieties.

CONFLICTS OF INTEREST: The authors declare that they have no conflicts of interest to report regarding the present study.

ABBREVIATIONS: 2iP: N6-(2-isopentenyl) adenine; BAP: 6-Benzylaminopurine; NAA: 1-naphthaleneacetic acid; MS medium: Murashige and Skoog medium.

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THE PRIMATES OF ASSAM: ROLE OF RED RIVERS AND BLUE HILLS IN THEIR DIVERSITY AND DISTRIBUTION

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ABSTRACT:

Assam, Northeast India, is globally known for its wildlife wealth, mainly the Great Indian one-horned rhino and the Golden langur. However, Assam has a high diversity of primates, which include two sub-species of Hoolock gibbon, Golden langur, three sub-species of Capped langur, Phayre's langur, Bengal Slow loris, three sub-species of Assamese macaque, Pig-tailed macaque, Stump-tailed macaque and Rhesus macaque. The distribution and diversity of these primates have largely been affected by the rivers and high hills / mountains. This chapter reviews the role of these zoo-geographic barriers in the diversity and distribution of the primates of Assam.

Key words : *Diversity, Golden langur, Primates, Rhesus macaque.*

1. INTRODUCTION :

Assam, a Northeast Indian state, covers parts of two global biodiversity hotspots: the Indo-Burma and the Himalayan [1]. The region south of the Brahmaputra river falls in the Indo-Burma, while the northern region falls in the Himalayan biodiversity hotspot. Assam is known for its wild-life diversity, and some of the splendid wild species include the Golden langur, Great Indian one-horned rhino, Asiatic elephant, Asiatic wild water buffalo, Sloth bear, Malayan sun bear, Asiatic black bear, Gaur, Pigmy hog, etc. Assam is the home of nine primate species, viz., Hoolock gibbon (Hoolock hoolock), Bengal Slow loris (Nycticebus bengalensis), Capped langur (Trachypithecus pileatus), Phayre's langur (T. phayrei), Golden langur (T. geei), Pig-Tailed macaque (Macaca nemestrina), Stump-tailed macaque (M. arctoides), Assamese macaque (M. assamensis) and Rhesus macaque (M. mulatta) [2, 3].

The state is well-known as the 'Land of Red rivers and Blue hills'. There are two river systems in the region: the Brahmaputra in the north and Barak in the south, which are completely

disjunct within Indian limits. The Brahmaputra river originates in the Tibet of China from where the river flows eastwards and takes a U-turn at the India-China border to enter Arunachal Pradesh where the river is known as Siang. Lohit and Dibang rivers are the major south bank tributaries of Brahmaputra, both of which confluence at Kobo island within Assam. The major north bank tributaries of interest are the Subansiri, Jia-Bhoreli, Manas, Sankosh and Raidak. The river ultimately flows into Bangladesh. The Barak river originates in Manipur and takes a hill course to enter plains of southern Assam from where the river flows almost westwards, bifurcates at India-Bangladesh border into Surma and Kushiyara [2, 4]. The distribution of the primates in Assam has mainly been restricted by large rivers and mountains, which have served as zoo-geographic barriers of the primates. While this has restricted their distribution, it has also resulted in creation of geo-graphic variations and speciation.

2. PRIMATES OF ASSAM AND THE ZOO-GEOGRAPHIC BARRIERS :

Assam harbours nine species of primates belonging to three families and four sub-families. The family Lorisidae is represented by the Bengal Slow loris (Nycticebus bengalensis), while the family Cercopithecidae has two sub-families: the subfamily Cercopithecinae and Colobinae. The former is represented by four species: Rhesus macaque (Macaca mulatta), Pig-tailed macaque (M. nemestrina), Stump-tailed macaque (M. arctoides) and Assamese macaque (M. assamensis), while the latter is represented by three species: Capped langur (Trachypithecus pileatus), Phayre's langur (T. phayrei) and Golden langur (T. geei). The family Hylobatidae (Gibbons) is represented by one species comprising two sub-species: Western Hoolock gibbon (Hoolock hoolock hoolock) and Mishmi Hills Hoolock gibbon (H. h. mishmiensis). Photographs of eight, out of the nine, primate species is given at Fig. 1.

2.1 Bengal Slow Loris (Nycticebus bengalensis)

The loris occurs throughout Assam, and is relatively more common in the south of Brahmaputra. Its western-most limit is the Sankosh river. The species in the north of Brahmaputra river were surmised to be a separate species due to their segregation from the rest of the population since a long time [2]. It is a forest dweller and nocturnal in habit. It feeds on tree exudates. It occurs in most of the protected areas, reserve forests as well as forest patches including tea gardens.

2.2 Pig-Tailed Macaque (Macaca nemestrina)

Of the four subspecies recognised, Macaca nemestrina leonina, the Northern Pig-tailed macaque, occurs in Assam [2, 5]. The species is restricted to the south of the mighty Brahmaputra

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river. In the east, the species is recorded upto the Dibang river, while mountains in the further east acts as limit of distribution. The species is found in most of the protected areas and reserves forests south of Brahmaputra river. However, except Tinsukia district, the species is rare elsewhere.

Fig. 1: Photographs of some primates of Assam. (Top row, Left to right) A Slow loris injured by locals in Hailakandi; A Pig-tailed macaque in the Patharia Hills reserve forest of Karimganj; Two Assamese macaques on tree-top at Patharia Hills reserve forest of Karimganj. (Middle row, Left to right) A troop of Rhesus macaque in the Rosekandy tea estate, Cachar; A captive sub-adult Stump-tailed macaque at Irongmara, Cachar; An alpha male Phayre's langur at Rosekandy tea estate, Cachar. (Bottom row, left to right) An adult male Capped langur at Rosekandy tea estate, Cachar; An adult female Western Hoolock gibbon in the Patharia Hills reserve forest, Karimganj; Jhum cultivation by locals in the forests. Photographs of Hoolock gibbon, Pig-tailed macaque and Assamese macaque by Amir Sohail Choudhury, Hailakandi, Assam. Rest of the photographs by Dr. M.K. Mazumder.

2.3 Assamese Macaque (M. assamensis)

Assamese macaque is a dense forest dwelling primate, generally preferring higher elevations. It occurs throughout Assam, although rare, except in certain places of Tinsukia district. Three sub-species of Assamese macaque are found in Assam, and are distributed to both south and north of the Brahmaputra river [2].

M. A. assamensis : This is the nominate ssp. with a comparatively shorter tail. It occurs in the south of Brahmaputra river.

M. A. pelops : The adult males of the ssp. have a longer tail. The ssp. occurs to the north of the Brahmaputra river, while its easternmost limit is the Siang river in Arunachal Pradesh.

M. A. munzala : The ssp. occurs to the north of Brahmaputra river in high elevations. However, some authors consider it to be a separate species (M. munzala; Arunachal macaque).

2.4 Rhesus macaque (M. mulatta)

There are four subspecies of the Rhesus macaque, out of which the nominate race M. mulatta mulatta occurs in Assam. The species is widespread in the region, and inhabits a wide range of natural and disturbed habitats, often entering houses, and causing crop depredation. The rivers of Assam have not been found to be its barriers. The species is rare in high elevations, hills and dense forests, although common in foothills and plains [3, 6].

2.5 Stump-tailed macaque (M. arctoides)

Four sub-species of Stump-tailed macaque are recognised globally. Out of these, the nominate sub-species M. arctoides arctoides occurs in Assam. The species is restricted to the south of the Brahmaputra river. Although the easternmost distribution limit has not been elucidated in detail so far, it is at most upto the Dibang river, hopefully the river acts as barrier [2, 7]. It is rare macaque of Assam, with limited population in protected areas and reserve forests. It is a forest dwelling macaque.

2.6 Phayre's langur (Trachypithecus phayrei)

There are four recognized sub-species of this langur globally, of which the nominate ssp. occurs only in the southern districts of Assam, viz., Cachar, Hailakandi and Karimganj. Northeast India is the westernmost limit of distribution of this species, which is restricted to the south of Barak-Kushiyara river, and thus the species occurs in southern Assam, Tripura and Mizoram. It is

one of the most splendid and spectacular primates of Assam, and is also the state animal of Tripura. Its occurrence is southern Assam was originally surmised by Choudhury in 1983 [8]. It is sympatric with Capped langurs in southern Assam [9, 10]. It is found in the reserve forests of southern Assam including Innerline, Katakhal, Patheria Hills, Longai, Singla, Badshahitilla, etc. Within the limits of Assam, it does not occur in any wildlife sanctuary. It prefers dense forests, and bamboo groves.

2.7 Capped langur (T. pileatus)

The Capped langur occurs throughout Assam and Northeast India. It is the most common langur of Assam. The T. pileatus is found both to the south and north of Brahmaputra river [7, 11]. The species is seen in most of the protected areas, reserve forests, and tea planted areas. It prefers dense forests, moves in one-file, and rarely descends to the ground. Three sub-species of capped langur occur in Assam: pileatus, brahma and tenebricus.

T. P. PILEATUS: The distribution of this ssp. is restricted to the south of the Brahmaputra and the river Dibang acts as the easternmost limit [12].

T. P. brahma : The distribution of this ssp. is restricted to the north of Brahmaputra river, and is restricted in the east by Siang river and in the west by Jia-Bhoreli – Kameng river, while in the north the high elevation of the Himalayas act as distribution limit. In the west of Jia-Bhoreli – Kameng, it is replaced by tenebricus [12].

T. P. tenebricus : The distribution of this ssp. is restricted to the north of Brahmaputra, west to Jia-Bhoreli – Kameng river and east to Manas river. In the west of Manas, the species is replaced by Golden langur. Similar to brahma, the higher elevation acts as northern limit of distribution [12].

2.8 Golden langur (T. geei)

The description and distribution of the Golden langur was originally provided by E.P. Gee in his famous book Wildlife of India [13]. The species is endemic to western Assam and adjacent areas of Bhutan [2]. The species is restricted by the Brahmaputra river in the south, Manas in the east, Sankosh in the west, and the Himalayan lofty mountains to the north. It is surmised to have diverged from the Capped langurs. Within Indian limits, it is not sympatric with any other langur. Interestingly, in the upstream areas of Manas river where the channel width is narrow, and probably due to construction of bridges, sympatric populations of Golden langur and Capped langur are found, and natural hybrids are visible in the zones of overlapping distribution [2, 14].

2.9 Hoolock gibbon (Hoolock hoolock)

Hoolock gibbon is the only ape of India, and occurs in Northeast India only. It is a dense forest dweller, requiring canopy continuity due to its brachiating movement. It is still found in all the protected areas and reserve forests. Within Assam, the Brahmaputra river acts as the southern-most distribution limit, while in Arunachal Pradesh, they are distributed to the east of the Dibang river (a south bank tributary of Brahmaputra) and Ithum river (a south bank tributary of Dibang river) which act as the northernmost limits of distribution. There are three sub-species of the gibbon, of which two are found in Assam.

2.10 Western hoolock gibbon(H.H. hoolock)

The Western Hoolock gibbon is distributed to the south of Brahmaputra and Lohit river. In the further north, the ssp. is replaced by the Mishmi Hills Hoolock gibbon. It occurs in all the states south of Brahmputra river [2, 15].

2.11 Mishmi Hills hoolock gibbon (H.H. mishmiensis)

It is a newly described ssp. of Hoolock gibbon, and is found in Arunachal Pradesh and a small part of north-eastern tip of Assam (Sadiya sub-division of Tinsukia district). Thus, its distribution is the most restricted among all other primates. It was described by Dr. Anwaruddin Choudhury [15]. It occurs in north to Lohit river in Sadiya subdivision of Tinsukia district of Assam. Dibang river (a south bank tributary of Brahmaputra) and Ithum river (a south bank tributary of Dibang river) act as the westernmost and northernmost limit of distribution respectively. Lohit river acts as a barrier, and is found in north of the river which isolates it from H. h. hoolock. In the north and east, the higher elevations of Mishmi Hills and lofty mountains act as barriers. The ssp. was previously mistaken by others as Eastern Hoolock gibbon (H. h. leuconedys).

3. CONSERVATION ISSUES :

Alike the other regions of India, the primates of Assam face several threats. The most devastating threat to the primates is habitat loss due to deforestation, jhum cultivation, monoculture, and encroachment in the protected areas and reserve forests (Fig. 1). In addition, poaching for meat, skin, and other body parts (for ornamental uses) are performed by several tribes. Macaques often invade crops, steal eatables from houses, and thus enter into direct conflict with human, especially in forest villages and fringes. Depletion of food plants is another vital threat. Macaques are often captured as pets (Fig. 1). Some of the primates like Slow loris, are considered to be bad omen, and are prosecuted upon sight.

Govt. of India notified most of these primate species under schedule I/II of the Wildlife Protection Act (1972). Although there are several protected areas in Assam, most of these have the issues of illegal logging, encroachment, and killings of the wildlife. Such illegal activities are more common in the reserve forests. In some areas, the reserve forests have been turned into monoculture plantations. Further, due to such disturbances, primates often venture in search of food into human habitations. This leads to conflicts and retaliatory killings [2, 3, 7]. Thus, there is immense need to create more protected areas as well as extension of existing ones. Moreover, proper implementation of laws is inevitable for the continued survival of the primates. The Phayre's Langur occurs in no protected area within Assam. The Patheria Hills reserve forest of Karimganj district should be upgraded to a wildlife sanctuary for the Phayre's langur. Further, since the Golden langur and Mishmi Hills Hoolock gibbons have very restricted distribution, creation of protected areas and extension of existing ones is inevitable required.

4. CONCLUSION :

The Brahmaputra and Barak rivers of Assam, and their tributaries and distributaries have played a major role in the distribution and dispersal of the primates. Most importantly, the isolation of sub-populations of certain primates by these rivers have led to development of variations and ultimately speciation. The Golden langur has diverged from the Capped langur due to isolation effected by the rivers. The rivers have created three sub-species of Capped langur, two of Hoolock gibbon, and three of Assamese macaque. However, in addition to the Red Rivers, the Blue Hills also had their share in the divergence and creation of geographic variations. Thus, Assam has immense primate diversity, largely bestowed upon by its 'Red Rivers and Blue Hills', which however face severe and varied threats, and need effective conservation efforts.

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STRUCTURE AND ELECTRICAL PROPERTIES OF $La_2Mo_{2-x}Nb_xO_{9-\delta}$ ($0.025 \leq x \leq 0.075$)

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ABSTRACT :

Solution combustion synthesis processwas used to synthesize the compositions $La_2Mo_{2-x}Nb_xO_{9-\delta}$ (x=0.025, 0.050 and 0.075). Both XRD and temperature dependent conductivity plot confirm that incorporation of Nb at Mo-site cannot stabilize the high conducting cubic (ß) phase at room temperature. At sintering temperature 1000^0C, solubility limit of Nb was found to be less than 3.75% as revealed by the XRD pattern of the composition x=0.075 and reflects secondary phase formation. Thus, Nb-doping is not useful in enhancing the ionic conductivity in parent $La_2Mo_2O_9$.

Keywords: *Arrhenius plot, Phase transition, RT-XRD, Ionic conductivity, LAMOX.*

1. INTRODUCTION :

Among the oxide ion conductors, $La_2Mo_2O_9$ is promising one because of its high ionic conductivity at a relatively lower temperature 800^0C, the order of which is same as that of yttria stabilized zirconia at 1000^0C [1].The phase transition from monoclinic (a) to cubic (ß) phase gives rise to the high ionic conductivity at around 580^0C, which is also a barrier for the potential application of $La_2Mo_2O_9$ as a solid electrolyte[2].Various substitutions have been performed at both La and Mo-sitein the parent compound to obtain the high conducting cubic (ß) phase at room temperature. This is popularly known as LAMOX family. Partial substitutions of isovalent dopants like rare-earth elements Bi, etc. or aliovalent dopants like Sr, Ba, etc. suppress the phase transition which is characteristic feature of the parent compound [3-11]. Similarly, doping of W at Mo-site retains the high conducting phase at room temperature and also it is reported to be useful in low oxygen partial pressure environments [2, 12-14].Apart from W, doping with other elements like Cr and V at Mo-site also stabilize phase transition in $La_2Mo_2O_9$ [2, 15-18]. Nb at Mo-site has also been tried by various groups but there is ambiguity regarding the enhancement of ionic conductivity and the solubility limit of Nb at Mo-site [15, 16, 19].

To resolve the conflicting reports, in this work we have substituted Nb at Mo-site of $La_2Mo_2O_9$ and presented its effect on structure and electrical properties of the parent compound.

2. MATERIALS AND METHODS :

2.1. Synthesis

Solution combustion route has been followed to obtain the compositions $La_2Mo_{2-x}Nb_xO_{9-\delta}$ (x=0.025, 0.050 and 0.075). The detail of synthesis is given in references [18]. Briefly, in 20 ml distilled water required amounts of Lanthanum Nitrate Hexahydrate (LobaChemie, 99%), Ammonium Molybdate Tetrahydrate (LobaChemie, 98%), Glycine (LobaChemie, 99%) andAmmonium Niobate (V) oxalate hydrate (Sigma Aldrich, 98%) were mixed and heated at 80^0C. This resulted in gel which was fired and powders were obtained for calcination and sintering. Pellets of powder were prepared and fired at 1000^0C for 12 hours duration.

2.2 Characterization

RIGAKU ULTIMA IV (Cu-Ka radiation of wavelength 1.54059 Å) was used to obtain XRD patterns at room temperature.

Electrical characterizations of the specimens were carried out with the HIOKI-LCR TESTER 3532-50 in the temperature range 200^0C to 750^0C with frequency limit 42 Hz to 5 MHz.

3. RESULTS AND DISCUSSION

3.1. XRD

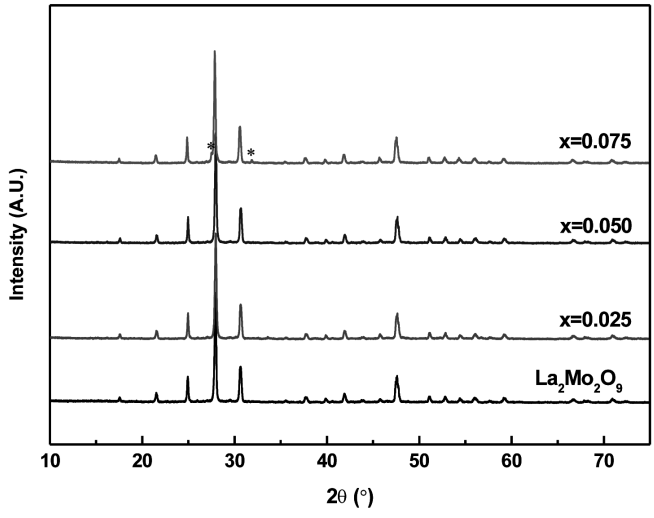

Fig. 1(a): Room temperature X-Ray diffraction data of the compositions $La_2Mo_2O_9$ [18] and $La_2Mo_{2-x}Nb_xO_{9-\delta}$ (x=0.025, 0.050 and 0.075).

Figure 1(a) shows the XRD patterns of the parent and doped compounds at room temperature. The XRD patterns of doped composition x=0.025 and 0.050 indicate the pure phase formation at room temperature while in the case of the composition x=0.075, reflections corresponding to secondary phase of $LaNbO_4$ appear at Bragg angle $2\theta \approx 27.495°$, 31.85° (JCPDS 81-1973).This leads to a conclusion that at sintering temperature 1000^0C, the solubility limit of Nb is 3.75%.

The presence of superstructures at the characteristic peak $2\theta \approx 47°$ [2] are observed for the compositions $La_2Mo_{2-x}Nb_xO_{9-\delta}$ (x=0.025, 0.050 and 0.075), as shown in Figure 1(b), indicating the existence of monoclinic to cubic phase transition in the Nb incorporated compounds.

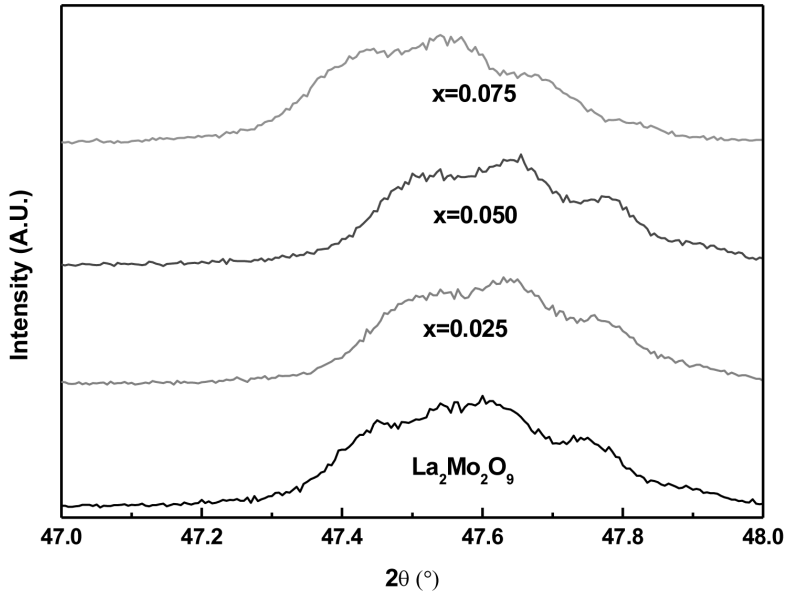

Fig. 1(b): Enlarged characteristic peak at $2\theta \approx 47°$ for the compositions $La_2Mo_2O_9$ [from 18] and $La_2Mo_{2-x}Nb_xO_{9-\delta}$ (x=0.025, 0.050 and 0.075).

Table 1: Parameters obtained from Reitveld refinement of the compositions $La_2Mo_2O_9$ [18] and $La_2Mo_{2-x}Nb_xO_{9-\delta}$ (x=0.025, 0.050 and 0.075).

Compositions	Lattice parameter a ($\dot{A}$)	Volume ($\dot{A}$)^3	Space group	Rp (%)	Rwp (%)	RE (%)
$La_2Mo_2O_9$	7.15350 (2)	366.060 (1)	$P2_13$	10.1	12.9	6.71
x=0.025	7.15402 (4)	366.143 (3)	$P2_13$	10.6	13.4	7.33
x=0.050	7.15421 (5)	366.172 (7)	$P2_13$	10.8	13.6	7.25

Reitveld refinement of the room temperature XRD profiles of the samples were carried out in Fullprof [20] using cubic symmetry (space group P213) [21] and refined parameters are listed in Table 1. The slight increment in the cell parameter as well in cell volume is expected due to the larger ionic radii of Nb^{5+}(0.64 Å) than that of Mo^{6+} (0.59 Å).Also, with the increase in Nb concentration cell parameter consistently increases.

3.2. Impedance studies

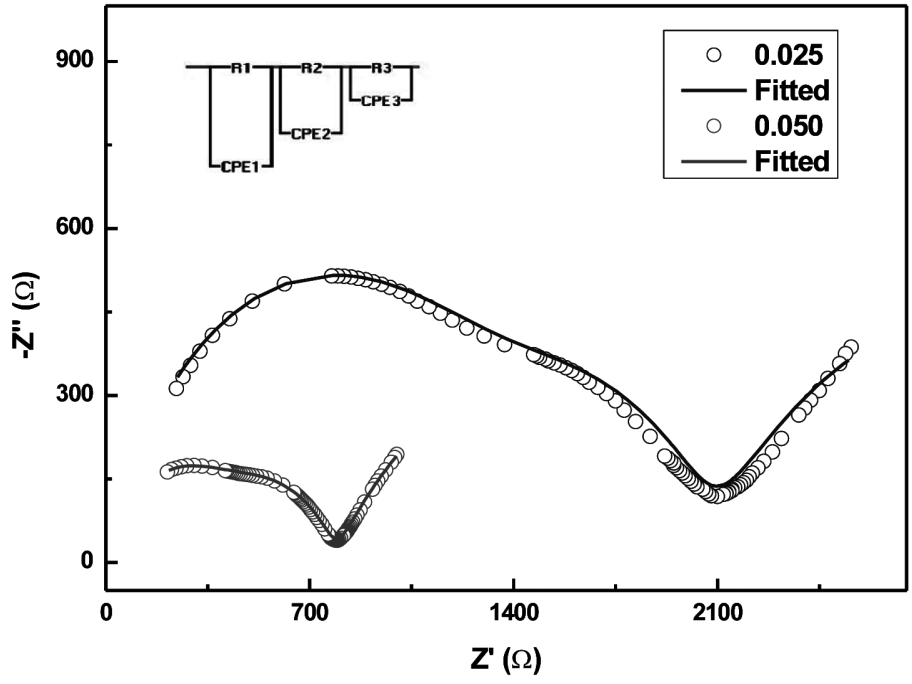

Fig. 2 (a) : Fitted Nyquist plot of the Nb doped compositions x=0.025 and 0.050 at temperature 560^0C.

Figure 2(a) represents the fitted Nyquist plot of the Nb doped compositions x=0.025 and 0.050 at temperature 560^0C. Three distinct regions are evident from the plot indicating contributions of grain, grain boundary and electrode polarization. The Nyquist plots are fitted with equivalent circuit model with circuits (R_1|| CPE_1), (R_2 || CPE_2) and (R_3|| CPE_3) connected in parallel in order to calculate grain boundary resistance (R_1) and grain boundary resistance (R_2). The fitting process was carried out using EIS spectrum analyser [22].

The ionic conductivities of the compositions were estimated from impedance plots and specimen dimensions.

The Figure 2(b) shows the temperature dependent conductivity plots of the Nb doped compositions x=0.025 and 0.050, along with the data of $La_2Mo_2O_9$ [18].

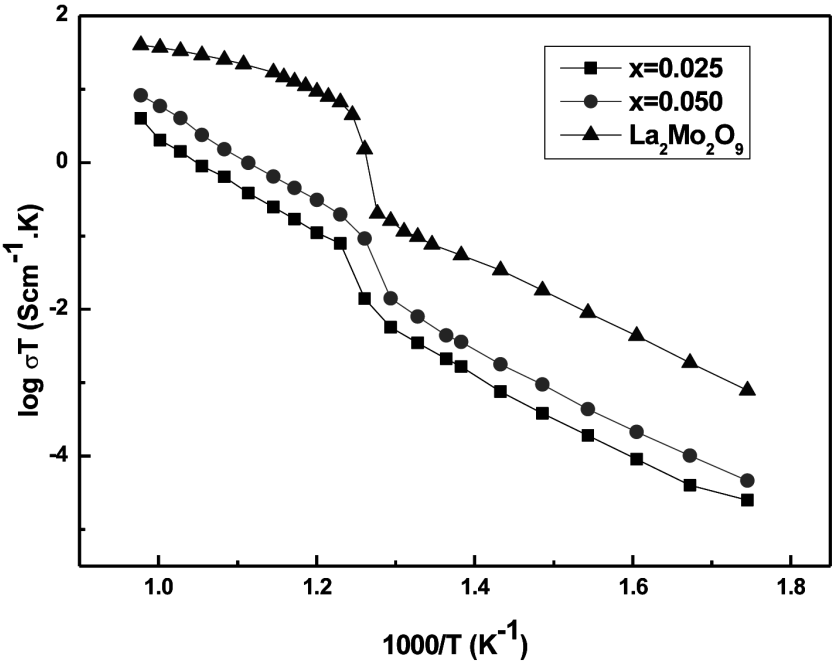

Fig. 2 (b) : Temperature dependent conductivity plot of the Nb doped compositions x=0.025, 0.050 and $La_2Mo_2O_9$ [18].

The conductivity vs temperature plots indicate the presence of phase transition from monoclinic (α) to cubic (ß) phase at temperature around 500^0C for the Nb doped compositions x=0.025 and 0.050 which implies that cubic phase was not stabilized by the incorporation of Nb at Mo-site. The temperature dependent conductivity plots of the Nb doped compositions indicates Arrhenius type behaviour and follows Arrhenius equation

$$\sigma = \frac{\sigma_0}{T} \exp\left(-\frac{E}{k_B T}\right)$$

σ_0, k_B, E represent; pre-exponential factor, Boltzmann constant and activation energy, respectively.

Table 2: Fitting parameters obtained in both below and above phase transition.

x	Below phase transition		Above phase transition	
	E_A (eV)	$ln\sigma_0$ (S.cm^{-1})	E_A (eV)	$ln\sigma_0$ (S.cm^{-1})
0	1.0004	6.609	0.580	3.5583
0.025	1.114	11.55	1.29	15.86
0.050	1.08	11.79	17.03	1.31

As can be observed from Table 2, fitting parameter $\ln\sigma_0$ increases for the Nb-doped compositions compared to the parent compound: both below and above the phase transition regime. $\ln\sigma_0$ corresponds to the oxygen vacancies concentration [18] and incorporation of aliovalent Nb^{5+} at Mo-site creates extra oxygen vacancies, which justifies the point. On the other hand, the increased activation energy barrier in the Nb-doped composition slow down the hopping of oxygen vacancies which causes decrement in overall conductivity of the doped compositions compared to the parent compound.

Upon increasing Nb concentration from x=0.25 to x=0.050, cell volume increases slightly which improves the ionic conduction by opening more space for the migration of oxygen vacancies [2]. The composition x=0.075 is excluded from the discussion as it is beyond the solubility limit.

As compared to the parent compound conductivities are found to be less in the Nb-doped compositions which is contradictory to the report of Basu et al. [19] and C. Li. et al.[16]. It may be due different synthesis technique. By increasing the sintering temperature, ionic conductivity might be improved and slightly higher solubility limit can be achieved as suggested by D. M. Lopez et al. [15].

4. CONCLUSION

$La_2Mo_{2-x}Nb_xO_{9-\delta}$ (x=0.025, 0.050 and 0.075) has been synthesized using solution combustion method. Sintering temperature of the specimens was kept at 1000^0C. At this sintering temperature the solubility limit of Nb at Mo-site is less than 3.75% as the RT-XRD pattern of the composition x=0.075 reflects secondary phase of $LaNbO_4$.Incorporation of Nb is not helpful in stabilizing the cubic (ß) phase at room temperature which is confirmed by both XRD and temperature dependent conductivity plots. This is in contradiction with earlier reports.

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SYNTHESIS METHODS OF AZULENE: THE AROMATIC CHAMELEON

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ABSTRACT:

Azulene, $C_{10}H_8$, an isomer of naphthalene, is a non-alternant non-benzenoid aromatic system. The resonance stabilization arising by the aromatic stabilization results in the five-membered ring being negatively charged and the seven-membered ring being positively charged, thus resulting in an inherent dipole moment of 1.08 D for azulene, unlike naphthalene which has a dipole moment of zero. An insight into the frontier molecular orbital diagram of azulene reveals that the HOMO and LUMO are not related as mirror images. Thus, the absolute values of their atomic orbital coefficients differ substantially, and the energy gap is smaller than anticipated, and this leads to lower transition energy. Hence, incorporation of azulene results in systems with smaller HOMO-LUMO gap. This review highlights the major developments that have taken place in the synthetic approaches of azulene starting from the first synthesis of azulene by Pfau and Plattner in 1937.

Key words : *Azulene, Aromatic, Electron, Napthelene*

1. INTRODUCTION:

Azulene, $C_{10}H_8$, an isomer of naphthalene, is a non-alternant non-benzenoid aromatic system. The word azulene comes from the Greek word "azul" which means blue, and it was named by Piesse in 1863 [1]. The structure of azulene can be viewed as a fusion of electron-rich five-membered ring and an electron-deficient seven-membered ring (Figure 1). So, the resonance stabilization arising by the Huckel's aromatic stabilization results in the five-membered ring being negatively charged and the seven-membered ring being positively charged, thus resulting in an inherent dipole moment of 1.08 D for azulene unlike naphthalene which has a dipole moment of zero [2]. Azulene is now referred as the aromatic chameleon as it displays complete opposite characterstics when compared to its isomer naphthalene which has a dipole moment of zero debye.

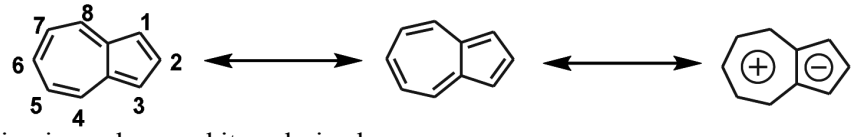


Fig. 1: Numbering in azulene and its polarized resonance

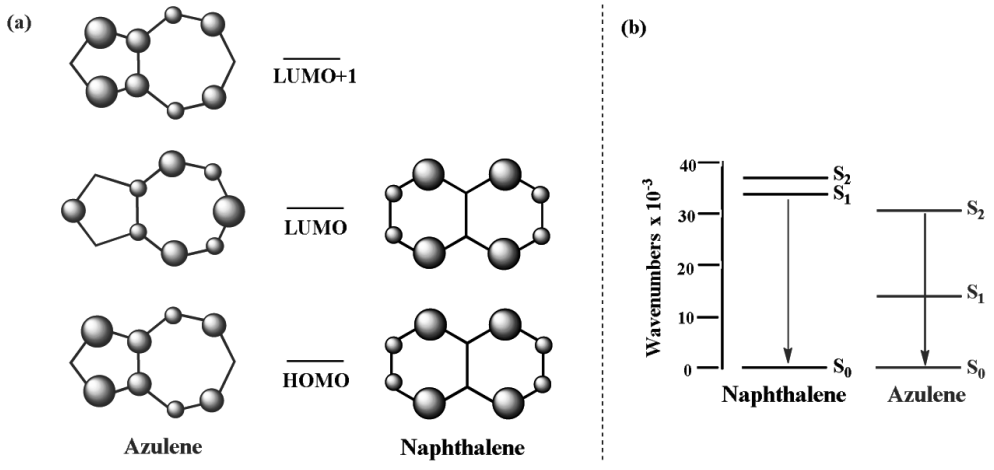


Fig. 2: (a) Probability of locating an electron in the HOMO, LUMO and LUMO+1 of azulene (left) and naphthalene (right). Spheres represent the squares of atomic orbital coefficients, (b) Unique fluorescence observed for naphthalene and azulene. (S_0, S_1 and S_2 denote the zero-point vibrational level of the three singlet states).

An insight into the frontier molecular orbital diagram of azulene reveals that the HOMO and LUMO are not related as mirror images (Figure 2a). Thus, the absolute values of their atomic orbital coefficients differ substantially, and the energy gap is smaller than anticipated and this leads to lower transition energy. Hence, incorporation of azulene results in systems with smaller HOMO-LUMO gap [3]. Azulene appears blue because of the weak $S_0 \rightarrow S_1$ transition observed in the visible range. Azulene also has a strong absorption resulting from optical transition occurring from the second excited state S_2. Interestingly azulene also violates Kasha's rule and this result in an anomalous emission from S_2 while the emission from S_1 is negligible (Figure 2b). The energy gap between S_1 and S_2 is significantly large caused by the low lying S_1. The overall effect of this is a decreased radiation less transition rate from S_2 to S_1 and hence a prominent fluorescence from S_2 to S_0 [4].

2. SYNTHESIS OF AZULENE AND ITS DERIVATIVES:

2.1 General strategies for direct functionalization of azulene

The most efficient way of synthesizing azulene derivatives is by direct functionalization of the azulene scaffold. An insight into the frontier molecular orbital diagram [5] reveals that due to

resonance stabilization, the positions 1-, 3-, 5-, and 7- are electron rich and capable of undergoing electrophilic substitution reaction whereas the positions 2-, 4-, 6-, and 8- are electron-deficient and hence capable of undergoing nucleophilic substitution reaction (Figure 3). Under the influence of an incoming electrophile the positions 1- and 3- are substituted because of their high reactivity. When treated with electrophilic reagents azulene derivatives of the type 1.1 (a-l) are easily obtained, and these derivatives can further take part in common coupling reactions to give larger conjugated systems [6].

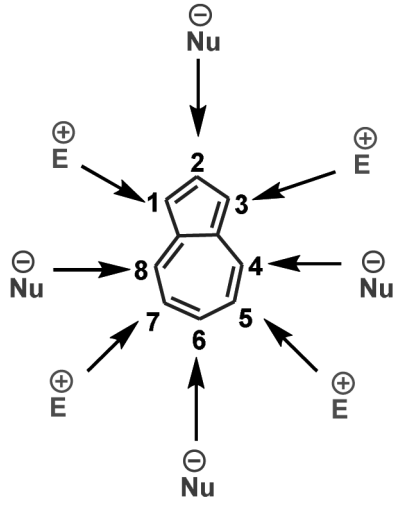
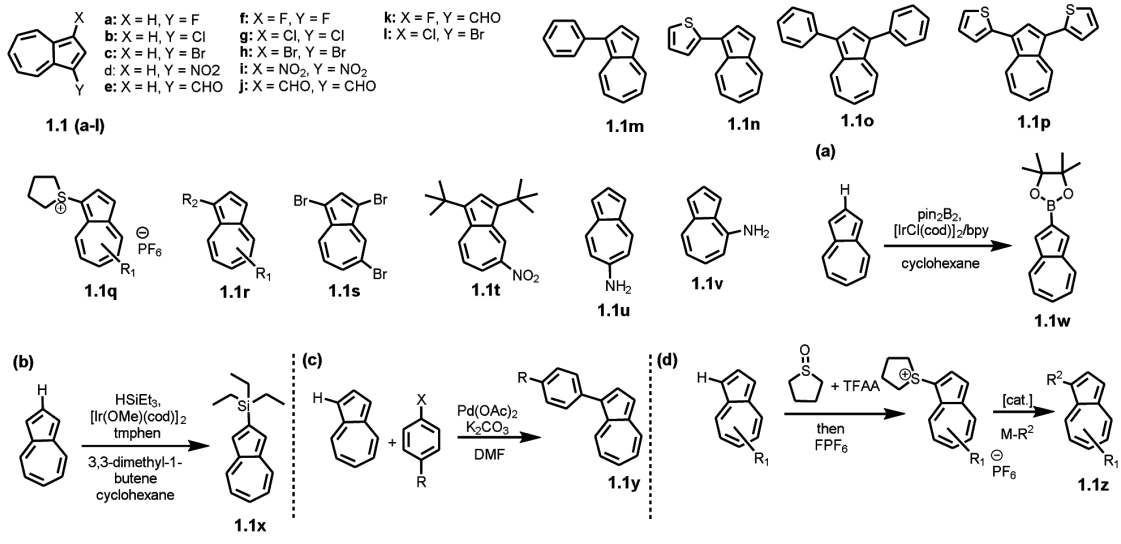


Fig. 3: Possible sites for direct functionalization of the azulene framework

Cowper and coworkers [7] reported the synthesis of azulenesulfonium salts that can undergo Suzuki-Miyaura cross coupling reaction to give larger conjugated systems. These azulenesulfonium salts can be easily prepared, purified and even stored, unlike the azulene halide derivatives. Dyker and group [8] reported the direct fuctioalization at position 1- of azulene by C-H activation method under palladium catalyzed conditions. Functionalisation of azulene by direct C-H activation under different conditions was also independently reported by Ho [9] and Murai [10].

The 5-and 7-positions are significantly less reactive and functionalization at these positions can be done only when the positions 1- and 3- are protected [11]. Nucleophilic substitution in azulene has been tricky, and generally, a mixture of isomeric products are obtained [12]. The nature of nucleophile sometimes dictates the selectivity. For example, the addition of tritylsodium occurs at

6-position, whereas methyl and phenyl lithium add to 4-and 8- positions. Earlier functionalization at the 2-position of azulene was considered most difficult. Sugihara and group reported an Ir catalyzed method for direct borylation at position 2- of azulene [13]. Takai and group developed iridium-catalyzed dehydrogenative silylation of C-H bond of azulene to yield the 2-silylazulene[14]. Both these methods are highly effective for the preparation of azulene derivatives functionalized at 2-position.



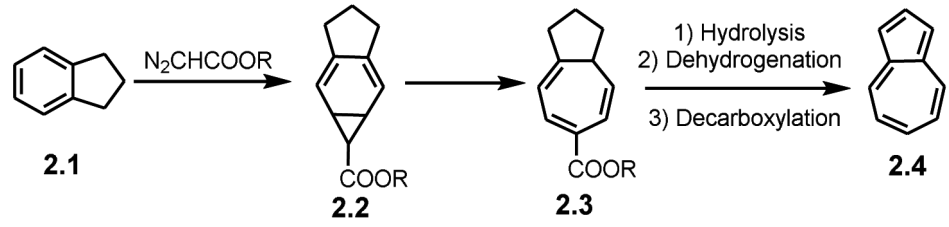
Scheme 1: Azulene derivatives obtained by the functionalization of azulene skeleton

2.2 Synthesis of functionalized azulene derivatives based on the construction of the azulene skeleton

Synthesizing azulene derivatives by direct functionalization of azulene is not a cost-effective method if considered from practical point of view. It is more advantageous to synthesize azulene derivatives with appropriate substituents at desired position. The first synthesis of azulene was reported by Plattner and Pfau in 1937 [15]. It involved formation of azulenes by ring enlargement of indanes on addition of diazoacetic ester, hydrolysis, dehydrogenation and decarboxylation of the resulting acid. The tedious dehydrogenation step limits the practical application of this method (Scheme 2). Ziegler-Hafner's azulene synthesis (Scheme 3) was highly effective for azulene synthesis, having substituents on the seven-membered ring [16]. It involved the use of a cyclopentadienyl anion along with a pyran or pyridine derivative, finally leading to azulene substituted

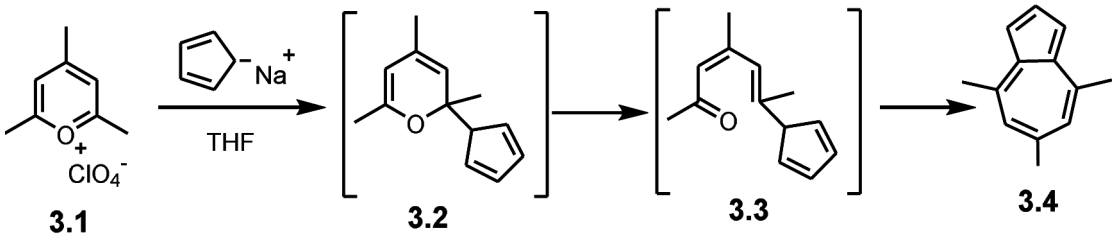
on the seven-membered ring. The most remarkable azulene synthesis was given by Nozoe and group. The method involved treating an active troponoid precursor with an active methylene compound in the presence of a base. This method leads to the synthesis of multifunctional azulene and presents a broad scope for the modification of these functional groups as shown in Scheme 4 [17].

Pfau-Plattner azulene synthesis



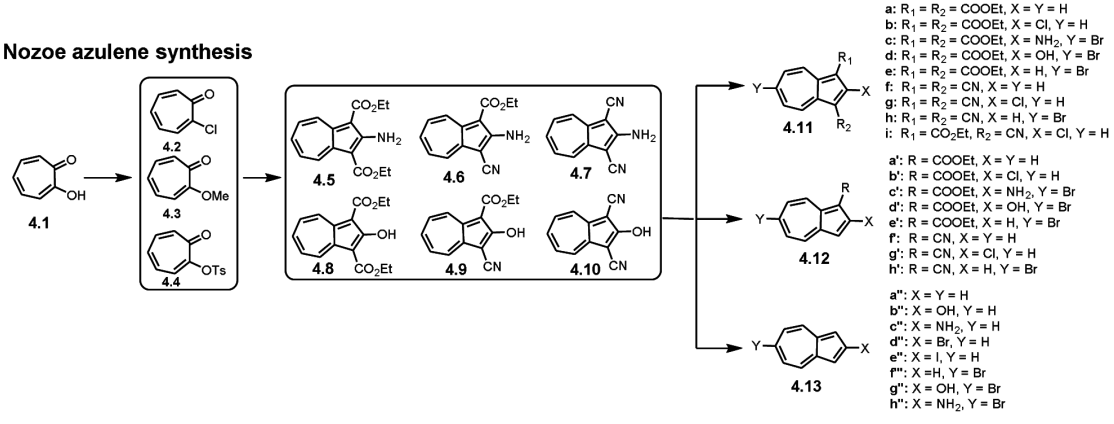
Scheme 2: Pfau-Plattner azulene synthesis

Ziegler-Hafner azulene synthesis



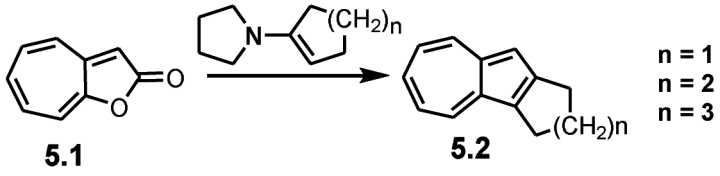
Scheme 3: Ziegler-Hafner azulene synthesis

Nozoe azulene synthesis



Scheme 4: Nozoe's azulene synthesis

Another interesting azulene synthesis was reported by Takase and group [18]. It involved the synthesis of azulene derivatives starting from 2*H*-cyclohepta[*b*]furan-2-one derivatives. In this case, the end product was a polycyclic system containing an azulene ring (Scheme 5).

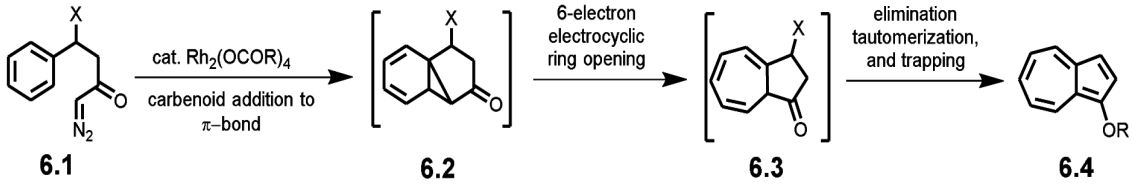


Scheme 5: Takase's azulene synthesis

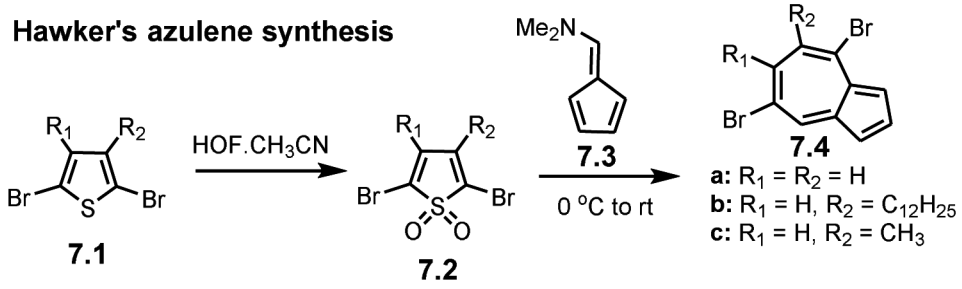
Danheiser and group reported the Rh-catalyzed ring expansion–annulation of β'-bromo-α-diazo ketones [19]. This method for azulene synthesis involved intramolecular addition of a rhodium carbenoid to an arene π-bond, electrocyclic ring opening, β-elimination, tautomerization, and trapping to produce 1-hydroxyazulene derivatives (Scheme 6).

Hawker and group presented an azulene synthesis starting from thiophene derivatives. This method is also highly advantageous considering the fact it gives the possibility of synthesizing azulene derivatives with substituents on the seven-membered ring (Scheme 7). The thiophene precursor needs to be modified in accordance with the functional group required on the seven-membered ring [20]. Nanajdenko and group reported the [6+4] cycloaddition reactions [21] of functionalized thiophene dioxides with fulvenes to afford the corresponding azulenes (Scheme 8). This approach was similar to the one reported by Hawker. Another major development in azulene synthesis has been the Pt-catalyzed ring expanding cycloisomerization [22] developed by Suemene and co-workers. It involved platinum (II)-catalyzed intramolecular ring-expanding cycloisomerization to prepare azulenes from eneynes with ortho-disubstituted benzenes (Scheme 9).

Danheiser and co-workers

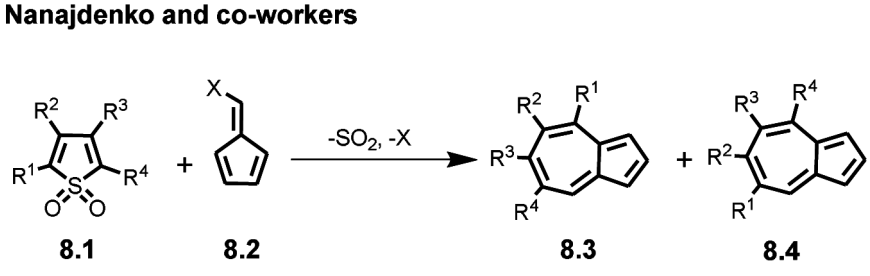


Scheme 6: Danheiser's azulene synthesis

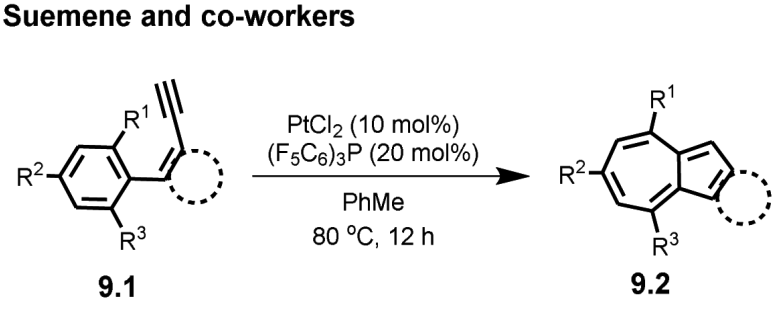


Scheme 7: Hawker's azulene synthesis

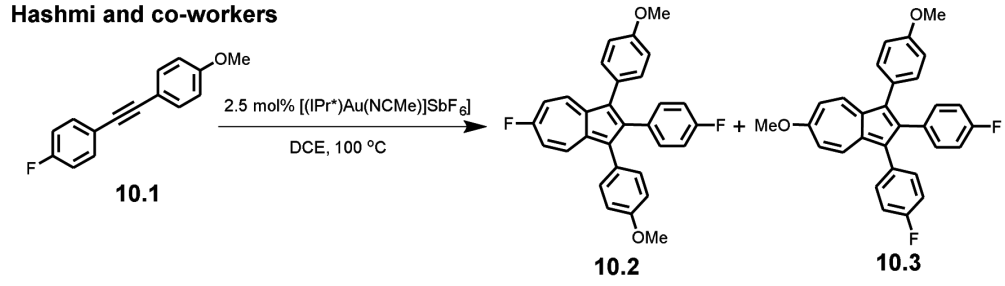
In the recent years, the most remarkable synthesis of azulene is by Au-catalyzed dimerization of diaryldialkynes [23]. In this method employed by Hashmi and group, the azulenes are formed by the dimerization of push-pull diarylalkynes having a fluorine atom at the ortho or para position, or by the dimerization of a symmetric electron rich diarylalkyne (Scheme 10).



Scheme 8: Nanajdenko's azulene synthesis

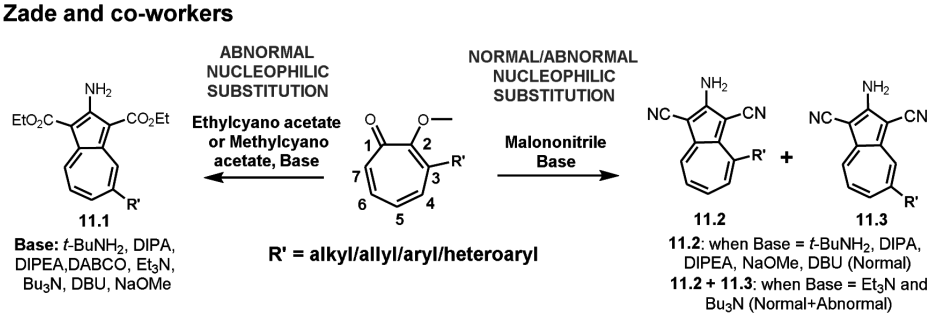


Scheme 9: Suemene's azulene synthesis



Scheme 10: Hashmi's azulene synthesis

Zade and group [24, 25] explored anomalous reactivity of 3- and 7-substituted 2-methoxytropones and developed a steric strategy to synthesize 5-substituted multifunctional azulenes. They also studied the effect of different nucleophiles and bases on the nucleophilic substitution of substituted methoxytropones and developed a regioselective synthetic strategy to obtain both 4- and 5-substituted multifunctional azulenes (11.1, 11.2, 11.3). The position of the substituents on the 2-methoxytropone dictates the mechanism and hence the product formation. Unsubstituted 2-methoxytropone forms azulene by the attack of the nucleophile at C-2 as the primary step, whereas the presence of a substituent on the carbon adjacent to methoxy group facilitates the attack of the nucleophile at C-7 and leads to the formation of steric guided 5-substituted azulenes. However, this nucleophilic substitution depends on the bulkiness of the nucleophile used. Smaller nucleophile like malononitrile gives base dependant both normal and abnormal nucleophilic attack on substituted methoxytropones (Scheme 11). The regioselective modification of the seven-membered ring of azulene is arduous due to the subtle reactivity difference among the various positions and the base and nucleophile dependant azulene synthesis provides easy access to the otherwise difficult to synthesize multifunctional azulenes. The multifunctional 5-membered ring further broadens the scope of the methodology for the synthesis of substituted azulene derivatives.



Scheme 11: Synthesis of 4-and 5-substituted multifunctional azulene: Effect of nucleophile and base on nucleophilic substitution of 3-substituted 2-methoxytropone

CONCLUSION:

Azulene, derivatives of azulene and azulene based conjugated systems are of great significance in the field of organic electronics and biology. Thus, it is highly imperative for scientists to come up with more efficient and greener synthesis of multifunctional azulene considering the future of organic electronics for the benefit of mankind. Out of all the synthesis methods of azulene summarized in this review, Nozoe's azulene synthesis is considered the most efficient method. This method involves a single step reaction and affords the multifunctional azulene in excellent yields. The effect of base and nucleophile on the nucleophilic substitution of methoxytropones explored by Zade and group is also significant in the aspect that it affords 4-and 5-substituted multifunctional azulenes in limited number of steps and in significant yield.

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ICT AND ITS ROLE IN YOUTH EMPLOYMENT OPPORTUNITIES IN ASSAM

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ABSTRACT :

The rapid urbanization is leading to an unsteady increase in youth population in metropolitan and urban areas, particularly in developing countries like India. The impacts of job and training availability, and the physical, social and cultural quality of urban environment on young people are huge, and influence their health, life-styles, and well-being. Besides this, globalization and technological developments are affecting youth in urban areas in all parts of the world, both positively and negatively. The broader aim of this paper is to investigate successful practice principles for the information and communication related training and income generation opportunities for young people to promote youth entrepreneurship. It reviews the role of ICTs for vocational skill development and employability. It discusses the issues surrounding the development of the digital divide and emphasizes types and the importance of developing ICT initiatives targeting young people, and reviews some of the successful policy implementations on ICT-based initiatives from both developed and developing countries that offer opportunities to young people for learning, skill development and employment.

Key words:- *Digital, Investigate, Physical, Skill, Unsteady.*

1. INTRODUCTION :

The rapidly advancing information and communications technologies (ICTs) helps in addressing social and economic problems caused by the fast growth of urban youth populations in developing countries. ICTs offer opportunities to young people for learning, skill development and employment. But there are downsides, young people in many developing countries lack in having broad access to these new technologies. At the beginning of the twenty-first century, there are over a billion young people between the ages of 15 and 24, of which 85 percent live in developing countries and mainly in urban settings [1]. Many of these young people are in the process of making, or have already made, the transition from studies to work. During the last two decades all around the world, these young people, as new workers, have faced a number of challenges associated with globalization and technological advances in labor markets [2]. The continuous decrease in employment in the manufacturing domain has made many of the young people facing three options: getting jobs in the informal economy with insecurity and poor wages and working conditions,

getting jobs in the low-tier service industries, or developing their vocational skills to benefit from new opportunities in the professional and advanced technical/knowledge sectors. Moreover in developing countries like India although the overall literacy rate modest, a large portion of young people are not able to choose among any of these options causing long-term unemployment, which makes them highly vulnerable.

2. KNOWLEDGE ECONOMY, SKILL, EDUCATION AND TRAINING :

The knowledge economy is an economy that can apply its fast increasing knowledge effectively in work and social situations to increase productivity and general well-being, and to create and apply new knowledge. In the knowledge economy, any country's greatest asset is human capital and nations need to take time to invest by benefiting from new technological opportunities through educational or employment programs for their people. Unarguably an important factor with regard to much of the structural unemployment in developed countries has been them is match between skills and newly created jobs [3]. In India specially in Assam more then 25% of the youth population is unemployed. Youth unemployment is affected by both demand and supply issues. Low levels of technology use have led to weak demand for better educated youth, resulting in unemployment in skilled categories [4]. India is facing scarcity of skilled human capital across most sectors. It is strongly reliant on foreign skilled workers in the areas of engineering, mining and construction. There is also a noticeable shortage of soft skills including ICT. In the knowledge era, criteria for employability are getting higher and higher every day and more advanced skill requirement is becoming a prerequisite of employment. Most importantly knowledge workers or the creative people have already gained mobility, that is to say tough global competition for high-skilled jobs [5]. Hence, providing education, vocational training and advanced skill development to young people for their workforce participation have never been that important before [6].

3. THE ROLE OF ICT FOR VOCATIONAL SKILL DEVELOPMENT :

The production and use of ICTs have become the influential force of change in the modern world. ICTs have dramatically reshaped employment markets around the world. The increasing importance of knowledge for economic development and the greater capacity to classify information and knowledge are rapidly increasing. The number of unskilled, semi-skilled and entry level jobs in a wide variety of sectors have reduced and the demand for relevant, often high-level, skills is growing. Large organizations both in the public and private sectors have shed millions of low skill required positions. For young people this has resulted in persistently high unemployment levels.

Access to Information and Communication Technology (ICT) infrastructure and services in Assam is low, particularly in rural and remote areas. The entry of private operators and aggressive competition in the mobile sector has resulted in increased coverage and access to telecommunications services. However, operators continue to roll-out second-generation (2G) mobile services, that is, basic voice and text, in rural areas rather than third-generation (3G) or higher capacity networks that offer faster data transmission (mobile broadband). Thus, access is still limited in many rural communities, and services remain very basic. Fixed broadband penetration is below 1% of the population, and remains far beyond the affordability of average citizens and small businesses. Percentage of people using internet in Assam is very low and many educational institutions are yet to start using ICT as their major aid to quality education. ICTs are playing a pivotal role in reforming the ways in which most of the traditional services are produced, traded and delivered, as well as offering opportunities for the generation of new activities and employment in many service industries [7] [8]. ICT has been extremely important in generating strongly diverging forces for the young workers. It contributed to the automation of processes making some workers unnecessary and closing off jobs many young people could have expected to begin their careers with. ICT changed the economics of many sectors reducing the importance of scale, facilitating an expansion in employment in small and medium enterprises (SMEs), and created new skilled employment opportunities through a number of ICT training initiatives [9]. In the knowledge era continuous education and training is the only way for job security, especially if the education and training is in ICT-related skills. If they demonstrate enterprise and creativity there are vast opportunities for the young people. Equitable access to information, knowledge (know-how) and education is one of the most vital principles in the emerging global knowledge economy. ICTs are practical tools in narrowing knowledge gaps between countries, regions and also people by providing new frontiers in the areas of information exchange, intellectual freedom and online education. ICT can make a great contribution to human development, but only for those that have access [10]. ICT access and usage differs mainly by socio-economic status, and not because of personal preferences, and because many crucial social and economic benefits may grow from greater access to and usage of communication technologies, such communication differences constitute a serious 'divide' between segments of a society [11].

4. THE DIGITAL DIVIDE :

The pace of technological development in the new knowledge economy has created more powerful ICTs and rising demand on workers with advanced (ICT) skills. However, just because

the technology is available does not mean everyone can get the training and develop skills in it. Those who cannot access necessary information and training, and cannot keep up with technological revolution will be left behind and vulnerable as knowledge economy has already imposed confusion in unskilled and semi-skilled employment [12]. In developed and some of the developing countries, governments and non-governmental organizations (NGOs) have been working on a wide range of ICT initiatives to close the ever growing digital divide. These initiatives include but are not limited to:

(a) Providing public ICT access through libraries and community centers;

(b) Offering ICT skill training programs

(c) Providing ICT access and training to disadvantaged target groups including people with disability and their caretakers

(d) Distributing free computer training resources through libraries, shop fronts and community centers

(e) Providing subsidized electronic gadgets to learning community through government initiatives. For instance Government of Assam is distributing low cost tablet devices to the student community.

(f) Establishing computer reuse schemes to provide affordable refurbished computers to people on low income and non-profit community groups [13].

5. SUCCESSFUL EXAMPLES AND STRATEGIES ON ICT INITIATIVES TARGETING YOUTH :

The employment market for young people has changed significantly over the past two decades under the combined impacts of globalization, market liberalization and the adoption of ICTs into work places. ICTs are playing an essential role in providing novel training and employment opportunities for youth. There are a number of successful initiatives from both developed and developing countries that endeavor to provide support for young people in developing skills and employment opportunities. Some of these initiatives are clustered and presented in eight groups. These groups include initiatives on:

(a) Providing ICT and skill training;

(b) Education through ICT;

(c) Narrowing the digital divide;

(d) ICT employment generation through entrepreneurship;

(e) Promoting public-private partnership to generate employment;

(f) Using ICT-based employment opportunities for disadvantaged youth;
(g) Bridging the gap between the knowledge economy and the informal sector; and
(h) Putting young people in charge.

6. INITIATIVES ON PROVIDING ICT AND SKILL TRAINING :

The first group of initiatives primarily focuses on providing ICT and training. ICT training could offer particular advantages to young people starting a business (i.e. SMEs) in both developed and developing countries. One of these advantages is that ICTs offer potentially low cost forms of communication with high-income markets or large domestic markets. Another one is the greater range of opportunities the application of new communication based technologies can offer for servicing the needs of the disadvantaged people (e.g. remote, poor) [14].

One of the many successful initiatives that provide skills training including ICT is the Australian Technical and Further Education (TAFE) institutions [15]. They are publicly-funded postsecondary organizations that provide a range of technical and vocational education and training courses and small business courses including niche areas, such as viticulture, aquaculture, ICTs and biotechnology. Each State and Territory in Australia has its own TAFE system, and TAFE programs provide industry-relevant, leading-edge skills that can help get people into the workplace faster, upgrade existing skills, or prepare them for further tertiary studies

Another example can be Self employed women's association (SEWA), India. It is a trade union in India for poor, self-employed women workers who earn a living through their own labor or small businesses and do not obtain regular salaried employment with welfare benefits like workers in the organized sector. Most of the members of SEWA are young women under the age of 25. SEWA's main goals are to organize women workers for full-employment whereby workers obtain work security, income security, and social security (at least health care, child care and shelter). SEWA has been one of the first organizations in India to realize the potential for harnessing ICT to help women in the informal sector. It has sought to develop the organization's capacity to use computers by conducting awareness programs and imparting basic computer skills to its team leaders .

7. CONCLUSION :

Promoting youth employment and employability requires important integrated effort that includes actions in the areas of education, skills development, job supply and support for young low-income entrepreneurs, particularly in the knowledge intensive sectors. It is clear that there is an

extensive potential for ICTs to generate employment for young people. However, this potential will not be realized unless a country has a range of supporting strategies in place, including an enabling environment. ICTs offer developing countries the opportunity to close the gap with developed countries and narrow the global digital divide. Applying ICTs in education is a key to provide young people with ICT skills. The participation of young people in the development and implementation of initiatives involving the use of ICTs to generate employment is likely to be a key factor in the success of such initiatives. Mentor support for starting ICT-related enterprises is an important service that governments, NGOs or international organizations could organize to provide advice and guidance to young entrepreneurs. Partnership with international organizations such as United Nations and its agencies may help in implementing new best practices. Investing only on technology is not the solution of the young population's problems, investing on social and human capital makes a better change.

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REFORMER SANKARDEVA : A SOCIOLOGICAL ANALYSIS

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ABSTRACT :

The contributions of Mahapurush Srimanta Shankardeva to the Assamese society were worthy to mention in true sense. He was considered as the stalwart of Assam for his outstanding contributions in terms of literature, culture, social upliftment and progrssive religious thoughts. Sukapha, the founder of Ahom kingdom in the Brhamputra valley laid the very fundation stone of unity and integrity among the people of Assam in political line and it was none but Shankardeva who left no stone unturned to unite Assam through his vibrant mode of socio-cultural ideologies. Shankardeva ushered a new era in Assam during 15th and 16th century through Neo-Vaishnavite Movement which not only limited to religious sphere but also touched all contemporary social issues and lecunas prevailed on the society. His Neo-Vaishnavite movement germinated and developed new ideas regarding social reforms and unification of greater Assamese society instead of age old superstitons and beliefs. His progressive ideals not only raised strong opposition against prevailing situations but also tried his level best to uproot it through his liberal outlook. He was not merely a religious preacher, at the same time he was a genuine social reformer of medieval Assam. He tried to establish a progressive society on the basis of his dynamic socio-religious ideoglogies. In true sense Shankardeva was the "Morning star" of socio-cultural and religious emancipation in Medieval Assam.

Keywords: *Integrity, Neo-Vaishnavite, Geminate, Progressive, sphere*

1. INTRODUCTION:

Sankardeva, an immensely gifted genius, blessed this pristine land of Assam in the 15th and 16th centuries with his theological teachings, blended with various colours of social and cultural elements. The people of medieval Assam were curled in the wreath of Tantraism, illiteracy, lingering amidst caste discriminations and socio-political segregation and conflicts. The great saint, Sankardeva not only spread the cult of Bhakti Movement in Assam but also enriched the people socially, culturally and laid the foundation of a greater Assamese nation. Prior to Sankardeva, the socio-cultural and religious aspects of Assam were blurred with some unscientific and age old traditions and beliefs. It was Sankardeva who educated people of Assam with his new ideas and appealed all people to give up those outdated and uncultured traditions. The Neo-Vaishnavite

Movement spearheaded by Sankardeva is remarkably brought a great socio-cultural revolution in medieval Assam. It paved the way for social unity and integrity in Assam among the common people to a large extent. His liberal and utilitarian ideologies were not only limited to religious sphere but at the same time it ushered a new era in terms of social reforms and organization. He left no stone unturned to uproot all outdated socio-religious customs from Assamese society with his modern, updated and scientific line of thinking. He was against the idol worship and opened his door to all religions and brought a kind of renaissance to the socio-cultural and religious life of Assam.

2. AIMS AND OBJECTIVES:

The present study is analytical in nature and the main objectives of the study are as follows:

(1) To assess the socio-cultural and religious reforms of Sankardeva during Medieval Assam
(2) To study about the core values of Neo-Vaishnavite Movement in Assam.
(3) To analyze the feminist approach of Sankardeva.

3. METHODOLOY:

In order to prepare the research paper a historical and analytical method has been used. Maximum data have been collected from the primary as well as secondary sources. Secondary sources are in form of different books written by different scholars, articles published in different journals, internet etc. All collected data and sources have been critically analyzed.

4. FINDINGS AND ANALYSIS:

The Neo-Vaishnavite Bhakti movement ushered an epoch making chapter in the history of Medieval Assam. It marked a new beginning not only in the field of literature, culture and religion but also steered the ship of Assam during the period of transition. In the field of idol worship and practice of unscientific norms and values, Sankardeva strongly raised his opposition during medieval Assam and he was always in favor of a progressive and utilitarian society in Assam. During those days tantric way of worship prevailed throughout Assam and irrespective of different strata of society and common people used to observe and follow outdated traditions like human sacrifices and worship of various gods and goddess in idol form. Meanwhile, Jagatguru Sankardeva preached and propagated the core values of monotheism i.e. the worship of lord Krishna or Vishnu among the people of Assam. It was indeed a hercules task for Sankardeva to make people aware with these rational ideology. Through his writings and oratory skills he disseminated outstanding teachings among the people that one can easily venerate and worship lord Vishnu or Krishna without scarifying

other living being. Instead of this, he argued that with pure devotion and dedication one can worship their supreme being through *Sarvana* and *Kirtana* i.e. listening and chanting. Sankardeva could very well verse with the fact that maximum people of Assam were illiterate and with a view to make them out he quoted

"Onya devi dev nokoriba heb
Nakhaiba Prasad taar
Murtiku nosaiba grihoo nopokhiba
Bhakti hoibo biyobhisar (Bhagawata/2/545)

In terms of social reform and upliftment in Medieval Assam was concerned, Sankardeva played an anchoring role. During those days, racial discrimination was strongly followed by the people of Assam. Only Brahmin and *Kayastha* disciples were allowed to admit in the *Tols* for intellectual exercise and discourse. He strongly denounced racial discrimination in contemporary society. *Varna* system and castism was prevalent among the people and egalitarian means of social order was absent in those days. Meanwhile, Sankardeva started *'Ek sarana nam dharma'* or *Ek sarana bhagawati dharma'* in order to eradicate racial as well as social discrimination in Medieval Assam. He undertook some revolutionary and far reaching measures for the same. In 1468 A.D, Sankardeva established the first *'Kirtan Ghar'* at Tambuwani and by degrees it became a pillar of the social life of Assam. It served not only a centre of religious, cultural and social assimilation but also championed the cause of social justice among the people of Assam. Establishment of *'Kirtan Ghar'* made deep and far reaching impact on the daily life of the people in Medieval Assam because it allowed everyone to assemble, sit and participate in religious discussions irrespective of their caste and class barrier. Sankardeva provided all sort of social freedom to the so called lower category people and also provided them the opportunity to raise any query. Sankardeva was genuinely a socialist minded person; his brother got married to a lower category woman which truly reflected his attitude towards contemporary social order. It was Sankardeva who tried his level best to spread the message of social and communal harmony among the people of medieval Assam. He expressed his cordial sense of affection and love all deprived caste and class in Medieval Assam. One of his favorite disciples Paramananda was belonged to the *Mising* community which indicated his level of liberal outlook and thinking. Apart from this Govinda of *Garo*, Modhai of *Jayantia*, Jayananda of *Bhutiyas*, Naruttom of *Nagas* and Chandsai of *Muslim* accepted the ideologies of Neo-Vaishanvism and took *sarana*. It is worthy to mention that Sankardeva became the first person in the Brahmaputra Valley who tried to build

a bridge of communal harmony and peace among various scheduled castes and scheduled tribes of Assam. His valiant effort subsequently helped to form a strong Assamese nation. He made sincere appeal to the people of Assam to give up all demonic and evil practices in the name of religious practice.

"Heno jani oshura swabhav sobe ari
Hamosto pranik puja bishnu buddhi kori"

Sankardeva was a great schloar and an educationist. He could very well realize the ignorance and illiteracy of the people during 15th and 16th century. To disseminate the teachings of Neo-Vaishnavism among the people, he extended the knowledge of social and moral science to them. It was really praiseworthy that Sankardeva put ample insist on professional and vocational education to the people of Assam and he personally set a great example because Sankardeva himself was a great artist and architect of Medieval Assam. By performing his drama *'Chihna Yatra'* Sankardeva introduced *'Khul'*, a form of folk instrument in Assam. He was excelled in weaving activities too and took some far reaching steps for the greater interest of the *Tanti* community people of Borduwa. With the help and great cooperation of the people of Tantikuchi, Sankardeva beautifully designed and completed the famous '*Vrindabani Bastra'*. It was indeed a great milestone in the cultural and social history of Assam. He depicted the life and activities of lord Krishna on the *'Vrindabani Bastra'* in a magnificent manner. Contemporary Koch king Naranarayana, highly appreciated the marvelous work of Sankardeva. He worked for the development of cottage industries in the *Satras*. Moreover artisans were trained to manufacture traditional items like *xarai, thaga, garudasana, mayurasana* etc.

It is noteworthy to state that Sankardeva was a leading feminist of Medieval Assam. During 15th and 16th century, the position and status of Assamese women were not at all sound socially. Being a prolific social scientist Sankardeva inspire women section to take part and cooperate in activities like *naam kitran, xarai laguwa* etc. Except Neo-Vaishnavism, the same was not granted by the other contemporary religious cults of India. Even Sankardeva allowed married and unmarried women to accept *Ek sarana Naam Dharma* and to take *Sarana.* After the death of Sanakardeva the tradition of *Sarana* was carried out by Kalindi Aai. He offered crucial space and scopes for women to highlight their skills and inherent talents and for this woman like Padmapriya and Kanaklata could contribute to the mainstream socio-religious order of Assam. He compared women with fire for their tremendous mental force. During this period women also played a vital role for propagation of the teachings of Neo-Vaishnavism in Assam. In his famous creation *"Uttarakanda*

Ramayana" Sankardeva analyse the character of *Sita* whereby he raised his voice for women's right and justice. He portrayed the character of Devi *Sita* as a means of protest. Thus, Sankardeva initiated a new herald in the field of women emancipation.

On the other hand, Sankardeva was concerned with issue of public health to a large extent. His ideology of Neo-Vaishnavism was based on proper scientific lines and for this he suggested to observe some physical activities which had tremendous impacts on common people of Assam. *Maah* and *Prasad* was used extensively during the time of *Kirtana* had some terrific medicinal qualities and very suitable for health. All particles were very beneficial for health. Apart from this Sankardeva introduced famous *Sankari Dance* form to spread the message of his religious cult among general masses. It is evident from the Sankari dance that it has a close relationship with *Yoga.* These dance forms and songs like *Borgeet* enebled to maintain not only physical fitness but also mental peace of order. Holy songs like *Borgeet* can be considered as a form meditation during medieval period. Moreover, Sankardeva also put stress on the eating of vegetarian items like banana, moog, coconut, ginger, rice etc. because these are very much suitable for the climatic condition of Assam and also tribal people were accustomed to these items.

5. CONCLUSION:

At length, it is clear that Sankardeva was far advanced in compare to his period. It was only Sankardeva who took remarkable and bold steps to uplift the status of deprived, oppressive and untouchable section our society. Mahatama Gandhi raised his voice agnist social discrimination and injustice during the 20th century India but before Gandhiji it was Sankardeva who ventilated his grievances during 15th and 16th century in the context of Assam. He also received tremendous success against recial and social discrimination. He became the first person who tried to unite all tribes of Assam with the chain of social harmony and mutual respect. He laid a strong foundation of greater Assamese nation with his vibrant mode of socio-cultural entities. His humanitarian ideology is quite memorable for all of us. By following the ideology of unity in diversity Sankardeva undertook some significant socio-cultural and religious reforms which strengthened the process of nation building in Assam. Thus, by dint of Sankardeva, a platform of progressive and egalitarian society was created in Medieval Assam.

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INTERVENING HETERONORMATIVITY: A STUDY OF SHYAM SELVADURAI'S *FUNNY BOY* AND RAJ RAO'S *THE BOYFRIEND*

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ABSTRACT :

This paper brings out the subsistent, 'natural' heterosexuality, the subsequent heteronormativity, and studies the underlying mechanisms that structure and construct heterosexuality as the 'norm,' something which is 'natural.' It is a truth universally acknowledged that homosexuals or individuals who are not gender conforming or who does not recognize themselves to the fixed gender and sexual norms have always been categorized as the 'odd,' 'strange,' 'psychotic,' hurling all those adjectives that are derogatory in nature. Therefore, the paper is an attempt to highlight the struggle and survival strategy of such non-conforming individuals. Moreover, the study of certain characters in both novels reveals how sexuality and gender are fluid, unstable, and a performance of specific actions by which one comes to be recognized as a male/female. It is significant to note that while two novels, namely, Shyam Selvadurai's Funny Boy(1994) and Raj Rao's The Boyfriend(2003), have been taken up for this study yet the homosexual disgust/ homophobia is far worse and inhumane which all of humanity needs to acknowledge and work for equal rights to life and choice.

Keywords: *Heteronormativity, heterosexuality, gender-performativity, homophobia, queer.*

1. INTRODUCTION :

"I took the road less traveled by
And that has made all the difference."

Since the dawn of civilization, the man-woman relationship has been conceptualized as the ideal natural bond and our society along with its institutional forces such as politics, religion, law, marriage validates this exclusive argument. History bears witness as to how individuals who do not conform or wish to follow pre-established norms of sex, sexuality and gender is not a myth but a reality. Such individuals are marginalized and cornered to a closet whereby they are seen as abnormal, unnatural, and as outlaws. This paper will study the survival strategies of such 'unnatural' or 'non-conforming' individuals, their spaces of self-assertion, and their miserable plight in a heterosexual world. For this study, we take up two novels viz., Shyam Selvadurai's *Funny Boy* (1994) and Raj Rao's *The Boyfriend* (2003). Sexual binary of man/woman and pre-established

norms have always been an ever cruising dominant structure whereby all the values and morals are constructed in society. Our society, which is irrefutably patriarchal, or if I may use the term 'hetero-patriarchal,' channel these binary norms through which heterosexuality has come to be seen as the only 'natural' form and condition of sexuality. Laws of the land have always condemned sexual acts that do not reproduce and denounced such 'nefarious' actions as being against God and nature.

Therefore, such ill-practices and misconceptions result in the shaming of non-conforming individuals, criminalizing those involved in such 'unacceptable' activities. This is where queer intervenes and associates itself with every 'unnatural' and attempts to deconstruct sexuality and gender. To destabilize what 'natural' is, or what 'normal,' 'normative,' 'normativity' exemplify and has culminated into, occupy the locus of the queer.

2. METHODOLOGY:

This study will take up Queer Theory and draw on ideas of notable theorists as well as critics such as Michel Foucault, Anna Marie Jagose and Judith Butler as the theoretical framework. Queer Studies, as a field of study, is a broad area that brings together poststructuralism, gender, and sexuality studies, queer theory, which eventually explore and analyze critically the representation of the queer individuals. Queer encompasses all that escapes the 'natural' label of heteronormative society and maybe said as an umbrella term where multiple identities come together as one to tackle the dominant and compelling heteronormativity. According to Eve Kosofsky Sedgwick, "queer" is a non-normative category that is always open to possibilities, and remains undefinable, fluid in character and do not signify anything which is monolithic (*Tendencies* 8).

Also, Teresa de Lauretis who is a well-acclaimed academician and critical theorist, credited to have coined the term 'Queer Theory' defines queer or what it means to be queer in her essay 'Queer Theory: Lesbian and Gay Sexualities' by providing three critical insights. To paraphrase de Lauretis, queer is the denial of the benchmark of heterosexuality as the norm for all sexuality; it is also an awareness or attentiveness to gender capable of interrogating all the said assumptions that homosexuality, gay and lesbian studies are a single, homogenous object, and queer is also a determined force to show how race crucially shapes and forms sexual subjectivities in not one but multiple ways. Incorporating the tenets of poststructuralism and Foucault's concept of sexuality and Judith Butler's concept of 'performativity,' Queer Theory challenges any binary opposition and accepts differences and gender fluidity. Most of us need to understand that queer individuals are not mentally unstable or possessed by an evil spirit; instead, being queer reflects that binaries of gender or sexuality are a constructed entity.

3. RESULTS :

The novels exemplify the stigma related to any deviance in gender or sexuality and the societal disgust towards such queer individuals. It is little, and as seen in most parts of the world, there is no acceptance and no social space for individuals who do not conform to gender roles or heterosexuality. Therefore, the need to make people aware and educate about the openness and varied possibilities of sex, sexuality and gender norms other than man/woman binary and heterosexuality remains an absolute necessity. Also, the need to create a fluid, a more accepting space vis-à-vis a queer space is necessary to facilitate those marginalized and bring them to the forefront. These queer spaces should challenge the overarching power structure of heteronormativity and heterosexuality, which perhaps is not the 'norm' or the 'center.' Nevertheless, it remains a formidable challenge indeed for all the queer individuals in their life long quest to establish themselves not merely as gay, lesbian, trans, or any other but as humans living life as they wish or choose to live. Meanwhile, this queer voice of resistance is also dealt with in literature. Literature, which is often said to be a mirror to our society, echoes queer subjects, their assertion of a queer space, and their life-long battle with the hetero-patriarchal organization.

No doubt, the presence of the queer has been there in the literary domain, but the outright representation of queer society, politics, culture, and queer subjects entered the literary discourse and narrative framework in the late half of the twentieth century. In this regard, both Shyam Selvadurai and Raj Rao in their texts, *Funny Boy* and *The Boyfriend,* respectively, have fearlessly taken up the queer way of writing. They present before us how people who do not wish to conform to the hetero-patriarchal standard and norms struggle, experience shame and their strategy to live, resist and exist with all their queer identity despite the dominating 'natural' heterosexual, heteronormative society.

4. DISCUSSION :

As postcolonial nations, both Sri-Lanka and India have suffered the colonial brunt of power, oppression, and identity politics. This is evident if we study the inhumane laws framed during those colonial times to suppress people and resisting individuals. Since both Sri-Lanka and India have been colonies of the Empire, the British colonial rules dictated life. More particularly, non-conforming individuals were under severe attack. The colonial laws criminalized homosexuality or anything that seemed deviant and misfitted the pre-established heterosexual, heteronormative, hetero-patriarchal domineering view. Article 365, 365A of the Sri Lankan Penal Code and Indian Penal Code's Article 377 were extensions of the British Colonial laws enacted in both these lands in the year 1885 and 1860, respectively. All these laws criminalized 'unnatural' individuals and prohibited any sexual behavior which did not pro-create or was seen as an aberration such as

'carnal intercourse.'This argument here validates the fact that our land, the spaces we exist, are hetero-spaces where there is no liberty for any 'other' space. The Supreme Court of India, on 6th Dec. 2018, provided a massive relief when it decriminalized Section 377 as 'unconstitutional' and 'in so far as it criminalizes consensual sexual conduct between adults of the same sex.'

On the contrary, Sri Lanka has not decriminalized 365, 365A yet. While the decriminalization of Section 377 is a glorious achievement, the question remains whether homosexuals/queer individuals are free to express themselves, or they are still seen as 'abnormal,' 'unnatural,' and suffer societal shame. *Funny Boy,* published in the year 1994, situates its story in the Sinhalese-Tamil riots, and the storyline of *The Boyfriend* is set in the backdrop of the 1992 Hindu-Muslim Bombay riots. Shyam Selvadurai's story is more of a queer/homosexual bildungsroman where Arjie, the protagonist, is seen to be a non-conforming individual who does not fit into the 'norms' of what or how a boy must be or ought to be. Biologically a male, Arjie is inclined towards the constructed 'feminine' or 'femininity.' He is seen to situate himself more comfortably in a feminine space. In this regard, he is 'queering' the male space and deconstructs the male/female binary of the society. He seems to be attracted and fascinated by the 'female traits' or 'the girls' territory' as we find in the novel. The game of cricket is not his concern, while all his cousins (boys) are keenly interested. What excites him and what he is interested in is the 'bride-bride' game. Arjie declares, "For me the culmination of this game, and my ultimate moment of joy, was when I put on the clothes of the bride" (4)

His actions, in fact, dismantle binary norms, enabling us to rethink the notions of gender as well as sexuality. He is a misfit in the pre-conceived idea of 'male identity.' Tanuja, his cousin, represents the societal mindset of the male-female dichotomy. Although young, she has a clear view of the gender roles, and she denounces her cousin Arjie for being a bride. She asserts, "A girl must be the bride" (11). It is to be noted that gender norms have been 'normalized,' 'naturalized' to such an extent that one does not feel like they are thrust upon us by society but an innate part of our lives. Judith Butler, in *Gender Trouble: Feminism and the Subversion of Identity* (2006), writes how gender as well as sexuality are a 'performative construct' and not something which is fixed or innate within us. We learn how to become a man, woman, heterosexual, or homosexual. Echoing Michel Foucault, Butler claims that these identities are constituted and formed as a result of the multiple discourses that society facilitates; discourses of medicine, law, science, religion, and so on. Our society cannot accept non-conforming individuals such as Arjie or Soyza. Instead, they become the 'laughing-stock,' a project of 'shame.' Coming back to the Yudi-Milind love complex in *The Boyfriend*, both Yudi and Milind are different from what Arjie is but somehow caught in the cobweb of gender roles. The constant exertion of how or what 'man,' 'manliness,' or 'manly' constitutes pervade their discourse. Milind's marriage is the quintessential example of

how heterosexual roles and heteronormativity is validated in society. There are no doubt innumerable instances that exhibit the pre-set gender norms. One instance is in Chapter 10 when Yudi comes looking for Milind at his home and does not find him, Yudi is about to break down. Milind's parents recall Yudi and say, "What kind of womanly man is your friend? He was almost in tears when we told him you had left home" (207).

In a heterosexual society, one cannot escape the gendered norms, and thus, any non-heterosexual behavior will be under scrutiny, criticized, and even shamed or punished. This is where queer intervenes to tackle heteronormativity or conformist roles and agendas. Having said this, the spaces where the homosexuals/queer characters in these two texts express their sexuality and their true-self are not entirely amidst the heterosexual society but in the reconstructed spaces of their own. To highlight, garages, school toilets, Soyza's room are spaces of homosexuality in *Funny Boy*. Likewise, Azad Maidan, local trains, specific public toilets, cafes, bars, and clubs that facilitate queer individuals, Yudi's room in Nalla Sopara, are sites of sexuality in *The Boyfriend*. The question that looms is whether they escape the heterosexual, heteronormative 'panopticon' that lurks to punish any 'non-conforming' behavior. The answer, without any doubt, is negative. All the queer individuals/homosexuals here, be it Arjie, Soyza, Yudi, or Milind, fear that hetero-society would not be able to accept the 'unnatural' activity in which they are involved. Yudi's fear of his maid, Saraswati, that compels him to ask Milind to leave his place for an hour portrays the 'shame' and 'unacceptability' associated with homosexuals. Queer individuals, homosexuals, in this case, are in constant fear; heterophobia.

Jimmie Manning in *Heterosexuality* says,

> Heterosexuality is so successfully established as normal and natural in everyday communication that the notion of homosexuality does not really exist in the minds of most people, especially as a sexual orientation for oneself (3)

In the space in which we exist, the social, physical and mental space, heterosexuality and heteronormativity is being constituted as well as reconstituted through spontaneous enactments. Butler talks about this in *Gender Trouble,* and she deciphers how heterosexual space is in constant formation and institutions such as marriage, laws conform again and again to such views. The validation of a relationship in our society, which marriage attributes, is what Yudi and Milind enact. Marriage as a hetero-patriarchal institution has been under attack even with the feminists, and the constant push to marriage, mostly in Indian society, is a clear example of the heteronormative mindset. Reproduction or reproducing mechanism is associated with the 'norm,' 'natural,' and the society, as well as the culture, mandates it to the individuals. Michael Warner in *The Trouble with Normal Sex, Politics, and the Ethics of Queer Life* sees it as the mechanism of 'moralism(s).' He further states,

> The secular argument persists as well: though few people still think that the preservation of the species is a law of nature that has to be executed in every orgasm, they do still think that marital hetero sex has a rationale in nature, however Darwinian, and that it is therefore normative. These alibis of sexual morality crop up everywhere, from common prejudice to academic psychology. Popularized versions of evolutionary biology are enjoying quite a vogue now because they seem to justify the status quo as an expression of natural law. Perhaps we should call it moralism, rather than morality, when some sexual tastes or practices (or rather an idealized version of them) are mandated for everyone (4)

To state further, queer does not oppose heterosexuality/heteronormativity or supports homosexuality/homonormativity but pioneers the right for every individual to be open and liberal to varied views where sexual or gender norms do not intervene, penetrate. The hegemonic patriarchal structure and heteronormative establishments have been imbibed in our societal roots deeply. What we need to do is 'queer' subjects; look at things 'queerly' without any pre-conceived set of ideas and norms, deconstructing and demystifying sex and gender as given essences. Raj Rao brilliantly advocates the homosexual/queer history of Indian culture by invoking the Krishna-Sudama myth and also by mentioning Ramakrishna-Vivekananda, associating Yudi-Milind homo-relationship, where Yudi belongs to high class and Milind is a Dalit boy, thus queering history as well as the subjects. Both *Funny Boy* and *The Boyfriend* tells the story of the marginalized homosexual/ queer individuals along with the issues of class struggle, racial discrimination, poverty, inner-conflicts and how amidst all these hetero-patriarchal clouds of heteronormativity, their limited space and identity is cautiously negotiated, re-negotiated.

At this point in time, where heteronormativity is taken and accepted as the 'natural,' any deviation or creation, construction of any space, let alone queer space seems a Sisyphean task. Berlant and Warner in "Sex in Public" rightly assert the multitude amalgamation of practices which is not necessarily 'sex' and a world where this hegemonic cluster would not work and be dominant remains an unimaginable task at this point (557).

5. CONCLUSION :

In this process of intervention and countering the heterosexual boundaries, Shyam Selvadurai and Raj Rao have undoubtedly created a queer space through their works and have tried to give a voice to the homosexuals/queer individuals by bringing them, their struggle to the forefront. What remains interesting and critical in the novel which I would like to mention here is not the 'coming out' of Arjie but the 'coming out' of Gauri. As far as the whole story in the novel, *The Boyfriend* is concerned nowhere do we find or think of Gauri as a closeted being. From the very outset, when Gauri enters the frame as a painter and meets Yudi in the office of the Editor of

Metropolis on Saturday, she seems to be attracted to Yudi. Her revelation to Yudi at the end of the novel about her sexuality and attraction to women comes as a surprise. She confesses to Yudi

> You know, hearing you go on and on, I've started feeling attracted to women! ...I mean it. For starters, how about introducing me to Milind's wife? I've done a painting depicting the four of us (232)

Her character is a fitting example of how 'fluid' our sexuality is and something which is not confineable to 'gendered norms.'

The main argument here, therefore, is the need to recognize and acknowledge individuals other than heterosexuals. Also, the need for a queer space where individuals move beyond gendered norms to create what has been uncreated by the dominant heterosexual binary and heteronormativity. There lies a challenge, a formidable task to overcome whereby we create a society that is all-inclusive and where contradictions, dissonance thrive within. Also, it is vital to note that such creation of non-heteronormative space(s) should not imitate heteronormativity and result in homonormativity but build a genuine free space(s), social, physical, and mental space of co-existence. No doubt, a complete queer space remains a distant dream, but by making the sexual subcultures visible, thus creating a space for them, heteronormativity can be challenged and tackled.

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‘নতুন দৈনিক’ত প্ৰকাশিত চন্দ্ৰ প্ৰসাদ শইকীয়াৰ সম্পাদকীয় লেখা ঃ এটি বিশ্লেষণাত্মক অধ্যয়ন

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সংক্ষিপ্ত সাৰ ঃ

মূল্যবান লেখাৰে অসমীয়া সাহিত্যৰ ইতিহাসৰ ভেটি টনকীয়াল কৰোঁতা বিশিষ্ট সাহিত্যিক-সাংবাদিক চন্দ্ৰ প্ৰসাদ শইকীয়া চিৰ স্মৰণীয়। সৃষ্টিশীল ৰচনাৰে প্ৰভূত বৰঙণি আগবঢ়াই যোৱা বিৰল প্ৰতিভাসম্পন্ন চন্দ্ৰ প্ৰসাদ শইকীয়াৰ এগৰাকী সুদক্ষ সম্পাদক ৰূপেও স্বকীয় পৰিচয় আছে। গ্ৰন্থ সম্পাদনা কাৰ্য যিমান কষ্টকৰ, সেইদৰে সম্পাদকীয় লেখাটো যথেষ্ট জটিল মানসিক শ্ৰম। গ্ৰন্থ, বাতৰি অথবা আলোচনী আদিৰ সম্পাদকীয় লেখাটোৰ বৈশিষ্ট্যসমূহে পাঠকক গ্ৰন্থখনিৰ প্ৰতি আগ্ৰহ বৃদ্ধি কৰিব পাৰে। সম্পাদকীয় লেখাসমূহৰ ৰচনা কৌশল মনকৰিবলগীয়া। এই দৃষ্টিৰে বিচাৰ কৰিলে দেখা যায় যে -- চন্দ্ৰ প্ৰসাদ শইকীয়াৰ বিভিন্ন গ্ৰন্থ আৰু আলোচনী তথা বাতৰি কাকতৰ সম্পাদকীয়সমূহৰ মাজত চন্দ্ৰ প্ৰসাদ শইকীয়াৰ অভিজ্ঞতাৰে পুষ্ট চিন্তাৰ আভাস পোৱাৰ লগতে তেখেতৰ জীৱন-দৰ্শনৰো পৰিচয় অন্তর্নিহিত হৈ আছে। একো একোটা সম্পাদকীয় লেখাৰ মাজত সম্পাদকগৰাকীৰ বিৰল প্ৰতিভাক বিচাৰি উলিয়াব পৰা যায়। সুদক্ষ সম্পাদকে যিকোনো কাকত-আলোচনীৰ আয়ুস বৃদ্ধিতো অৰিহণা যোগায় আহিছে। সেয়েহে ‘অসম বাতৰি’ (তিনিমহীয়া কাকত), ‘মণিদীপ’ আলোচনী, ‘অসমীয়া’ আলোচনী, ‘প্ৰকাশ’ আলোচনী, ‘নতুন দৈনিক’ কাকতৰ প্ৰতিষ্ঠাপক সম্পাদক, ‘গৰীয়সী’ আলোচনীৰো প্ৰতিষ্ঠাপক সম্পাদক, মাত্ৰ তিনিমাহৰ বাবে ‘অসম বাণী’ৰ সম্পাদক আৰু ‘অসমৰ বাতৰিকাকত-আলোচনীৰ ডেৰশবছৰীয়া ইতিহাস গ্ৰন্থ’ৰ মুখ্য সম্পাদক চন্দ্ৰ প্ৰসাদ শইকীয়াৰ সম্পাদকীয় লেখাসমূহ অসমীয়া সাহিত্যৰ ঐতিহ্যমণ্ডিত সৃষ্টি সম্ভাৰ। এই সম্পাদকীয় লেখাসমূহ নিশ্চয় জ্ঞান অন্বেষণৰ এক উৎস হ’ব পাৰে। তেনে কাৰণতে ‘নতুন দৈনিক’ত প্ৰকাশিত চন্দ্ৰ প্ৰসাদ শইকীয়াৰ সম্পাদকীয় লেখাত প্ৰতিফলিত দিশৰাজি অধ্যয়ন কৰাৰ প্ৰয়োজন অনুভৱ কৰা হৈছে।

বীজ শব্দ ঃ *সম্পাদনা, সম্পাদকীয় লেখা, ভালকৈ লিখিব পৰাটো গুণ, গ্ৰন্থ উৎসৱ, ধনাঢ্য গ্ৰন্থকাৰ, সৃষ্টি প্ৰতিভা।*

০.০১ অৱতৰণিকা ঃ

সম্পাদনা কৰা কাৰ্য মুঠেই সহজ নহয়। সম্পাদনা কৰা গৰাকীয়েই হ’ল সম্পাদক (Editor)। সম্পাদক শব্দটোৱে কেইবাটাও অর্থ মনলৈ আনি দিয়ে। কোনো অনুষ্ঠানৰ হৈ কাৰ্য পৰিচালনা আৰু সম্পাদনা কৰাৰ ভাৰপ্ৰাপ্ত লোকজনকো সম্পাদক (Secretary) বোলা হয়। দ্বিতীয়তে, বাতৰি কাকত, আলোচনী, গ্ৰন্থ ছপাবলৈ যুগুত কৰা মুখ্য ব্যক্তি (an Editor) গৰাকীক বুজায়, কিন্তু ‘সম্পাদকীয়’ই কাকত সম্পাদকৰ মতামত প্ৰকাশক

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'মুখ্য প্রবন্ধ'ক সূচায়। লগতে এই অভিধাটোৱে কাকত-আলোচনীৰ 'সম্পাদক-সম্পকীয়' অর্থ প্রকাশ কৰে। সেয়েহে কাকত-আলোচনী, গ্রন্থ আদি যুগুত কৰা (Editing) কার্য জটিল আৰু গধুৰ দায়িত্ব বুলি অনুভৱ কৰা হয়।

০.০২ বিষয় পৰিচয় ঃ

অসমীয়া সাহিত্য জগতলৈ ভিন্নধর্মী লেখাৰে অৱদান আগবঢ়াই সাহিত্যক সমৃদ্ধিশালী কৰা চন্দ্র প্রসাদ শইকীয়া বহুমুখী প্রতিভাৰ অধিকাৰী। স্বাধীনতা আন্দোলনত বিশেষ অংশগ্রহণ কৰি দুবাৰকৈ কাৰাবাস খটা চন্দ্র প্রসাদ শইকীয়াই ২০০৬ চনৰ ৮ আগষ্ট অর্থাৎ মৃত্যুৰ আগলৈকে সংবাদসেৱাত ব্রতী হৈ আছিল। তেখেতে প্রচুৰ ৰচনা সম্ভাৰে অসমীয়া সাহিত্যক সমৃদ্ধ কৰি তোলে। ১৯৯৯ চনত অসম সাহিত্য সভাৰ ৬৫তম হাজো অধিৱেশনত সভাপতিৰূপে দুবছৰীয়া কার্যকাল সমাপ্ত কৰাৰ উপৰিও ১৯৬৩-৬৭ লৈ 'অসম বাতৰি' নামৰ তিনিদিনীয়া কাকতৰ সম্পাদক, ১৯৬৪-৬৬ লৈ 'মণিদীপ' আলোচনীৰ সম্পাদক, ১৯৭৪-৮৬ লৈ 'প্রকাশ' আলোচনীৰ সম্পাদক, ১৯৮৮-৯৩ লৈ 'নতুন দৈনিক' কাকতৰ প্রতিষ্ঠাপক সম্পাদক, ১৯৯৩ চনত 'গৰীয়সী' আলোচনীৰ প্রতিষ্ঠাপক সম্পাদক, ১৯৯৭ চনত মাত্র তিনিমাহৰ বাবে 'অসম বাণী'ৰ সম্পাদকৰূপে কার্যনির্বাহ কৰা চন্দ্র প্রসাদ শইকীয়াই চাৰিখনকৈ গল্প সংকলন, নখনি উপন্যাস, ভ্রমণ কাহিনী আৰু ভিন্নস্বাদৰ ৰচনাসমূহৰ যোগেদি সাহিত্য জগতলৈ মূল্যবান বৰঙণি আগবঢ়ায়। গতিকে এইগৰাকী মহান লেখকৰ 'সম্পাদকীয় লেখা'ৰ মাজেৰে প্রতিফলিত হোৱা বিশেষত্বসমূহ বিচাৰ কৰাৰ উদ্দেশ্যে উক্ত বিষয়টো নির্বাচন কৰি অধ্যয়নৰ প্রয়াস কৰিছোঁ।

০.০৩ বিষয়ৰ গুৰুত্ব আৰু উদ্দেশ্য ঃ

অসমৰ শিল্প-সাহিত্যৰ ক্ষেত্রখনিৰ উজ্জ্বল ৰত্নস্বৰূপ চন্দ্র প্রসাদ শইকীয়াৰ জীৱন, দর্শন, কর্মসংস্কৃতিৰ বিচিত্র দিশসমূহ অন্বেষণ কৰি নৱ-প্রজন্মই উৎসাহ আৰু প্রেৰণা লাভ কৰাৰ লগতে নতুন পথৰ সন্ধান পাব পাৰে। চন্দ্র প্রসাদ শইকীয়াৰ সকলো ৰচনা অধ্যয়নৰ লগতে সমালোচকসকলে তেখেতৰ লেখাসমূহৰ বিষয়ে আগবঢ়োৱা আলোচনা-সমালোচনাই নিশ্চয় লেখকগৰাকীৰ সম্পর্কে বহুদিশ অৱগত কৰে। তেখেতৰ গল্প, উপন্যাস, ভ্রমণ সাহিত্য, প্রবন্ধ সম্ভাৰ সম্পর্কে যিমানখিনি আলোচনা আজিলৈকে কাকত-আলোচনীত প্রকাশ পাইছে; ইয়াৰ ভিতৰত তেখেতৰ সম্পাদকীয়ৰ বিষয়ে অধ্যয়ন-আলোচনা অদ্যপি হোৱা নাই। তেখেতৰ সম্পাদকীয়সমূহ নিঃসন্দেহে কলাসন্মত, তথ্যসমৃদ্ধ আৰু আকর্ষণীয়। সম্পাদকীয় প্রস্তুত কৰা ৰচনা কৌশল, ভাৰ-ভাষাৰ কলাগুণ, জীৱনৰ বিচিত্র অভিজ্ঞতাক সংক্ষেপে আকর্ষণীয় ৰূপত উপস্থাপন, বিষয় বৈচিত্র্য ইত্যাদি দিশ কিদৰে সম্পাদকীয়ত নিহিত হৈ থাকে -- এইবোৰ মনকৰিবলগীয়া। তেখেতৰ বিভিন্ন গ্রন্থ আৰু আলোচনীৰ সম্পাদকীয় অধ্যয়ন কৰিলে উপলব্ধি হয় যে -- এই লেখাসমূহ এক প্রকাৰৰ সাহিত্যই। তেনে কাৰণতে চন্দ্র প্রসাদ শইকীয়াৰ সম্পাদকীয়

শিতানৰ মাজত অন্তর্নিহিত হৈ থকা দিশসমূহ অন্বেষণৰ জৰিয়তে লেখকগৰাকীৰ সৃষ্টিশীলতাৰ কিছু গুণৰ সন্ধেদ লাভ কৰিব পৰা যায়। উক্ত বিষয়টোৰ গুৰুত্বও এইখিনিতে।

০.০৪ অধ্যয়নৰ উদ্দেশ্য ঃ

(১) চন্দ্র প্রসাদ শইকীয়াৰ 'নতুন দৈনিক'ত প্রকাশিত সম্পাদকীয় স্তম্ভৰ বিশেষত্বসমূহ অধ্যয়ন আৰু বিশ্লেষণ।

(২) পদ্ধতিগতভাৱে অধ্যয়ন কৰি লেখকগৰাকীৰ প্রতিভাৰ সন্ধান কৰা।

০.০৫ অধ্যয়নৰ পদ্ধতি আৰু পৰিসৰ ঃ

সাহিত্য বিচাৰৰ সকলো পদ্ধতিয়ে গুৰুত্বপূর্ণ। এই বিষয়টি প্রস্তুত কৰোঁতে বিশ্লেষণাত্মক পদ্ধতিৰ সহায় লোৱা হ'ব। চন্দ্র প্রসাদ শইকীয়াই সম্পাদনা কৰা আটাইবিলাক গ্রন্থৰ সম্পাদকীয় স্তম্ভবিলাক গৱেষণাৰ একোটা দিশ হ'ব পাৰে; কিন্তু পৰিসৰলৈ গুৰুত্ব দি কেৱল 'নতুন দৈনিক' কাকতৰ সম্পাদকীয়সমূহক অধ্যয়নৰ সীমাত অন্তর্ভুক্ত কৰা হৈছে।

০.০৬ অধ্যয়নৰ সমল ঃ

উক্ত বিষয়টি পদ্ধতিগতভাৱে অধ্যয়ন কৰি বিশ্লেষণ কৰোঁতে প্রাথমিক অথবা মুখ্য সমল আৰু গৌণসমল দুয়োবিধৰে সহায় লোৱা হ'ব। প্রাথমিক সমলৰ বাবে 'চন্দ্র প্রসাদ শইকীয়াৰ ৰচনাৱলী', দ্বিতীয় খণ্ড, সম্পা. হৃদয়ানন্দ গগৈ, অসম প্রকাশন পৰিষদ, গুৱাহাটী - ৭৮১০২১, প্রথম প্রকাশ, ডিচেম্বৰ, ২০১৪, গ্রন্থখনিত সন্নিৱিষ্ট "নতুন দৈনিক'ত প্রকাশিত চন্দ্র প্রসাদ শইকীয়াৰ সম্পাদকীয়" অংশটো মুখ্য সমল। গৌণ সমলৰ বাবে লেখকগৰাকী সম্পর্কে লেখা বিভিন্ন প্রবন্ধ আৰু আলোচনাৰ সহায় লোৱা হ'ব।

০.০৭ পূর্বকৃত অধ্যয়ন সমীক্ষা ঃ

অসমীয়া সাহিত্যৰ বুৰঞ্জী 'অসমীয়া সাহিত্যৰ সমীক্ষাত্মক ইতিবৃত্ত' (ড° সত্যেন্দ্র নাথ শর্মা), ড° মহেশ্বৰ নেওগৰ 'অসীয়া সাহিত্যৰ ৰূপৰেখা'ৰ পৰা আৰম্ভ কৰি হোমেন বৰগোহাঞিৰ সম্পাদিত 'সাহিত্যৰ বুৰঞ্জী', ষষ্ঠখণ্ডলৈকে ৰামধেনু যুগৰ লেখকসকলৰ ৰচনা সম্ভাৰৰ পৰিচয় পোৱা যায়। চন্দ্র প্রসাদ শইকীয়াৰ ৰচনাবিলাক 'ৰামধেনু'ত প্রকাশ পায়। পৰৱর্তী লেখাসমূহ ব্যক্তিগত প্রচেষ্টাত প্রকাশৰ লগতে কাকত-আলোচনীত প্রকাশ পায়। সমসাময়িক আলোচনী 'প্রকাশ', 'মণিদীপ', 'প্রান্তিক' আদিত সমালোচনামূলক প্রবন্ধবিলাক প্রকাশ হয়। 'গৰীয়সী' আলোচনীখনতো ভিন্নজন লেখকৰ সাহিত্য সম্ভাৰৰ আলোচনা কৰা হৈছে। আলোচনীৰ সম্পাদক আৰু সাংবাদিক চন্দ্র প্রসাদ শইকীয়াই নিজে সম্পাদনা কৰা আলোচনীত তেওঁৰ নিজৰ সাহিত্য-কৃতিৰ আলোচনাক প্রকাশ কৰা দেখা নাযায়। তেখেতৰ মৃত্যুৰ পিছতহে লেখকসকলে চন্দ্র প্রসাদ শইকীয়াৰ উপন্যাস আৰু চুটিগল্পৰ

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বিচাৰ-বিশ্লেষণ কৰিছে। 'এশবছৰৰ অসমীয়া উপন্যাস' (সম্পাদনা - ড° নগেন ঠাকুৰ) গ্ৰন্থত চন্দ্ৰ প্ৰসাদ শইকীয়াৰ উপন্যাসৰ আলোচনা হৈছে। 'প্ৰান্তিক', 'প্ৰকাশ', 'গৰীয়সী' আৰু অন্যান্য আলোচনী যেনে -- সদৌ অসম কলেজ শিক্ষক সংস্থাৰ আলোচনীৰ দুই-এটি সংখ্যাত, শিক্ষানুষ্ঠানৰ আলোচনী, গৱেষণা পত্ৰ আদিত তেখেতৰ গল্প আৰু উপন্যাসৰ কিছু দিশ বিচাৰ-বিশ্লেষণ হৈছে। কিন্তু তেখেতৰ সম্পাদকীয় সম্ভাৰৰ বিষয়ে এতিয়ালৈকে বিদ্যায়তনিক আলোচনা হোৱা চকুত নপৰে। হৃদয়ানন্দ গগৈৰ দ্বাৰা সম্পাদিত 'চন্দ্ৰ প্ৰসাদ শইকীয়া ৰচনাৱলী' (দ্বিতীয় খণ্ড)ৰ পাতনিত বিশিষ্ট সাহিত্যিক-সাংবাদিকগৰাকীৰ সম্পাদনা কাৰ্যৰ বিষয়ে সংক্ষেপে আলোকপাত কৰা পৰিলক্ষিত হৈছে।

১.০০ বিষয়ৰ আলোচনা ঃ

চন্দ্ৰ প্ৰসাদ শইকীয়াৰ ৰচনাৰাজি অধ্যয়ন কৰিলে অনেক বৈশিষ্ট্য পৰিলক্ষিত হয়। আলোচনীৰ সম্পাদক আৰু সাংবাদিক চন্দ্ৰ প্ৰসাদ শইকীয়াক বাদ দি তেখেতৰ দ্বাৰা ৰচিত উপন্যাস আৰু গল্প সম্ভাৰৰ মাজত লেখকগৰাকীৰ সূক্ষ্ম মনৰ পৰিচয় পোৱা যায়। তেখেতৰ উপন্যাসত মধ্যবিত্ত শ্ৰেণীৰ জীৱনৰ বিচিত্ৰ দিশৰ প্ৰতিফলন ঘটিছে। সমাজ জীৱনৰ বাস্তৱ ছবি তেখেতৰ উপন্যাসৰ আন এটি চকুত পৰা দিশ। 'ৰামধেনু'ত প্ৰকাশ পোৱা 'এদিন' উপন্যাসৰ পিছৰেপৰা 'মেঘমল্লাৰ', 'মন্দাক্ৰান্তা', 'জন্মান্তৰ', 'উত্তৰকাল', 'মহাৰথী', 'তোৰে মোৰে আলোকৰে যাত্ৰা', 'সূৰ্যস্নান' আদি উপন্যাসৰ যোগেদি অসমীয়া সাহিত্যক সমৃদ্ধ কৰে। চন্দ্ৰ প্ৰসাদ শইকীয়াৰ গল্প পুথিসমূহ হৈছে -- 'মায়ামৃগ', 'নাচপতি ফুল', 'চক্ৰৱৎ' আৰু 'অঙ্গীকাৰ'। চন্দ্ৰ প্ৰসাদ শইকীয়াই 'মণিদীপ', 'অসমীয়া', 'প্ৰকাশ', 'নতুন দৈনিক' আদি কাকত-আলোচনীৰ সম্পাদকৰ দায়িত্ব সুচাৰুৰূপে পালন কৰে। ১৯৯৩ চনত তেখেতে 'গৰীয়সী' নামৰ সাহিত্য আলোচনীখনৰ প্ৰতিষ্ঠাপক সম্পাদকৰূপে মৃত্যুৰ আগলৈকে এই দায়িত্ব পালন কৰি আছিল। সুদীৰ্ঘকাল কাকত-আলোচনীৰ সম্পাদক চন্দ্ৰ প্ৰসাদ শইকীয়াৰ সম্পাদকীয় লেখা কৌশল চমকপ্ৰদ। 'সাহিত্যৰথী বেজবৰুৱাৰ লগত এক কাল্পনিক সাক্ষাৎ' শীৰ্ষক লেখাৰ মাজত সম্পাদক চন্দ্ৰ প্ৰসাদ শইকীয়াৰ গভীৰ চিন্তাৰ আভাস পোৱা যায়। 'গৰীয়সী' নামটো কিয় গ্ৰহণ কৰি সাহিত্য আলোচনীখন প্ৰতিষ্ঠা কৰিলে এই বিষয়ে শইকীয়াই নিজে ব্যক্ত কৰিছে--

"লঃ বেজ ঃ গৰীয়সী? এই নামটো প্ৰথমতে কাৰ মুখেদি প্ৰকাশ পাইছিল।

চঃ প্ৰঃ শ ঃ জানো। ৰামচন্দ্ৰৰ মুখেদি।

লঃ বেজ ঃ এনে এক মহান নামেৰে তুমি তোমাৰ আলোচনীৰ নামকৰণ কৰিলা কেলেই? পাৰিবা সেই নামৰ মৰ্যাদা আৰু গৌৰৱ ৰক্ষা কৰিব?

চঃ প্ৰঃ শ ঃ পাৰিম বুলি বিশ্বাস। এক মহৎ উদ্দেশ্যৰ লগত জড়িত নহ'লে মানুহে মহত্বৰ সন্ধান নেপায়।" [১]

এইধৰণৰ লেখাৰ মাজত সাহিত্যিক চন্দ্ৰ প্ৰসাদেই নহয়, কাকত-আলোচনীৰ পাকৈত সম্পাদকগৰাকীৰ

চিন্তাৰ গভীৰতাৰ উমান পোৱা যায়। এইদৰে কাল্পনিক বেজবৰুৱাৰ লগত হোৱা সাক্ষাৎকাৰ ভিত্তিক লেখাৰ মাজত সাহিত্য সৃষ্টিৰ প্ৰতি লেখকৰ আগ্ৰহ, অথবা সাহিত্য ৰচনাৰ উদ্দেশ্য কেনে হ'ব পাৰে -- এই বিষয়ে চন্দ্ৰ প্ৰসাদ শইকীয়াৰ দৃষ্টিভঙ্গী সময়োপযোগী আৰু তাৎপৰ্যপূৰ্ণ বুলি ধৰিব পাৰি। "পুৰষ্কাৰ পাম বুলি যি সাহিত্য ৰচনাত লাগে, তাৰ সাহিত্য কৰাৰ যোগ্যতা নাই। গোটেই জীৱন সাহিত্য সাধনা কৰি দুই-চাৰিজনক মানুহে সন্মান জনায়, সেই সন্মান ল'বলৈকে সেইসকলক মহান সাহিত্যিকে লজ্জাবোধ কৰে। .... তোমাক কৈ থ'লো চন্দ্ৰ প্ৰসাদ, সাহিত্যৰ বৰণ ডাঠ, কিন্তু প্ৰশংসাৰ বৰণ ঢেলা, সেই বৰণ বিবর্ণ হ'বলৈ মাত্ৰ দুদিন লাগে। সাহিত্য পুৰষ্কাৰে সাহিত্যৰ সন্মান মর্যাদা আৰু গুণ বঢ়াইছে বুলি মই ক'তো শুনা নাছিলো। মোৰ সোণৰ অসমৰ যে আজি কি অৱস্থা হ'ল।" [২]

চন্দ্ৰ প্ৰসাদ শইকীয়াই 'নতুন দৈনিক' (১৯৮৮-৯৩) কাকতৰ প্ৰতিষ্ঠাপক সম্পাদক ৰূপে যিখিনি গুৰুত্বপূৰ্ণ সম্পাদকীয় লেখা প্ৰস্তুত কৰি উলিয়ালে সেইখিনি লেখা অমূল্য সম্পদ ৰূপে বিবেচনা কৰিব পৰা যায়। ইয়াৰ ভিতৰত তেখেতে 'ভালকৈ লিখিব পৰাটো', 'উত্তৰ পূৰ্বাঞ্চলৰ বিকাশ', 'কামৰ সপক্ষে জনমত', 'গ্ৰন্থ উৎসৱ', 'গুৱাহাটীৰ গৌৰৱ', 'আত্মজীৱনী', 'জনমাধ্যমৰ কথা', 'সংস্কৃতিৰ সংকট', 'মেজ আৰু লেমৰ কাষলৈ', 'গ্ৰন্থ প্ৰকাশৰ সংকট', 'ধনাঢ্য গ্ৰন্থকাৰ', 'নীতিবচন', 'শব্দ-প্ৰদূষণৰ ভয়াবহতা', 'সৃষ্টি প্ৰতিভা', 'সর্বস্বান্ত' ইত্যাদি উল্লেখযোগ্য।

১.০১ সম্পাদকীয় লেখাত প্ৰতিফলিত দিশসমূহ ঃ

- চন্দ্ৰ প্ৰসাদ শইকীয়াৰ সম্পাদকীয় লেখাসমূহ চুটি অথচ গভীৰ ভাব প্ৰকাশক।
- চুটি চুটি বাক্যৰ প্ৰয়োগ, ব্যঞ্জনাময় ভাষা এই লেখাৰ অন্য এটা বৈশিষ্ট্য।
- সম্পাদকীয়সমূহ বিভিন্ন তথ্যৰ ভঁৰাল।
- সমসাময়িক সমাজৰ বাস্তৱ চিত্ৰ ইয়াৰ মাজেদি প্ৰকাশ পাইছে।
- পৃথিৱীৰ মহৎ লোকসকলে মহান কর্মৰ জৰিয়তে বিশ্ববিখ্যাত হোৱাৰ প্ৰসঙ্গ, মহৎ লোকৰ অদ্ভুত শক্তি, ভাগ্য আৰু বর্ণাঢ্য জীৱনৰ বিচিত্ৰ কর্মৰাজিৰ উল্লেখ পোৱা যায়।
- ৰাজনৈতিক চেতনা, সমকাল চেতনা চন্দ্ৰ প্ৰসাদ শইকীয়াৰ সম্পাদকীয় লেখাৰ এটি আকর্ষণীয় দিশ।
- পঢ়ুৱৈৰ গ্ৰন্থ অধ্যয়নৰ লিপ্সা, গ্ৰন্থমেলাত গ্ৰন্থ ক্ৰয়-বিক্ৰয়ৰ বাস্তৱ তথ্য, ধনাঢ্য গ্ৰন্থাকাৰ, গ্ৰন্থ প্ৰকাশৰ সংকট, গ্ৰন্থ ব্যৱসায়ীৰ গুণ আৰু দোষ, গ্ৰন্থ উৎসৱৰ প্ৰয়োজনীয়তা আদি দিশ আঙুলিয়াই দেখুৱাটো এই সম্পাদকীয় লেখাৰ অন্য এটি বৈশিষ্ট্য।
- স্বাধীনতাৰ পৰৱর্তীকালত ভালেসংখ্যক লোকৰ কলিকতাত থকাৰ হেপাহ কমি অহাত গুৱাহাটীত নাগৰিক জীৱন অতিবাহিত কৰাৰ আগ্ৰহ বৃদ্ধি, অথচ ব্যহ্যিক দৃষ্টিত গুৱাহাটীৰ নগৰৰ ৰূপ-লক্ষণ প্ৰকট যদিও প্ৰকৃত অর্থত এই নগৰবাসীৰ মহৎ চিন্তা-চর্চা আৰু কামৰ ওপৰত নগৰখনৰ যি মহত্ব প্ৰতিফলিত হোৱা উচিত;

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গুৱাহাটীত যে এইটো গুণ প্ৰকট নোহোৱাৰ কাৰণ বিশ্লেষণ, নগৰখনৰ উত্তৰণৰ প্ৰচেষ্টাৰ বাবে কৰণীয় ইত্যাদি প্ৰসঙ্গ তেখেতৰ সম্পাদকীয় লেখাত প্ৰতিফলন ঘটিছে।

▶ চন্দ্ৰ প্ৰসাদ শইকীয়াৰ সম্পাদকীয় লেখাৰ আন এটি দিশ হৈছে -- সাম্প্ৰতিক সময়ত ৰাজনৈতিক নেতা, সাহিত্যিক, ক্ৰীড়াবিদ, সাংবাদিক, একাংশ অৱসৰপ্ৰাপ্ত চৰকাৰী আৰু সামৰিক বিষয়াৰ আত্মজীৱনী লিখাৰ ব্যাপক প্ৰৱণতা, আত্মজীৱনী লিখাসকলৰ সত্যৰ সন্মুখীন হোৱাৰ ভয়ানক নীতি, প্ৰখ্যাত-অৰ্ধখ্যাত সকলোৰে মাজত আত্মজীৱনী ৰচনাৰ পয়োভৰে সমাজৰ উত্তৰণত কিছুপৰিমাণে পেলোৱা ঋণাত্মক প্ৰভাৱ, পৃথিৱীৰ বহুত মহৎ ব্যক্তি সমাজৰ নিম্নখাপৰ লোকৰ দ্বাৰা আক্ৰান্ত আৰু জৰ্জৰিত হোৱাৰ উদাহৰণ তেখেতে স্পষ্টকৈ দাঙি ধৰিছে।

▶ কিতাপ অথবা গ্ৰন্থৰ ভৱিষ্যৎ চিৰদিন উজ্জ্বল হৈ থকাৰ আশা, কিতাপ পঢ়াৰ বিমল আনন্দৰ বিকল্পহীনতা, গ্ৰন্থ অধ্যয়নৰ ফলত মানুহৰ মনৰ দিগন্ত অধিক প্ৰসাৰিত হোৱা, মহৎ চিন্তাৰ উত্তৰণ ঘটা, গ্ৰন্থই জীৱনৰ সঙ্গী হ'ব পাৰে, গ্ৰন্থই যে কেতিয়াও মানুহক বিশ্বাসঘাটকতা নকৰে, গ্ৰন্থ অধ্যয়নৰ শক্তিয়ে মানুহৰ বিষয়ে মানুহৰ ধাৰণা যে গাঢ় কৰে -- এনেবোৰ দিশ চন্দ্ৰপ্ৰসাদ শইকীয়াৰ সম্পাদকীয় লেখাৰ গুৰুত্বপূৰ্ণ বিষয়।

▶ জন-মাধ্যমে সমাজত পেলোৱা সুদূৰপ্ৰসাৰী প্ৰভাৱ, ইলেক্ট্ৰ'নিক মাধ্যমবিলাক কেৱল আমোদৰ মাধ্যম নহৈ যাতে যোগাত্মক চিন্তা-ভাৱনাৰ বাহক হ'ব পাৰে তাৰ বাবে সতৰ্ক হোৱাটো প্ৰয়োজনীয়। জ্ঞান আৰু চিন্তা প্ৰসাৰৰ দিশটোৰ প্ৰতি অধিক গুৰুত্ব প্ৰকাশ কৰাটো এই মাধ্যমবিলাকৰ লক্ষ্য হোৱা উচিত বুলি চন্দ্ৰ প্ৰসাদ শইকীয়াই সম্পাদকীয় লেখাৰ মাজেৰে উল্লেখ কৰিছে।

▶ জাতীয় চৈতন্য আৰু ঐতিহ্য চেতনা চন্দ্ৰ প্ৰসাদ শইকীয়াৰ সম্পাদকীয় লেখাৰ আটাইতকৈ লেখতল'বলগীয়া একোটা দিশ। তেওঁৰ মতে -- "নিজৰ ঐতিহ্যক নিচিনাৰ হেতু সাংস্কৃতিক ক্ষেত্ৰত সময়ে সময়ে ভুল বুজাবুজিৰ উদ্ভৱ হোৱা দেখি ৰাজ্যখনৰ গৌৰময় সাংস্কৃতিক পৰম্পৰাৰ বিষয়ে সোঁৱৰায় দিবৰ প্ৰয়োজনবোধ কৰা হৈছে। অসমীয়া সংস্কৃতিক যি মনে-প্ৰাণে ভাল পায়, যি অসমীয়া বুলি প্ৰকৃততে গৌৰৱবোধ কৰে, তেওঁ অসমৰ বিভিন্ন জনগোষ্ঠীৰ মাজত বিভেদৰ বীজ সিঁচিব পৰা কাৰ্যত কেতিয়াও লিপ্ত নহয়। ক্ষুদ্ৰ স্বাৰ্থৰ বশৱৰ্তী হৈ যি জাত-পাতৰ বিচাৰ কৰে, সি সংস্কৃতিৰ অৰ্থকে বুজা নাই বুলিব পাৰি।" ৩

'সংস্কৃতিৰ সংকট' শীৰ্ষক সম্পাদকীয়ৰ মাজেদি চন্দ্ৰ প্ৰসাদ শইকীয়াই কৈছে যে -- সংস্কৃতিৰ ওপৰত দুষ্কৃতিৰ প্ৰাধান্য কেতিয়াবা ঘটিলেও সেইখিনি সাময়িক বুলি পৰিগণিত হয়। তদুপৰি মুখেৰে সংস্কৃতিৰ ধ্বনি দি মানৱতাক উলাই কৰাসকল সোনকালেই জনমানসত অপ্ৰাসঙ্গিক হৈ পৰে বুলি তেখেতে ব্যক্ত কৰিছে। স্বদেশৰ প্ৰতি থকা ভালপোৱাৰ ভাৱৰ বাবেই তেখেতে অনুভৱ কৰিছে যে -- "অসমতো ৰাজনীতিৰ সংকীৰ্ণ বিবেচনাৰে মহান অসমীয়া সংস্কৃতিক কলঙ্কিত কৰিবলৈ প্ৰয়াস কৰা সকলৰ প্ৰতি সতৰ্ক দৃষ্টি ৰখাৰ সময় হ'ল।" [সংস্কৃতিৰ সংকট (২১ জুন, ১৯৯১), পৃঃ ৪৩১]

▶ সমাজৰ যুৱ-প্রজন্মক জ্ঞান অন্বেষণৰ কার্যত অধিক ব্রতী হৈ নিৰৱচ্ছিন্ন অধ্যয়ন সাধনাৰ শ্রেষ্ঠ কর্ম ৰূপে গ্রহণ কৰিবলৈ জনোৱা আহ্বান মনকৰিবলগীয়া। চন্দ্র প্রসাদ শইকীয়াই 'মেজ আৰু লেমৰ কাষলৈ' শীর্ষক সম্পাদকীয়ত অসমৰ 'আছু' কর্মী নেতাবৃন্দক আঙুলিয়াই দেখুৱাইছে যে -- বিবৃতি, প্রস্তাৱ, প্রতিবেদন, ভীতি প্রদর্শন, স্মাৰক পত্র, স্পষ্টীকৰণ লিখি থাকোঁতে অধ্যয়নৰ দৰে মহান কার্যক আওকাণ কৰাটো দেশৰ প্রগতিৰ অন্যতম অন্তৰায়। যি দেশৰ যুৱ-প্রজন্ম জ্ঞানলাভৰ প্রতি অসীম আগ্রহশীল নহয়, সেই সমাজৰ কেতিয়াও ভৱিষ্যৎ উজ্জ্বল হ'ব নোৱাৰে। চন্দ্র প্রসাদ শইকীয়াই সুচাৰুৰূপে নিৰীক্ষণ কৰি মত প্রকাশ কৰিছে এইদৰে -- "ছাত্র সন্থাৰ 'অবিৰত শোভাযাত্রা'ৰ সেই উত্তাল বছৰবোৰত সেই ছাত্রসকলৰ সৃষ্টিশীল প্রতিভাৰ এনেদৰে বিনাশ ঘটিল যে তেওঁলোকৰ মাজৰ পৰা ওলাই নাহিল কোনো মহৎ ৰসোত্তীর্ণ কবিতাৰ সামান্য এক শাৰীও, কোনো এক অমৃত উপন্যাসৰ, গল্পৰ, নাটকৰ সামান্য কেইটামান বাক্যও।" [৪]

▶ নির্ভীকভাৱে চৰকাৰৰ কাম-কাজক সমালোচনা কৰিব পৰাটো চন্দ্র প্রসাদ শইকীয়াৰ সম্পাদকীয়বোৰৰ আন এটা বৈশিষ্ট্য। উদাহৰণস্বৰূপে গ্রন্থ প্রকাশৰ ক্ষেত্রত ভাৰততে দেখা দিয়া সংকটে দেশৰ শিক্ষা-সংস্কৃতিৰ ক্ষেত্রখনিত বিৰূপ প্রভাৱ পেলাইছে বুলি তেখেতে অনুভৱ কৰিছে। কাগজৰ নাটনি গ্রন্থ প্রকাশনৰ এটি সমস্যা বুলি জনাৰ পিছতো কিয় চৰকাৰে উক্ত বিষয়টো গুৰুত্বহীন বুলি বিবেচনা কৰিছে -- সেয়াও ৰহস্যজনক। জনকল্যাণকামী দেশ ভাৰততে চৰকাৰে এই ক্ষেত্রত এক প্রচেষ্টা লোৱাটো বাঞ্ছনীয় বুলি মত প্রকাশ কৰে।

▶ দেশ-বিদেশৰ মহৎ, জ্ঞানীলোকৰ কর্মৰাজিৰ অনেক তথ্যৰে স্থান-কাল উপযোগীকৈ দাঙি ধৰা উদাহৰণৰ যোগেদি চন্দ্রপ্রসাদ শইকীয়াৰ জীৱন-দর্শনৰ আভাস পোৱাটো সম্ভৱ। তেখেতৰ সম্পাদকীয় লেখাৰ এইটো দিশ সঁচাই আকর্ষণীয় আৰু মনোৰম। পৃথিৱীৰ বিখ্যাত লেখকসকলৰ ভিতৰতে পৰস্পৰ বিৰোধী চিন্তা চির্ত্তাকর্ষক আৰু গুৰুত্বপূর্ণ। যিসকল লেখকে গ্রন্থ ৰচনা কৰি পৃথিৱীৰ ধনাঢ্য গ্রন্থকাৰসকলৰ তালিকাত নিজৰ নাম অর্ন্তভুক্ত কৰিছে; তেখেতলোকৰ তুলনাত বিখ্যাত লেখক মিল্টনে ধনৰ বাবেই মাত্র দহ পাউণ্ডত (৪২ টকা) মহাকাব্য 'পেৰেডাইজ লষ্ট'ৰ কপিৰাইট বিক্রী কৰিবলৈ বাধ্য হৈছিল। আনহাতে প্রখ্যাত লেখক 'ডমিনিক লেপিয়ে'ৰে 'দী চিটি অব্ জয়' আৰু 'বিয়ণ্ড লাভ' গ্রন্থ দুখনিৰ প্রথমখনিত পঁয়ষষ্ঠী লাখ কপি আৰু দ্বিতীয়খনৰ বিশ লাখৰো অধিক কপি বিক্রী কৰি ধনাঢ্য লেখকত পৰিণত হৈছে যদিও চন্দ্র প্রসাদ শইকীয়াই মত প্রকাশ কৰিছে -- "লেপিয়েৰৰ গ্রন্থই বিপুল পৰিমাণৰ ধন অর্জন কৰিছে যদিও, সাহিত্যৰ যিটো মূল লক্ষ্য, মানুহৰ বিষয়ে মানুহৰ ধাৰণা গাঢ় কৰা, সেই দিশত সার্থক হ'ব পৰা নাই।" উক্ত উদাহৰণৰ যোগেদি চন্দ্র প্রসাদ শইকীয়াই ব্যক্ত কৰিছে যে -- মানুহে কি পঢ়িবলৈ ভাল পায়, অথবা কি পঢ়ি ভালপোৱা উচিত বা কি পঢ়াটো একান্ত বাঞ্ছনীয়; তাৰ ওপৰতহে এখন গ্রন্থৰ মহত্ব বা গ্রন্থ সংস্কৃতি নির্ভৰ কৰে।

▶ চন্দ্র প্রসাদ শইকীয়াৰ অসমীয়া জাতিৰ বর্তমানৰ স্থিতি আৰু গতি সম্পর্কে গভীৰ দৃষ্টি সম্পাদকীয় লেখাৰ মাজেদি প্রকাশ পাইছে। 'অসমীয়া জাতি আজি নিঃস্ব, সর্বস্বান্ত আৰু অন্তহীন দুদর্শাত ধৰাশায়ী' বুলি

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অকপটে স্বীকাৰ কৰিছে। তেখেতৰ জাতিটোৰ প্ৰতি সামান্য পৰিমাণে হ'লেও ক্ষোভ প্ৰকাশ পাইছে। শংকৰ-মাধৱ দুজনাকৈ বৈষ্ণৱ গুৰু ও সাহিত্যিক বেজবৰুৱা-জ্যোতিপ্ৰসাদৰ দৰে লেখকৰ কথাৰে বাতৰিকাকতৰ পৃষ্ঠা ভৰাই পেলোৱা আজিৰ প্ৰজন্মই তেওঁলোকৰ বাণী আৰু কৰ্মক অন্তৰে স্বীকাৰ নকৰে। আনকি ইয়াৰ দ্বাৰা অনুপ্ৰাণিত হোৱাৰ আকাংক্ষাও নকৰা হৈছে। 'অসমীয়াৰ হাজাৰ বছৰীয়া ইতিহাসত এতিয়াৰ দৰে শূন্য আৰু নিঃস্ব অধ্যায় কেতিয়াও হোৱা নাছিল' বুলি তেখেতে মুক্তভাৱে প্ৰকাশ কৰে।

লগতে অসমীয়া উদীয়মান বিশ্ববিদ্যালয় আৰু কলেজ শিক্ষকৰ প্ৰতিও তেখেতৰ আক্ষেপ প্ৰকাশ পাইছে। কিয়নো "তেওঁলোকৰ কাপৰ পৰা কোনো দৰ্শন সম্পৰ্কীয় ৰসোত্তীৰ্ণ নৱ নৱ দৃষ্টিকোণৰ প্ৰবন্ধ প্ৰকাশ পোৱা নাই। সাহিত্যৰ সেইসকল অধ্যাপকে অসমীয়া সাহিত্যৰ দিক্ নিৰ্ণয় কৰি দিয়া নাই; অজস্ৰ কবিতাৰ মাজৰ পৰা, অজস্ৰ ৰচনাৰ মাজৰ পৰা কোনখিনি ভাল, কোনখিনি বেয়া, সেইখিনি বিচাৰ কৰি দিব পৰা নাই।" [নতুন দৈনিক (৩১ মে', ১৯৯২), পৃঃ ৪৪৫]

▶ চন্দ্ৰ প্ৰসাদ শইকীয়াৰ সম্পাদকীয়ত প্ৰকাশিত আন এটি আকৰ্ষণীয় দিশ হৈছে সমাজৰ লোকসকলে যাতে সময়োপযোগী চিন্তা-চেতনাৰে সমৃদ্ধ হৈ জীৱন অতিবাহিত কৰিবলৈ সক্ষম হ'লে সেই সমাজৰ পৰা অন্ধবিশ্বাস আৰু কু-সংস্কাৰ লাহে লাহে আঁতৰি যাব। ইয়াৰ বাবেই মানুহৰ মাজত জীৱনোপযোগী বিচাৰধাৰা আৰু বৈজ্ঞানিক মানসিকতা গঢ় লৈ উঠাটো প্ৰয়োজন। উদাহৰণস্বৰূপে চন্দ্ৰ প্ৰসাদ শইকীয়াই অসমীয়া সমাজত প্ৰচলিত কিছুমান নীতি-বচন আজিও প্ৰাসঙ্গিক হৈ আছে; অথচ প্ৰতিটো কথা আৰু কামৰ ব্যৱহাৰিক দিশটোলৈ গুৰুত্ব দিয়াৰ বাবে কিছুমান নীতি-বচনে প্ৰাসঙ্গিকতা হেৰুৱাইছে বুলি কৈছে। সেয়েহে বৰ্তমান সময়ত ভৱিষ্যৎ প্ৰজন্মৰ মাজত সাধাৰণভাৱে নৈতিকতা গুণ বৃদ্ধিৰ হেতু নীতি-বচন প্ৰয়োগ কৰাতকৈ অধিক ফলপ্ৰসু ও আকৰ্ষণীয় কৌশল গ্ৰহণত গুৰুত্ব দিবলৈ আহ্বান জনাইছে।

চন্দ্ৰ প্ৰসাদ শইকীয়াৰ সৃষ্টিশীল ৰচনাৰাজিৰ সকলোখিনিৰে যথাযথ আলোচনা-সমালোচনা এতিয়াও সম্পূৰ্ণ হৈ উঠা নাই। সাংবাদিক আৰু সম্পাদক চন্দ্ৰ প্ৰসাদ শইকীয়া মানুহগৰাকী আৰু সাহিত্যিক চন্দ্ৰ প্ৰসাদ শইকীয়াৰ মাজত থকা পৃথক গুণসমূহ মনকৰিবলগীয়া। সম্পদক হিচাপে তেখেতৰ লগত প্ৰতিজন লেখক-লেখিকাৰ ব্যক্তিগত সম্পৰ্ক থকাৰ বাবেহে একোখন আলোচনী জীয়াই ৰখাৰ সম্ভৱ হৈ উঠিছিল। তদুপৰি, কৌশলী মনৰ অধিকাৰী চন্দ্ৰ প্ৰসাদ শইকীয়াই কোনো গৰাকী লেখকৰ লেখাটো প্ৰকাশৰ উপযোগী নহয় বুলি নকয়। লগতে পৰৱৰ্তী সময়ত আন এটা লেখা পঠাবলৈহে আহ্বান জনায়। মুখ্য সম্পাদক চন্দ্ৰ প্ৰসাদ শইকীয়াই সহকাৰী সম্পাদকগৰাকীক প্ৰবন্ধ সংগ্ৰহ কৰাৰ লগতে নিৰ্বাচনৰ দায়িত্বও অৰ্পণ কৰিছিল। 'গৰীয়সী', 'প্ৰকাশ' আদি আলোচনী সম্পাদনা কৰা সময়ছোৱাত সহকাৰী সম্পাদকৰূপে কাৰ্যনিৰ্বাহ কৰা ৰঞ্জিত কুমাৰ দেৱগোস্বামীৰ দৃষ্টিত চন্দ্ৰ প্ৰসাদ শইকীয়া এগৰাকী 'বিকল্প বিহীন' সম্পাদক। চন্দ্ৰ প্ৰসাদ শইকীয়াই এইগৰাকী সহকাৰী সম্পাদকক 'সম্পাদনা কাৰ্য'ৰ কেইটিমান কিটিপ দিছিল। যেনে -- এগৰাকী লেখকৰ লেখা ধাৰাবাহিকভাৱে দিয়াতকৈ

এমাহৰ ব্যৱধান ৰখাটো ভাল। তেখেতে ৰঞ্জিত কুমাৰ দেৱগোস্বামীক উদ্দেশ্যি কৈছিল --

"মই যিবোৰ সাংবাদিকৰ সৃষ্টিত অৰিহণা যোগাইছিলো চব বেলেগ হৈ গ'ল, ডাঙৰ আৰু নামজ্বলা হ'ল, বৰ ভাল লাগে জানা। কিন্তু সাহিত্যৰ ক্ষেত্রলৈ কোনোৱে আহিব নিবিচাৰে। কিয়, তুমি কি ভাবা? .... ভয় নাখাবা লাগিলে তুমি অকলশৰেই আগবাঢ়ি থাকা। টকা-পইচাৰ সমস্যাত সেও নামানিবা।"

[চন্দ্র প্রসাদ শইকীয়া ৰচনাৱলী, ২য় খণ্ড, পাতনি, পৃঃ ০.৬]

"চন্দ্র প্রসাদ শইকীয়া ৰচনাৱলী", দ্বিতীয় খণ্ড, (প্রথম সংস্কৰণ, ২০১৪)ৰ সম্পাদক হৃদয়ানন্দ গগৈয়ে কথাশিল্পী, সাহিত্যিক, সাংবাদিক চন্দ্র প্রসাদ শইকীয়াই কোৱা 'লিখব পৰাটো ভাগ্যৰ কথা, ভালকৈ লিখিব পৰাটো পৰম ভাগ্য' -- এই সাৰুৱা কথাষাৰি তেখেতৰ সৃষ্টিশীল ৰচনাৰাজিৰ লগতে সম্পাদকীয়সমূহতো ইয়াৰ প্রতিফলন ঘটিছে। "জীৱনৰ অর্থবহ চিন্তা-চর্চা, মানৰিক দৃষ্টিভঙ্গী, দেশ-মাটি-পানী-বায়ুৰ কথা সহজ অর্থত এক আলোকসন্ধানী দিশৰ সন্ধান তেখেতৰ ৰচনাৰাশিত সদায় পৰিষ্কাৰ হৈছে। মানুহক এক উন্নতমানৰ জীৱন সন্ধান দিয়া, মানুহে মানুহৰ পৰিচয় বিচাৰি যাতে পাব পাৰে তাৰ উপযুক্ত পৰিৱেশ সৃষ্টি কৰাটো তেখেতৰ লেখনীৰ ঘাই বৈশিষ্ট্য। নক'লেও হ'ব ইয়াৰ দ্বাৰাই তেখেতৰ উদাৰ, বিশাল আৰু এক নৈতিক মনৰ পৰিচয় উন্মোচিত হৈছে। এই দিশৰ জ্বলন্ত উদাহৰণ বেছিভাগ সম্পাদকীয়। ইবোৰত তেখেতৰ বক্তব্যও পোনপটীয়া। তেখেতৰ মতে মানুহৰ পৰিচয় যে মানুহ সেই সত্য উদ্‌ঘাটন সকলোৱে কৰিব পাৰিব লাগিব আৰু তেহে মানৱ জীৱন সার্থক হৈছে বুলি ভাবিব পৰা যায়। ভাষা, ভৌগোলিক পৰিসীমা যাতে কোনো মানুহৰ মাজত সৃষ্টি নহয় তাৰ ওপৰতো তেখেতে গুৰুত্ব আৰোপ কৰে। তেখেতৰ মতে এনে পার্থক্য নাথাকিলে, সংকীর্ণতা ছিন্ন হ'লেহে সাহিত্যৰ বিশাল ভিত্তি স্থাপন হ'ব পাৰে। শইকীয়াদেৱৰ এনে গভীৰ চিন্তাই সমগ্র পৃথিৱীখনকে কায চপাই অনাত আৰু সকলো মানুহ এক হোৱাৰ পথ প্রশস্ত কৰে। শইকীয়াদেৱৰ তেনে উদাৰ মনৱতাবাদী মনৰ প্রতিফলন খুব কম লেখকৰ কাপেদিহে নিগৰিত হয়।" [পূর্বোক্ত গ্রন্থ, পাতনি, পৃঃ ০.৭]

২.০০ সামৰণি ঃ

গ্রন্থ সম্পাদনা এক জটিল আৰু কষ্টসাধ্য মানসিক শ্রম। সকলো সৃষ্টিশীল সাহিত্যিক আৰু কলা বিশাৰদৰ বাবে এই কামত সফল হোৱাটো সম্ভৱ নহয়। সম্পাদকগৰাকী বৌদ্ধিক জ্ঞানৰ অধিকাৰী হোৱাৰ লগতে নিৰন্তৰ কর্মশক্তিৰে যথাযথ লেখনীৰে নির্দিষ্ট কৰি লোৱা মাহ অথবা পযেকটোৰ ভিতৰত কাকত-আলোচনীখনি প্রকাশৰ দায়িত্ব সম্পূর্ণৰূপে পালনৰ ক্ষমতা থাকিব লাগিব। সম্পাদকৰ চিন্তাশক্তি আৰু মেধাৰ লগতে কৌশলী মনটোৰ দ্বাৰাই একোখন কাকত-আলোচনী সুচাৰুৰূপে সম্পাদনা কার্য সম্ভৱ হৈ উঠে। এইবিলাক গুণৰ অধিকাৰী হৈয়ো যশস্বী লেখক চন্দ্র প্রসাদ শইকীয়াই ১৯৮৮ চনত প্রথম প্রকাশিত 'নতুন দৈনিক' কাকতৰ প্রতিষ্ঠাপক সম্পাদকৰূপে স্বকীয় চিন্তা-চেতনাৰ পৰিচয় দাঙি ধৰে। ১৯৮৮ চনৰপৰা ১৯৯৩ চনলৈ সম্পাদকৰ দায়িত্বত থকা চন্দ্র প্রসাদ

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শইকীয়াৰ সম্পাদনা ৰীতিৰ বিশেষত্বসমূহ অধ্যয়ন কৰি তলত দিয়া দিশসমূহ চকুত পৰিল।

চন্দ্র প্রসাদ শইকীয়াই এই কাকতৰ সম্পাদকীয় লেখাৰ জৰিয়তে প্রকাশ কৰা উল্লেখযোগ্য বিশেষত্বটো হৈছে -- মানৱীয় দৃষ্টিভঙ্গী। লগতে তেখেতৰ জীৱনাদর্শ, দর্শন, কর্ম আৰু সুগভীৰ জ্ঞান ইবোৰৰ মাজেদি ভাস্কৰ হৈ উঠিছে। স্বদেশ-স্বজাতিৰ প্রতি থকা অকৃত্রিম ভালপোৱা তেখেতৰ 'নতুন দৈনিক' কাকতৰ সম্পাদকীয় লেখাত স্পষ্টৰূপত প্রতিফলন ঘটিছে। অসমীয়া সাহিত্যিকসকলক মহান গ্রন্থ অধ্যয়নত ব্রতী হ'বলৈ আহ্বান জনোৱা কার্যলৈ লক্ষ্য কৰিলে বুজিব পাৰি যে -- গ্রন্থ প্রকাশ, গ্রন্থমেলা সংস্কৃতিক গুৰুত্ব প্রদান কৰিলেহে এটা জাতিক উচ্চ চিন্তাৰ অধিকাৰী কৰি তুলিব পাৰি। এটা জাতিৰ জীৱনত গ্রন্থৰ মহৎ প্রভাৱৰ কথা তেখেতে বিভিন্ন উদাহৰণৰ সৈতে দাঙি ধৰিছে।

বিশ্ব মানৱৰ প্রতি, সমাজ ব্যৱস্থাৰ প্রতি সজাগ দৃষ্টি ৰখাটো তেখেতৰ সম্পাদকীয় লেখাৰ এটি লক্ষণীয় দিশ। কৃচ্ছ সাধনা আৰু কঠোৰ অধ্যৱসায়ৰ যোগেদি মানুহে মহান তথা বিশ্ববিখ্যাত হ'ব পাৰে। তেখেতৰ মতে "পিতৃৰ ভৰণ-পোষণৰ বাবে পথচাৰীক ডকাইতি কৰা এজন যুৱক ডকাইত, কালক্রমত 'ৰামায়ণ' মহাকাব্যৰ ৰচয়িতা হ'ব পাৰিলে, কিন্তু পথচাৰীক ডকাইতি কৰা প্রতিটো যুৱক ডকাইতেই বাল্মীকি হ'ব নোৱাৰিলে।"

চন্দ্র প্রসাদ শইকীয়াৰ সম্পাদকীয়ত লেখা আন এটি মূল্যবান কথা মনকৰিবলগীয়া। সেইটো হৈছে সংগঠনবিলাকে প্রতিবাদী কার্যসূচী হিচাপে লোৱা অসম অথবা ভাৰত বন্ধৰ আহ্বান। জনসাধাৰণে বন্ধৰ প্রতি কিমান সঁহাৰি জনায় -- সেইটো গুৰুত্বপূর্ণ কথা। হঠাতে দিয়া বন্ধ সংস্কৃতিয়ে দেশৰ উন্নয়নত কিমান যে ক্ষতি কৰিছে এই কথা ভাবিবলৈ সংগঠনবিলাকৰ সময়ে নাই। আচলতে উন্নত কর্মস্পৃহা আৰু সংস্কৃতি, কাম-কাজ কৰাৰ এটি নিৰৱচ্ছিন্ন পৰিৱেশ গঢ়ি তাৰ সপক্ষে জনমত সৃষ্টি কৰাত তেখেতে গুৰুত্ব আৰোপ কৰিছে।

এইদৰে বিচাৰ কৰি চালে দেখা যায় যে -- বিশিষ্ট সাহিত্যিক, সাংবাদিক আৰু সম্পাদক চন্দ্র প্রসাদ শইকীয়াৰ প্রায়বিলাক সম্পাদকীয় লেখাৰ মান নিশ্চয় উচ্চপর্য্যায়ৰ বুলি দাবী কৰিব পাৰি। হাতী মাৰি ভুৰুকাত ভৰাব পৰা শক্তি প্রদর্শন কৰি চন্দ্র প্রসাদ শইকীয়াই লেখা 'নতুন দৈনিক'ৰ সম্পাদকীয় লেখা কেৱল তথ্য সমৃদ্ধ, জ্ঞানৰ আকৰেই নহয়, আচলতে ইবোৰ উচ্চমানৰ চিন্তাধাৰাৰ বাহক আৰু অনুপম সাহিত্য বুলিলে অত্যুক্তি কৰা নহয়। তেখেতৰ মৃত্যুয়ে অসমীয়া ভাষা-সংস্কৃতিৰ ক্ষেত্রখনিত অপূৰণীয় ক্ষতি কৰিলে সঁচা, কিন্তু ভৱিষ্যৎ প্রজন্মক নতুন পথৰ সন্ধান দিবলৈ সক্ষম হৈছে বুলি নিঃসন্দেহে মত প্রকাশ কৰিব পৰা যায়।

সহায়ক গ্রন্থ

(ক) মুখ্য উৎস ঃ

গগৈ, হৃদয়ানন্দ (সম্পা.) ঃ চন্দ্র প্রসাদ শইকীয়া ৰচনাৱলী, দ্বিতীয় খণ্ড, অসম প্রকাশন পৰিষদ, গুৱাহাটী - ৭৮১০২১, প্রথম প্রকাশ - ডিচেম্বৰ, ২০১৪।

(খ) গৌণ উৎস ঃ

শর্মা, সত্যেন্দ্রনাথ ঃ অসমীয়া সাহিত্যৰ সমীক্ষাত্মক ইতিবৃত্ত, সৌমাৰ প্রকাশ, গুৱাহাটী।

শর্মা, হেমন্ত কুমাৰ ঃ অসমীয়া সাহিত্যৰ দৃষ্টিপাত, বীণা লাইব্রেৰী, গুৱাহাটী।

বৰগোহাঞি, হোমেন (সম্পা.) ঃ অসমীয়া সাহিত্যৰ বুৰঞ্জী, ষষ্ঠ খণ্ড, আনন্দ ৰাম বৰুৱা ভাষা-কলা-সংস্কৃতি সংস্থা, গুৱাহাটী।

ভূঞা, যোগেন্দ্র ঃ ঊনবিংশ শতিকাৰ অসম সংবাদ, অসমীয়া বিভাগ, ডিব্রুগড় বিশ্ববিদ্যালয়।

ঠাকুৰ, নগেন (সম্পা.) ঃ এশ বছৰৰ অসমীয়া উপন্যাস, জ্যোতি প্রকাশন, গুৱাহাটী।

<u>পাদটীকা</u> ঃ

১. হৃদয়ানন্দ গগৈ ঃ চন্দ্র প্রসাদ শইকীয়া ৰচনাৱলী, ২য় খণ্ড, প্রথম প্রকশ ২১০৪, ডিচেম্বৰ, পৃঃ ৩৪৯, ৩০০।

২. পূর্বোক্ত গ্রন্থ, পৃঃ ৩৫৭।

৩. পূর্বোক্ত গ্রন্থ, পৃঃ ৪৩১ [সংস্কৃতিৰ সংকট শীর্ষক লেখা, ২১ জুন, ১৯৯১]।

৪. পূর্বোক্ত গ্রন্থ, পৃঃ ৪৩২।

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