PROJECT REPORT

DARRANG COLLEGE, TEZPUR

প্ৰকল্প

দৰং মহাবিদ্যালয়ৰ অসমীয়া বিভাগৰ স্নাতক ষষ্ঠ ষান্মাসিকৰ ASM-HE-6056
কাকতৰ লগত সংগতি ৰাখি প্ৰস্তুত কৰা প্ৰকল্প ।

বিষয়ঃ বাৰেচহৰীয়া ভাওনাৰ পটভূমি আৰু বৈশিষ্ট্য সহ কাৰিকৰী দিশৰ এক সমীক্ষাত্মক অধ্যয়ন ।

তত্বাৱধায়কঃ খনীন্দ্ৰ কুমাৰ কলিতা ।
অসমীয়া বিভাগ , দৰং মহাবিদ্যালয় ।

প্ৰস্তুতকৰ্তাঃপ্ৰাণজিৎ কোছ।
ৰোল নং : UA-201-225-0423

অসমীয়া [illegible] মহাবিদ্যালয় ।

প্ৰকল্প

দৰং মহাবিদ্যালয়ৰ অসমীয়া বিভাগৰ স্নাতক ষষ্ঠ ষান্মাসিকৰ ASM-HE-6056 কাকতৰ লগত সংগতি ৰাখি প্ৰস্তুত কৰা প্ৰকল্প ।

মাননীয়া কুমাৰ কৰ।
সহযোগী অধ্যাপক
বাংলা বিভাগ
দৰং মহাবিদ্যালয়
তেজপুৰ
তাৰিখঃ 28/05/2023

বিষয়ঃ বাৰেচহৰীয়া ভাওনাৰ পটভূমি আৰু বৈশিষ্ট্য সহ কাৰিকৰী দিশৰ এক সমীক্ষাত্মক অধ্যয়ন ।

তত্বাৱধায়কঃ ৰবীন্দ্ৰ কুমাৰ কলিতা ।
অসমীয়া বিভাগ , দৰং মহাবিদ্যালয় ।

প্ৰস্তুতকৰ্তাঃপ্ৰাণজিৎ কোছ।
ৰোল নং : UA-201-225-0423

অসমীয়া বিভাগ, দৰং মহাবিদ্যালয় ।

২০২৩ বৰ্ষ ।

DEPARTMENT OF ASSAMESE
DARRANG COLLEGE,TEZPUR,ASSAM
অসমীয়া বিভাগ , দৰং মহাবিদ্যালয , তেজপুৰ অসম

Ref.....

Date: .....

প্রমাণ-পত্র

গুৱাহাটী বিশ্ববিদ্যালয়ৰ অন্তর্গত দৰং মহাবিদ্যালয়ৰ অসমীয়া বিভাগৰ স্নাতক ষষ্ঠ ষান্মাসিকৰ পাঠ্যক্রমৰ কাকত ASM-HE-6056 ৰ যুগুত কৰা ষষ্ঠ ষান্মাসিকৰ ছাত্র শ্রীমান প্রাণজিৎ কোছ (ৰোলনং:-UA-201-225-0423) আমাৰ তত্ত্বাৱধানত প্রস্তুত কৰা " বাৰে চহৰীয়া ভাওনাৰ পটভূমি আৰু বৈশিষ্ট্যসহ কাৰিকৰী দিশকৰ এক সমীক্ষাত্মক অধ্যয়ন " শীর্ষক এই ক্ষুদ্রগৱেষণা পত্রত তেওঁৰ মৌলিকতা প্রকাশ পাইছে।

আশা কৰোঁ আমাৰ নির্দেশ আৰু তত্ত্বাৱধানত প্রস্তুত কৰা এই ক্ষুদ্র গৱেষণা পত্রৰ জৰিয়তে তেওঁৰ গৱেষণাৰ প্রতি ধাউতি বৃদ্ধি হ'ব। শ্রীমান প্রাণজিৎ কোছ ৰ উজ্জল ভৱিষ্যত আৰু উত্তৰোত্তৰ কামনা কৰিলোঁ ।

খগেন্দ্র কুমাৰ কলিতা

সহকাৰী অধ্যাপক
অসমীয়া বিভাগ
দৰং মহাবিদ্যালয়

স্থানঃ- তেজপুৰ

তাৰিখ :-

কৃতজ্ঞতা স্বীকাৰ

'বাৰেচহৰীয়া ভাওনাৰ পটভূমি আৰু বৈশিষ্ট্যসহ কাৰিকৰী দিশৰ এক সমীক্ষাত্মক অধ্যয়ন' শীৰ্ষক গৱেষণা প্ৰকল্পটি প্ৰস্তুত কৰাৰ বাবে অনুমতি প্ৰদান কৰা গুৱাহাটী বিশ্ববিদ্যালয়ৰ অন্তৰ্গত দৰং মহাবিদ্যালয়ৰ অসমীয়া বিভাগৰ ওচৰত মই পোন প্ৰথমতে চিৰকৃতজ্ঞ । দ্বিতীয়তে এই বিষয়টিত গৱেষণা প্ৰকল্পটি প্ৰস্তুত কৰাৰ সময়ত এজোপা বটবৃক্ষৰদৰে থাকি মোক সকলো দিহা পৰামৰ্শ দি বাট বুলাই নিয়া গৱেষণাৰ তত্বাৱধায়ক , অধ্যাপক খনীন্দ্ৰ কুমাৰ কলিতা ছাৰলৈ মোৰ শতকোটি প্ৰণাম । তৃতীয়তে এই প্ৰকল্পটিৰ বিষয়-বস্তু অথবা সমল সমূহ যুগুত কৰাত সহায় সহযোগিতা আগবঢ়োৱা জামুগুৰিহাটৰ নিবাসী অঞ্জলী কাকতি আৰু লুনা নাথ বাইদেওক কৃতজ্ঞতা জ্ঞাপন কৰিলোঁ ।

সদৌ শেষত এই প্ৰকল্পটিৰ ইটো-সিটো কামত সহায় কৰা মোৰ সতীৰ্থবৃন্দ ক্ৰমে আস্কৰ আলী , পীতাম্বৰ ৰাভা ,সংকল্প বৰা আৰু নীৰঞ্জন শইকীয়া লৈ মোৰ হিয়াভৰা স্নেহ যাচিলোঁ ।

প্ৰাণজিৎ কোছ

তাৰিখ : ২৪/০৪/২০২৩

সূচীপত্র

০.০০ অৱতৰণিকা :-

অসমৰ স্বকীয় সংস্কৃত কলাকৃষ্টিৰ অক্লান্ত সাধক ঐতিহ্যমণ্ডিত জামুগুৰিহাট । উৎসৱৰ প্ৰয়োভৰৰ পার্থিক জীৱনৰ হাজাৰ সংঘাতক নেওচা দি জনজীৱনক জীপাল কৰিবলৈ প্ৰয়াস কৰা জামুগুৰিৰ নিৱাসী সংগ্ৰামী ৰাইজৰ ইতিহাস বহু দীঘল । এইখন জামুগুৰি যিখন জামুগুৰিৰ ৰাইজে নিজৰ কলিজাৰ ৰঙা তেজতকৈয়ো জন্মভূমিক আপোন বুলি ভাৱি আত্ম ত্যাগ কৰা বহুতো উদাহৰণ আছে । এইখন জামুগুৰিৰ ৰাইজে জাতিটোক বিশ্বদৰবাৰত জিলিকাই তুলিবলৈ ন ন কৌশল অৱলম্বন কৰি তাহানিৰে পৰা সাম্প্ৰতিক সময়লৈ তেজক পানী কৰি আহিছে , এই খন জামুগুৰি ৰাইজৰ সমাজ জীৱনৰ সুকীয়া বৈশিষ্ট্যৰাজি বুৰঞ্জীত অস্বীকৃত নহয় । শোণিতপুৰ জিলাৰ অন্তর্গত ১ লাখ জনসংখ্যাৰে পৰিপূর্ণ জামুগুৰিহাটৰ পূবে পৰিবেষ্টিত দিকৰাই জলধাৰ দ্বাৰা আৰু পশ্চিমে জীয়া ভৰলী , যিয়ে এসময়ত জামুগুৰিবাসী ৰাইজৰ জীৱনলৈ বোৱাই আনিছিল আতংকৰ চকুলো ।

ৰাঘজাল পাতি ৰাঘ ধৰা ভৰলীপৰীয়া সাহসী জামুগুৰিৰ অন্তৰ যেনেকৈ অফুৰন্ত সাহসেৰে ভৰা তেনেদৰে আকৌ উৎসৱ পার্বনত সিমানেই প্ৰাণ চঞ্চল । অসমৰ জাতীয় উৎসৱ বিহুৰ পৰা আৰম্ভ কৰি সত্ৰীয়া সংস্কৃতিৰ বিভিন্ন উৎসৱ পার্বন অনুষ্ঠিত কৰি জামুগুৰিৰ সৌন্দর্য বৃদ্ধি কৰি আহিছে । মহাপুৰুষ শংকৰদেৱৰ পৰশত প্ৰাণ পাই উঠা অংকীয়া ভাওনাক স্বকীয় বৈশিষ্টৰে প্ৰতি ৫ বছৰৰ অন্তত অনুষ্ঠিত কৰি অহা ৰাৰেচহৰীয়া

ভাওনা অন্যতম ।বাৰেচহৰীয়া ভাওনাৰ আৰম্ভণি আৰু এই সাংস্কৃতিক পৰম্পৰাৰ প্ৰসাৰ আৰু এক দুশবছৰীয়া পৰিক্ৰমা পোৱা হৈছে। জীয়া ভৰলীৰ পাৰৰ সংস্কৃতিৰ পৰশ-ক্ষেত্ৰ নদুৱাৰ অঞ্চলৰ ৰাইজৰ মাজত শংকৰী কলা-কৃষ্টিৰ আদৰ আৰু চৰ্চা অতি পুৰণি । জামুগুৰিহাটৰ সাংস্কৃতিক ইতিহাসত ওঠৰ শতিকাৰ শেষ শতিকাতেই জন্ম-লগ্নৰ খোজ দিয়া এই ভাওনা উৎসৱ বিংশ শতিকাৰ সামৰণি বৰ্ষলৈকে মুঠ তেইশবাৰ অনুষ্ঠিত হৈ যায়। পূৰ্বতে চাৰিখেলীয়া ভাওনা, বৰসবাহ, হেজাৰী ভাওনা আদি যি ৰূপতে এই ভাওনাৰ জন্ম-প্ৰচেষ্টাৰ কথা পোৱা নাযাওক কিয়, প্ৰথমে দক্ষিণ জামুগুৰি অন্তৰ্গত 'খুন্দখোৱা' পথাৰত আঠখন ৰভাৰে বাৰেচহৰীয়া ভাওনা অনুষ্ঠিত হয় আৰু তাৰ তিনিবছৰ পাছত ৰঘু-দলনিত (১৭৯৭)এই উৎসৱ অধিক পয়োভৰেৰে পতাৰ কথা পোৱা যায় । খুন্দখোৱা পথাৰত ১৭৯৪ চনতে এই ভাওনা মহোৎসৱৰ পাতনি মেলে যদিও কোনো কোনো আলোচক-গৱেষকে ১৮০৭ চনতহে খুন্দখোৱাত হোৱাৰ কথা কৈ ৰঘুদলনিতেই সৰ্বপ্ৰথম ১৭৯৭ চনত বাৰেচহৰীয়া ভাওনা জন্মৰ কথা প্ৰতিপন্ন কৰিব খোজে। কিন্তু প্ৰকৃতাৰ্থত দ্বিতীয় বাৰৰ কাৰণেহে পুনৰ ১৮০৭ চনত খুন্দখোৱাত এই ভাওনা উৎসৱ পতা হয়। অৱশ্যে আনুমানিক ১৭৯৩-৯৪ চন মানতে খুন্দখোৱা পথাৰত হোৱা আঠখেলীয়া ভাওনাৰ আলমতে ৰঘুদলনিত তিনিবছৰ পাছতে সমূহীয়া ভাওনা (পিছলৈ বাৰেচহৰীয়া ভাওনা নাম পায়) পতাৰ কথা নুই কৰিব নোৱাৰি। যি কি নহওক, ৰঘুদলনিত আৰম্ভ হৈ এই ভাওনা উৎসৱৰ পৰম্পৰা বিংশ শতিকা অতিক্ৰম কৰিলে। তেতিয়াৰে পৰা বৰ্তমানলৈকে বাৰেচহৰীয়া ভাওনা অনুষ্ঠিত হৈ এক বিশাল পৰিক্ৰমাৰে একক বৃহৎ সাংস্কৃতিক অনুষ্ঠান ৰূপে ধৰ্মীয়-সংস্কৃতিৰ দিশত

মহোৎসৱৰ বিস্তৃতি লাভ কৰিলে । শোণিত কোঁৱৰ গজেন বৰুৱাই প্ৰবন্ধ, বাতৰি, ছবি প্ৰকাশ আদিৰ মাধ্যমেৰে ভাৰতৰ বহুকেইখন বাতৰি কাকত আলোচনীত বাৰেচহৰীয়া ভাওনাৰ সবিশেষ প্ৰচাৰ কৰি সমগ্ৰ দেশতে এই মহান কৃষ্টিৰ মহত্ব সদৰি কৰাৰ লগতে তেখেতে বিদেশতো অসমৰ সংস্কৃতি প্ৰচাৰ কৰিবলৈ যোৱাৰ সময়ত বাহিৰৰ দেশতো এই ভাওনাৰ কথা প্ৰচাৰ কৰে। মৃত্যুৰ আগলৈকে মুঠ চাৰিবাৰ এই ভাওনা উৎসৱৰ লগত জড়িত থাকি গজেন বৰুৱাই মণ্ডপ নিৰ্মাণৰ দিশত অভিনৱত্ব প্ৰদান কৰাৰ লগতে উত্তৰ-পূৰ্বাঞ্চলৰ বিভিন্ন প্ৰদেশৰ সংস্কৃতিপ্ৰেমী ৰাইজক আনি বাৰেচহৰীয়া ভাওনাথলীত বিৰাট সাংস্কৃতিক সমন্বয়ৰ সৃষ্টি কৰিলে আৰু পূৰ্বাঞ্চলৰ সাতভনীৰ সাংস্কৃতিক অনুষ্ঠান পৰিবেশনেৰে সমন্বয় সাংস্কৃতিক সমাৰোহৰ কাৰ্যসূচী বাৰেচহৰীয়া ভাওনাৰ লগত সংযোগ কৰি এই মহান কৃষ্টি-সমাহাৰৰ ইতিহাস ৰচনা কৰিলে । এনেবোৰ কৰ্মৰ পৰিণতি স্বৰূপেই আজি সমগ্ৰ দেশত এই ভাওনা উৎসৱৰ কথা বিয়পি পৰিল আৰু বাৰেচহৰীয়া ভাওনা মহোৎসৱ ভাৰতৰ একক বৃহৎ সাংস্কৃতিক অনুষ্ঠান ৰূপে অসমৰ ভাওনা কৃষ্টিক বহুমুখী আৰু অভিনৱ ৰূপত ভাৰতীয় সংস্কৃতিৰ বুকুত জিলিকি উঠিছে।

বাৰেচহৰীয়া ভাওনাৰ কাৰিকৰীক দিশতো অতি মন কৰিব লগীয়া ।কোনো আনুষ্ঠানিক কাৰিকৰী প্ৰশিক্ষণ নথকা জামুগুৰিৰ গঞা ৰাইজে কোনো বিশেষজ্ঞ কিম্বা অভিযন্তাৰ সহায় নোলোৱাকৈ নিজৰ বুদ্ধি, অভিজ্ঞতা আৰু শিল্প পৰম্পৰাৰ সহায়ত এই বিচিত্ৰ ভাওনা-মণ্ডপ সাজি উলিওৱাটো শ্ৰম , নিষ্ঠা আৰু সমন্বয়ৰ পৰিচায়ক । শোণিতকোঁৱৰ গজেন বৰুৱাই

কৰা বৰ্ণনামতে পৃথিৱীত আন কোনোৱেই এনে ৰংগমঞ্চৰ পৰিকল্পনা কৰিব পৰা নাই। সঁচাই বিচিত্ৰ, তাৎপৰ্যপূৰ্ণ ইয়াৰ শিল্পধ্বজা। বাৰেচহৰীয়া ভাওনাৰ ধৰ্মীয় সাংস্কৃতিক পৰম্পৰামূলক প্ৰতিটো কাৰ্যসূচী আৰু ৰূপায়ণৰ ব্যৱস্থাপনা তাৎপৰ্য্যপূৰ্ণ।

০.০১:- অধ্যয়নৰ লক্ষ্য আৰু উদ্দেশ্য :-

অসমৰ অংকীয়া নাট্য পৰম্পৰাত বিশেষভাৱে স্থান দখল কৰা ভওনা , 'বাৰেচহৰীয়া ভাওনা' । ইয়াৰ অধ্যয়ন আৰু গৱেষণাই ভাওনা সংস্কৃতিৰ প্ৰৱাহমান বোৱতী সোঁতত সংযোজিত নতুন দিশবোৰৰ লগতে হেৰাই যাবলৈ ধৰা ঐতিহ্য আৰু পৰম্পৰা সমূহৰ বিষয়ে নৱপ্ৰজন্মক জ্ঞাত কৰোৱাৰ লগতে বাৰেচহৰীয়া ভাওনাৰ উদ্ভৱ,বিকাশ আৰু কাৰিকৰী দিশৰ বিষয়ে জনসাধাৰণৰ আগত দাঙি ধৰাটোৱে মূলতঃ ক্ষুদ্ৰ গৱেষণা প্ৰকল্পটিৰ মূল লক্ষ্য আৰু উদ্দেশ্য ।

০.০২ অধ্যয়নৰ পদ্ধতি :-

উক্ত গৱেষণাৰ বিষয়টিত অধ্যয়ন কৰোঁতে বাৰেচহৰীয়া ভাওনাত উপস্থিত হৈ , বৃহত্তৰ জামুগুৱহাটৰ বাৰেচহৰীয়া ভাওনা চাবলৈ অহা দুই এজন জেষ্ঠ্যলোকৰ পৰা শুনা বাৰেচহৰীয়া ভাওনাৰ ইতিবৃত্ত আৰু বাৰেচহৰীয়া ভাওনাৰ স্মৃতি গ্ৰন্থ , প্ৰসংগ পুথি , বাতৰি-কাকত , আলোচনী প্ৰয়োজন সাপেক্ষে ইণ্টানেটৰ পৰা তথ্য যুগুতাই এই গৱেষণা প্ৰকল্পটি প্ৰস্তুত কৰা হৈছে । মূলতঃ এই গৱেষণা প্ৰকল্পটিত ক্ষেত্ৰ অধ্যয়ন আৰু বিশ্লেষণাত্মক পদ্ধতি গ্ৰহণ কৰা হৈছে ।

০.০৩ অধ্যয়নৰ পৰিসৰ:-

'বাৰেচহৰীয়া ভাওনাৰ পটভূমি আৰু বৈশিষ্ট্যসহ কাৰিকৰী দিশৰ এক সমীক্ষাত্মক অধ্যয়ন' গৱেষণা প্ৰকল্পটিত জামুগুৰিহাটৰ চমু ইতিহাস সহ বাৰেচহৰীয়া ভাওনাৰ অৰ্থ , উদ্ভৱ, বিকাশ , বৈশিষ্ট্য কাৰিকৰী দিশ(কলচি) আদিৰ বিশ্লেষণাত্মক বিৱৰণেৰে এই গৱেষণা প্ৰকল্পটিত সামৰি লোৱা হৈছে ।

০.০৪ পূৰ্বকৃত অধ্যয়নৰ সমীক্ষা :-

বাৰেচহৰীয়া ভাওনাৰ অধ্যয়নৰ পথ মুকলি কৰোঁতাসকলৰ ভিতৰত পোন প্ৰথমতে শোণিতকোঁৱৰ গজেন বৰুৱা (১৯১৫-১৯৭৭)ৰ নাম উচ্চাৰণ কৰিব লাগিব। তেখেতে জীৱন চৰ্যাত ছবছৰ বয়সতে ১৯২১ চনৰ ভাওনাকে ধৰি মুঠ ১১ বাৰ বাৰেচহৰীয়া ভাওনা দেখিছে। ৰূপকোঁৱৰ জ্যোতিপ্ৰসাদআগৰৱালা দেৱৰ সান্নিধ্য লাভ কৰা বৰুৱাদেৱে দেশ-বিদেশৰ অভিজ্ঞতাৰে অভিজ্ঞ হৈ অসমত সাংস্কৃতিক চৰ্চা আৰু প্ৰচাৰত মন মেলি বাৰেচহৰীয়া ভাওনাৰ অন্তৰ্নিহিত আদৰ্শ, সামূহিক শ্ৰমদান, গণতান্ত্ৰিক আৰু উদাৰ নৈতিক শিক্ষা, মঞ্চনিৰ্মাণৰ কৌশল আদি বিৱৰণ কৰি ১৯৬১ চনত চিত্ৰ সহ 'অসম বাণী'ত এটি প্ৰবন্ধ প্ৰকাশ কৰিছিল। সেই সময়ৰ মুখ্যমন্ত্ৰী বিমলা প্ৰসাদ চলিহা দেৱক তেখেতে দাখিল কৰা আঁচনিৰ অনুমোদনমৰ্মে বৰুৱাৰ তত্বাৱধানত 'পাহাৰ-ভৈয়াম সাংস্কৃতিক মিশ্যন' গঢ় লৈ উঠে আৰু অৰুণাচল (নেফা)ৰ ভিন ভিন ঠাইত সত্ৰীয়া নৃত্য-গীতৰ চৰ্চাকেন্দ্ৰ খোলা হয় । তেখেতৰ নেতৃত্বত ১৯৬৯ চনৰ ভাওনাত পাহাৰভৈয়াম, চাহ জনগোষ্ঠী, বড়ো, কাৰ্বি,

মিছিং শিল্পীৰ সমাবেশেৰে বাৰেচহৰীয়া ভাওনাক অধিক গতি প্রদান কৰে। সেই বর্ষৰ ভাওনাত জাতীয় নাট্যশালাৰ গুৰিয়াল, নাট্য জগতৰ শ্রীধৰণী গেলাৰীৰ স্বত্বাধিকাৰী আব্রাহাম আলকাজিয়ে ভাওনা উপভোগ কৰি ৰাষ্ট্রীয় কাকতত প্ররন্ধ প্রকাশ, সংগীত নাটক অকাডেমীৰ সচিব সুৰেশ অৱস্থী, ফিল্ম ডিভিজনৰ সঞ্চালক গোবিন্দ বিদ্যার্থী, ৰাজ্যিক সাংস্কৃতিক বিভাগৰ সঞ্চালক ৰুদ্র বৰুৱা, মহেশ্বৰ নেওগ, গহন চন্দ্র গোস্বামী,মোহন চন্দ্র মহন্ত প্রভৃতি পণ্ডিত গৱেষকে গজেন বৰুৱাৰ আমন্ত্রণত ভাওনা উপভোগ কৰাৰ ফলত বাৰেচহৰীয়া ভাওনাৰ বহুল প্রচাৰ, প্রসাৰৰ লগতে গৱেষণাৰ বিষয় হৈ পৰে। বিশাল পদুম ফুলৰ আর্হিত নির্মাণ কৰা মঞ্চৰ শৈল্পিক ৰূপ গজেন বৰুৱাই চিত্রৰ যোগেদি অর্থবহ ৰূপত প্রকাশ কৰে। গজেন বৰুৱাৰ সম্পাদনাতে পোন প্রথমবাৰৰ বাবে 'জামুগুৰীয়া বাৰেচহৰীয়া ভাওনা' (১৯৭৫) স্মৃতিগ্রন্থ প্রকাশ হয়।

বাৰেচহৰীয়া ভাওনাৰ সৈতে সংগতি ৰাখি ১৯৭৫ বর্ষৰ পাছৰ প্রতিবছৰৰ ভাওনাতে স্মৃতিগ্রন্থ প্রকাশিত হৈ আহিছে। ১৯৭৯ বর্ষত ধর্মকান্ত শইকীয়াৰ সম্পাদনাত, ১৯৮৬ বর্ষত গণেশ পাঠকৰ সম্পাদনাত, ১৯৯৩ বর্ষত পুনৰ গণেশ পাঠকৰ সম্পাদনাত স্মৃতিগ্রন্থ প্রকাশিত হয়। ১৯৯৮ বর্ষত পোন প্রথমবাৰৰ বাবে গ্রন্থাকাৰে প্রদীপ ভূঞা আৰু নৰেন্দ্র হাজৰিকাৰ যুটীয়া সম্পাদনাত 'শংকৰী কলাকৃষ্টিৰ অধ্যয়ন' নামৰ গ্রন্থখনি প্রকাশ হয় । ইয়াৰ পৰৱর্তী সময়ত ২০০৭ বর্ষত ভৱ গোস্বামী আৰু নাৰায়ণ শইকীয়াৰ যুটীয়া সম্পাদনাত, ২০১৩ বর্ষত মহেশ্বৰ বৰা আৰু দিলীপ কুমাৰ ভট্টাচার্যৰ যুটীয়া সম্পাদনাত ,

২০১৮ বৰ্ষৰ বাৰেচহৰীয়া ভাওনাৰ স্মৃতিগ্ৰন্থখনি প্ৰেমনাৰায়ণ গোস্বামী, নাৰায়ণ শইকীয়া, ষড়ানন দেৱনাথ আৰু মিংকু কলিতাৰ (সম্পাদক মণ্ডলী)ৰ সম্পাদনাত আৰু শেহতীয়াকৈ ২০২৩ বৰ্ষত নাৰায়ণ শইকীয়া , বিকাশ বৰা আৰু বাসৰ ভূঞা (সম্পাদক মণ্ডলীৰ) সম্পাদনাত প্ৰকাশ হয় । এই স্মৃতিগ্ৰন্থ আৰু প্ৰকাশিত পুথিসমূহত বাৰেচহৰীয়া ভাওনা, অসমৰ সাহিত্য, কলা-সংস্কৃতিৰ বৰ্ণময় ইতিহাসৰ লগতে বিশেষকৈ নাট্য সাহিত্যৰ সকলো দিশ সামৰি দেশী-বিদেশী লেখকে লেখনিৰে সমৃদ্ধ কৰিছে।

পৰৱৰ্তী সময়ত দেশী-বিদেশী গৱেষকে বাৰেচহৰীয়া ভাওনাক বিষয়বস্তু ৰূপে লৈ বিভিন্ন প্ৰকাৰৰ পৰীক্ষা-নিৰীক্ষা, গৱেষণা অব্যাহত ৰাখিছে। গুৱাহাটী বিশ্ববিদ্যালয়ৰ লোক-সংস্কৃতি বিভাগৰ অৱসৰপ্ৰাপ্ত অধ্যাপক প্ৰবীণ চন্দ্ৰ দাসৰ তত্বাৱধানত জামুগুৰিহাটৰ বোৱাৰী গীতাঞ্জলি দাসে আৰু ড° উমেশ ডেকা দেৱৰ তত্বাৱধানত অশ্বিনী কুমাৰ ডেকাই বাৰেচহৰীয়া ভাওনাক সামৰি কৰা অপ্ৰকাশিত গৱেষণা গ্ৰন্থ উল্লেখযোগ্য ।

১.০০ জামুগুৰিহাটৰ ভৌগোলিক পৰিচয় :-

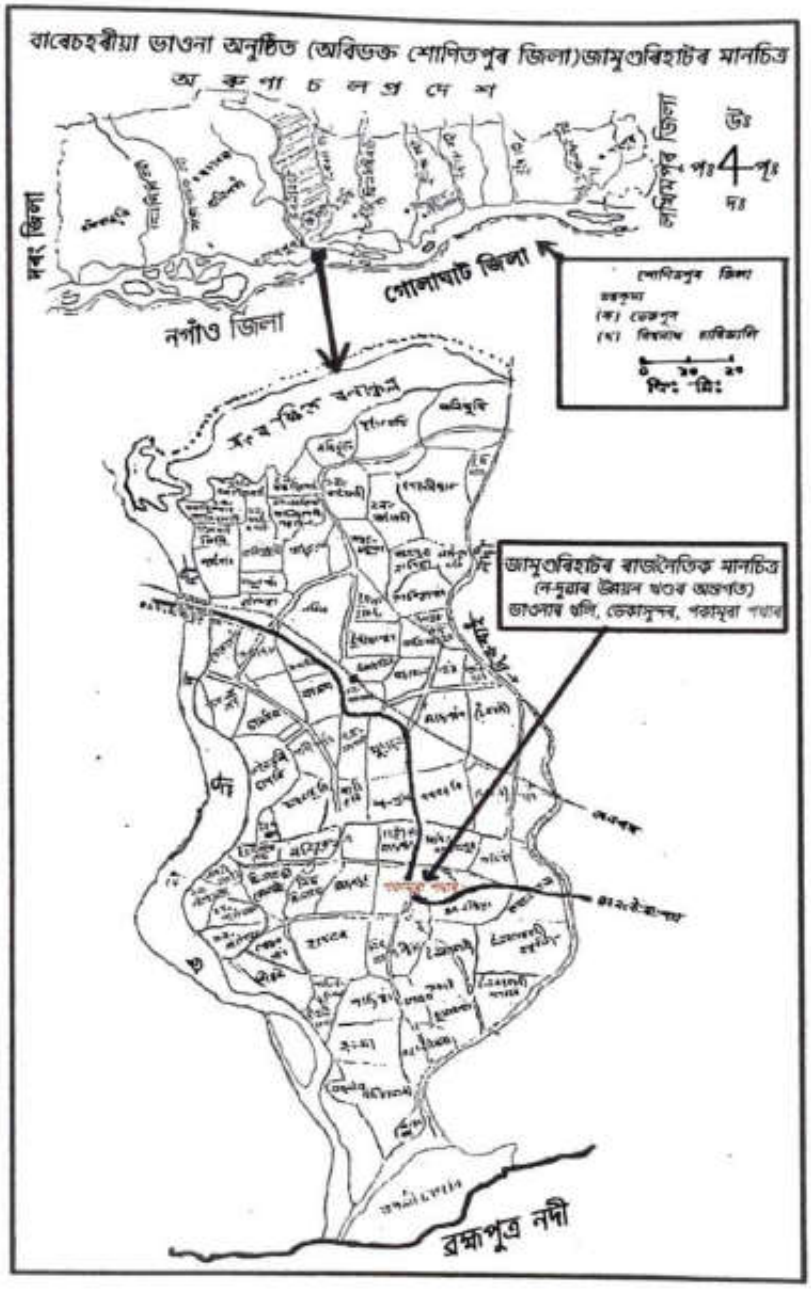
মহাবাহু ব্ৰহ্মপুত্ৰৰ উত্তৰ পাৰৰ প্ৰাচীন প্ৰসিদ্ধ ভূমি বৃহত্তৰ 'নদুৱাৰ' ৰ একাংশই হ'ল বৰ্তমানৰ জামুগুৰিহাট অঞ্চল। অৱশ্যে এই অঞ্চলৰ আদিতে নাম জামুগুৰিহাট নাছিল। নন্দিকেশ্বৰ নামটোহে এই অঞ্চলৰ অতি প্ৰাচীন নাম আছিল। জিতাৰী বংশৰ ৰজাসকল

আৰু অসুৰ বংশীয় ৰজাসকলে প্ৰাচীন কালত এই অঞ্চলত ৰাজত্ব কৰাৰ কথা বৰ্তমান এই অঞ্চলত থকা ভালেমান কীৰ্তিচিহ্ন, বিয়াগোম পুখুৰী, ভগ্ন দ'ল- দেৱালয় আদিয়ে বাৰুকৈয়ে সোঁৱৰাই দিয়ে। সেই সময়ত নন্দিকেশ্বৰ নামটোৱেই প্ৰচলিত আছিল বুলি জনা যায়। পৰবৰ্তী পৰ্যায়ত বৃটিছৰ যুগত ঘিলাধৰীয়া নামটো বেচিকৈ প্ৰচলন হয়। তাৰপাছত ছিলাবন্ধা নামেৰেও অঞ্চলটিয়ে পৰিচিতি পায়। দুই- আঢ়ৈ শতিকা মানৰ পৰাহে বৰ্তমানৰ জামুগুৰিহাট নামটোৱে স্থায়িত্ব পায়।

অঞ্চলটোৰ কেন্দ্ৰস্থলত থকা এজোপা বৃহৎ জামুগছৰ তলত বহা এখন সপ্তাহিক হাটৰ লগত অঞ্চলটোৰ বেপাৰ-বাণিজ্য ঘনিষ্ঠ হৈ পৰাত সমগ্ৰ অঞ্চলটো জামুগুৰিহাট হ'লহি বুলি জনা পালে ৰাজ্যৰ বিভিন্ন ঠাইত থকা 'জামুগুৰি' নামটোৰ পৰা পট' বুলি কোৱাটো অতিকৈ বন্ধা, বৰভগীয়া আৰু যায় হৈ পৰে। যি কি নহওক মুঢ়াদ'ল- এই তিনিটা মৌজাক সামৰিয়েই ঘাইকৈ এই বৃহত্তৰ জামুগুৰিহাট অঞ্চল। উত্তৰে অৰুণাচল ৰাজ্য, দক্ষিণে মহাবাহু ব্ৰহ্মপুত্ৰ, পূবত দিকৰাই নদী আৰু পশ্চিমে ভৰলী নদীয়েই ই অঞ্চলৰ চাৰিসীমা। জামুগুৰিহাট অঞ্চল ঘাইকৈ ভৰলী আৰু বৰদিকৰাই নদীয়ে ভঙা-গঢ়া ঠাই। প্ৰকৃতাৰ্থত, এই দুয়োখন নদীৰেই অৱদান-ইয়াৰ ধ্বংস আৰু সৃষ্টিয়েই জামুগুৰিহাটৰ ইতিহাস। ইয়াৰ য'ত-ত'ত সিঁচৰিত হৈ থকা পুৰণি দ'ল-দেৱালয়, সত্ৰ, মঠ-মন্দিৰ আদিয়ে ঠাইখনিৰ প্ৰাচীন আভিজাত্য আজিও সগৌৰৱে ঘোষণা কৰি আহিছে। বিশেষকৈ, প্ৰবাদ পুৰুষ ৰজা আৰিমত্তৰ বৰ্ণিল কাৰ্যাৱলী আৰু তেওঁৰ কালত ঘটা কিম্বদন্তিৰে জামুগুৰিহাট অঞ্চল জড়িত

হৈ আছে। কালক্রমত প্রায় ওঠৰ শতিকাৰ শেষলৈকে বিভিন্ন সময়ত বিভিন্নজন বিভিন্ন কাৰণত ব্রহ্মপুত্রৰ দক্ষিণ পাৰৰ পৰা আহি ইয়াতে থিতাপি লয়হি। সেয়েহে দক্ষিণ কূলৰ ভালেমান গাঁও-ভুইৰ নামৰ লগত ইয়াৰ গাওঁ-ভুইৰ নামৰ সাদৃশ্য আছে।

"বিশেষকৈ মানৰ আক্রমণৰ সময়ত একেলগে গাঁও এৰি আহি উত্তৰ পাৰত নতুনকৈ গাঁও পাতিয়েই সেই গাঁৱৰ নামকৰণ কৰি লৈছিল বুলি অনুমান কৰিব পাৰি।" [১]


বাৰেচৰীয়া ভাওনা অনুষ্ঠিত (অবিভক্ত শোণিতপুৰ জিলা)জামুগুৰিহাটৰ মানচিত্ৰ
অ রু ণা চ ল প্ৰ দে শ
দৰং জিলা
নগাঁও জিলা
গোলাঘাট জিলা
শোণিতপুৰ জিলা
জামুগুৰিহাটৰ ৰাজনৈতিক মানচিত্ৰ
ব্ৰহ্মপুত্ৰ নদী

১.০০ বাৰেচহৰীয়া ভাওনাৰ পটভূমিঃ-

প্ৰাচীন কালত জামুগুৰিহাট অঞ্চলটি যেতিয়া বহুতো হাবি-জংঘলৰে ভৰি আছিল তেতিয়া উত্তৰাঞ্চলত থকা পাহাৰীয়া লোক সকলৰ সঘন বিচৰণভূমি আছিল এই জামুগুৰিহাট। নতুন মানুহ আহি বসবাস কৰি উৰ্বৰ মাটিত খেতিবাতি কৰিলে তেওঁলোকে ডকাহকা দি উৎপাদিত শস্য লৈ গৈছিল। কালক্ৰমত লাহে লাহে মানুহৰ প্ৰব্ৰজন আৰম্ভ হ'ল আৰু আহোম ৰজা সকলেও বহুতো প্ৰজাক আনি ইয়াত বসতি কৰালে । বিশেষকৈ মানৰ আক্ৰমনৰ সময়ত বহুতো দক্ষিণপাৰৰ লোক এই জামুগুৰিহাটত আহি এই অঞ্চলটিত বসবাস কৰিলে । পৰিব্ৰাজিত সকলক একত্ৰিত কৰি ৰখাৰ স্বাৰ্থতে সমূহীয়াকৈ থলুৱা কলা-কৃষ্টি, উৎসৱ পাৰ্বন আদি অনুষ্ঠিত কৰিবলৈ লোকসকলে প্ৰয়াস কৰিলে। তেওঁলোকে মহাপুৰুষজনাই সৃষ্টি কৰা অংকীয়া ভাওনা পাতিবলৈ আৰম্ভ কৰিলে । সৰহ সংখ্যক গাঁও বা খেল হোৱা বাবে সমূহীয়া ভাওনাৰ বিস্ময়কৰ নব্য ধাৰণাৰ সৃষ্টি কৰিলে সেই সময়ৰ বয়োজ্যেষ্ঠ সাংস্কৃতিক কৰ্মীসকলে। কেইবাখনো খলা পাতি বহু খেলে বা গাঁৱে একে সময়তে ভাওনা ৰূপায়ণ কৰা ধাৰণাটোৱেই হ'ল বাৰেচহৰীয়া ভাওনা । তদানীন্তন অনাখৰিপ্ৰায় কৃষি সৰ্বস্ব, বুদ্ধিদীপ্ত, প্ৰত্যুৎপন্নমতি চহা সকলৰ সুসামঞ্জস্য সুচিন্তাৰ ফচলেই হ'ল আজিৰ ইতিহাস সমৃদ্ধ ঐশ্বৰ্য্যশালী বাৰেচহৰীয়া ভাওনা অনুষ্ঠান। গাঁও বৃদ্ধিৰ লগে লগে ১৭৯৭ চনত আৰম্ভ কৰা অমৃতোপম বাৰেচহৰীয়া ভাওনাৰ 'খলাও' কালক্ৰমত বৃদ্ধি হ'ল । ব্যয়বহুলতা আৰু অত্যাধিক শ্ৰমৰ প্ৰয়োজনীয়তাৰ প্ৰতি লক্ষ্য ৰাখি তদানীন্তন কৃষিজীৱি চহা ৰাইজে ৫/৬ বছৰৰ অন্তৰালত এই ভাওনা অনুষ্ঠিত কৰাৰ সিদ্ধান্ত গ্ৰহণ

কৰিলে । সাম্প্ৰতিক কালত এই ২২৫ বছৰীয়া সংস্কৃতিয়ে আৰু বিস্তৃতি লাভ কৰি দেশ বিদেশৰ দৃষ্টি কাঢ়িবলৈ সক্ষম হোৱাটো প্ৰণিধানযোগ্য । এনেধৰণে অনুষ্ঠিত কৰা সমূহীয়া ভাওনা সমগ্ৰ ৰাজ্যৰ ভিতৰতে একক আৰু অনন্য সাংস্কৃতিক সৌধ।

২.০১ বাৰেচহৰী ভাওনা আৰু বাৰেচহৰীয়াৰ অৰ্থঃ-

শংকৰী সংস্কৃতিৰ সৰ্বশ্ৰেষ্ঠ উপাদান, অসমীয়া সংস্কৃতিৰ গৌৰৱময় স্বৰ্ণসৌধ 'ভাওনা' অসমৰ সৰ্বত্ৰ অতি ভক্তিসহকাৰে আৰু পৱিত্ৰতাৰে পালন কৰা হয়। নৱবৈষ্ণৱ ধৰ্মৰ মহৎ ফলশ্ৰুতি, জগতগুৰু শংকৰদেৱৰ মহান শিল্পকৃতি 'ভাওনা'ক তেৱাই এহাতে যেনেকৈ ভক্তিধৰ্ম প্ৰচাৰৰ এক মাধ্যম, এক সামাজিক কলা হিচাপে সৃষ্টি কৰিছিল, ঠিক সেইদৰে সংগীত-নৃত্য-নাট্যাভিনয় সমন্বিতে ব্যঞ্জনাময় বিচিত্ৰ উপাদানৰে পূৰ্ণ কৰি ভাওনাৰ গাঁঠনিতো বৰ্ণাঢ্যতাৰ প্ৰকাশ ঘটাইছে। ইয়াৰ উপৰিও সামাজিক কলা হিচাপে ভাওনাৰ মাজত নিহিত হৈ আছে সংহতি আৰু সমন্বয়ৰ আদৰ্শ। আজিও গাঁৱত 'ভাওনা পাতিছে' বুলি ক'লে গাওঁখনৰ লগতে ইয়াৰ ওচৰ-চুবুৰীয়া অঞ্চললৈকে যি এক আনন্দ মুখৰ পৰিৱেশৰ সৃষ্টি হয়, সেয়া আন কোনো মাধ্যমেই সৃষ্টি কৰিব নোৱাৰে। শংকৰী কলা সংস্কৃতিৰ মহিমামণ্ডিত এই ভাওনাৰ মাজত নিহিত হৈ থকা সংহতি আৰু সমন্বয়ৰ আদৰ্শত উক্ত শোণিতপুৰ জিলাৰ ঐতিহাসিক জামুগুৰিহাটৰ ৰাইজে প্ৰায় দুশ বছৰ পূৰ্বেই সম্প্ৰতি অসমীয়া সমাজৰ সামাজিক আৰু সাংস্কৃতিক জীৱনধাৰাৰ অনুপম ৰূপৰেখা বুলি চিহ্নিত 'বাৰেচহৰীয়া

ভাওনা'ৰ পুলি ৰোপন কৰিছিল। জামুগুৰিহাটৰ গ্ৰাম্য জীৱনৰ প্ৰাণৰ উৎসৰ, জামুগুৰিহাটৰ স্বকীয় পৰিচয় বিশ্ববাসীৰ আগত দাঙি ধৰা এই 'বাৰেচহৰীয়া ভাওনা' ১৭৯৭ খ্ৰীষ্টাব্দত আৰম্ভ হৈ বিভিন্ন সামাজিক, অৰ্থনৈতিক, ৰাজনৈতিক উত্থান-পতনৰ মাজেদি আহি একবিংশ শতিকাৰ আজিৰ আধুনিক জীৱনযাত্ৰাটো স্বকীয় ঐতিহ্য আৰু গৰিমা অক্ষুন্ন ৰাখি সৰ্বসাধাৰণক আধ্যাত্মিকতালৈ ধাৱমান কৰাত যি যোগাত্মক ৰঙণি আগৰঢ়াই আহিছে সেয়া এক গুৰুত্বপূৰ্ণ দিশ। সেই সময়ৰ পৰাই জামুগুৰিহাটত অংকীয়া ভাওনাৰ পৰা অকণো হেৰ-ফেৰ নোহোৱাকৈ উলহ-মালহৰে, শ্ৰদ্ধা-ভক্তিৰে অথচ নতুন নতুন গ্ৰহণযোগ্য সংযোজনৰে বাৰেচহৰীয়া ভাওনা উদযাপনৰ পৰম্পৰা আৰম্ভ হয়। কথিত আছে - 'বাৰেচহৰীয়া ভাওনা নাপাতিলে জামুগুৰীয়া ৰাইজৰ মান নাথাকে'। সঁচাকৈয়ে এই কথাষাৰ যেন প্ৰতিগৰাকী জামুগুৰীয়াৰ অন্তৰৰ আঁহে আঁহে শিপাই আছে। সেয়ে হয়তো এই অঞ্চলৰ ৰাইজে হেজাৰ বিঘিনীকো নেওঁচি বাৰেচহৰীয়া ভাওনা উদযাপনৰ ধাৰাবাহিকতা অক্ষুন্ন ৰাখিছে। গাঁৱে গাঁৱে থকা নামঘৰ সমূহেও শংকৰী সংস্কৃতিৰ অনুপম ভক্তিৰসেৰে সিক্ত জামুগুৰিহাট অঞ্চলৰ আন এক সুকীয়া পৰিচয় দাঙি ধৰে। আজিও এই অঞ্চলত নিয়মীয়াকৈ অনুষ্ঠিত 'ভাওনা' সংস্কৃতিয়ে অঞ্চলটিক সজীৱ কৰি ৰাখিছে। ভাওনা আৰু ইয়াৰ সৈতে জড়িত গীত-মাত, বচন-বিলাপ-পয়াৰ-মধ্যাৱলীপীতাম্বৰী আদিৰ শুদ্ধ অনুশীলন আৰু শুদ্ধ পৰিৱেশনৰ প্ৰতি সদা-সচেতন জামুগুৰিয়া ৰাইজে চামে চামে এটা পুৰুষৰ পৰা আন এটা পুৰুষলৈ ভাওনা সংস্কৃতিৰ সুবাস বিলাই স্বকীয় উচ্চ সাংস্কৃতিক চেতনা আৰু

দায়িত্ববোধৰ পৰিচয় দাঙি ধৰিবলৈ সক্ষম হৈছে। জামুগুৰিহাটৰ প্রতিগৰাকী ব্যক্তিৰ হৃদয়ে হৃদয়ে প্ররাহিত এই সুউচ্চ সাংস্কৃতিক সত্বাৰে অপূর্ব নিদর্শন 'বাৰেচহৰীয়া ভাওনা'।

প্রতি পাঁচ বছৰৰ অন্তত অনুষ্ঠিত এই 'বাৰেচহৰীয়া ভাওনা' বুলি ক'লে বহুতৰে মনলৈ অহা স্বাভাৱিক প্রশ্নটো হ'ল- 'বাৰেচহৰীয়া' শব্দটোৰ অর্থ আৰু ভাওনাৰ লগত ইয়াৰ সম্পর্ক নো কি? দৰাচলতে বাৰেচহৰীয়াৰ অর্থ- 'বাৰে' মানে অনেক বা একাধিক। 'চহৰীয়া' শব্দই চহা মানুহ বা গাঁৱলীয়া কৃষিজীৱি মানুহে বসবাস কৰা গাঁওক বুজায়। অর্থাৎ 'বাৰেচহৰীয়া' মানে অনেক গাঁওৰ সমষ্টি; যেনেকৈ বাৰেবৰণীয়া, বাৰেৰহণীয়া শব্দ আমি সকলোৱে পাই আহিছো। এতেকে বাৰেচহৰীয়া ভাওনা মানে বহুতো গাঁও মিলি মহাপুৰুষ শ্রীমন্ত শঙ্কৰদেৱৰ শিল্প ভাৱনা সঞ্জাৰি অনুপম সৃষ্টি ভাওনা সংস্কৃতিৰ পৰম্পৰাৰে অনুষ্ঠিত কৰা ভাওনাকে বুজায়। বহুতো গাঁও বা খেল মিলি এপাহ পূর্ণপ্রস্ফূটিত পদুমফুলৰ দৰে বৃত্তাকাৰ মণ্ডপৰ তলত পৃথক পৃথক খলাত প্রদর্শন কৰা ভাওনাই হৈছে বাৰেচহৰীয়া ভাওনাৰ মূল উপজীব্য । 'খলা' শব্দটোৰ অর্থ হৈছে একো একোখন ভাওনা থলী বা অভিনয় স্থল। আনহাতে অস্থায়ী নামঘৰ বুলিও ক'ব পাৰি। 'খেল' মানে এখন গাঁওত থকা গৃহস্থী সমস্তক সামৰি সামাজিক দায়বদ্ধতাৰ বান্ধোনত আৱদ্ধ এক সামাজিক গোট।

"বাৰে শব্দৰ অর্থ 'অনেক' আৰু 'চহৰীয়া' শব্দৰ অর্থ -গাঁৱলীয়া বুজায়। এতিয়া এই বাৰেচহৰীয়া শব্দটোৰ অর্থই-অনেক গাঁৱৰ গাঁৱলীয়া সমষ্টিক বুজায়।" [২]

২.০২ বাৰেচহৰীয়া ভওনাৰ উদ্ভৱ বিকাশ:-

বাৰেচহৰীয়া ভাওনাৰ ঐতিহ্য সম্পৰ্কত আলোচনা কৰিলে পোন প্ৰথমতেই দৃষ্টি নিক্ষেপ কৰিব লাগিব অঞ্চলটোৰ জনগাঁথনি আৰু ইয়াৰ ইতিহাসৰ বিষয়ত । মোৱামৰীয়া বিদ্ৰোহ আৰু মানৰ অসমআক্ৰমণৰ আগে-পিছে ৰাজনৈতিক, সামাজিক বা অৰ্থনৈতিক বিভিন্ন কাৰণৰ লগতে নিৰাপদ আশ্ৰয় বিচাৰি ব্ৰহ্মপুত্ৰ পাৰ হৈ উত্তৰ পাৰলৈ প্ৰৱজন ঘটা দক্ষিণপাৰৰ লোকৰ দ্বাৰাই জীয়াভৰলীৰ পুৱপাৰৰ পলসুৱা ভূমিত এই অঞ্চলৰ অধিকাংশ গাঁৱেই গঢ় লৈ উঠিছিল যদিও আদিতে অষ্ট্ৰো-এছিয়াটিক গোষ্ঠীৰ খাছি-চিন্টে আদি লোকসকলে ইয়াত বসবাস কৰিছিল বুলি ইতিহাসত উল্লেখ আছে। পূৰ্বৱৰ্তী সময়ত বৰ্মণ, শালস্তম্ভ, পাল আদি বংশৰ ৰজা সকলৰ ৰাজ্যৰ অন্তৰ্ভূক্ত হৈ থকা এই অঞ্চলটোত বান ৰজাৰ শাসনো চলিছিল বুলি বিশ্বাস কৰা হয়। 'জামুগুৰিহাটৰ ইতিহাস পুথিত উল্লেখ থকা মতে – যিহেতু নন্দিকেশ্বৰৰ শিৱ-লিঙ্গ অতি পুৰণি আৰু শোণিতপুৰৰ ৰজা বানেই অসমত প্ৰথম লিঙ্গ পূজাৰ প্ৰৱৰ্তন কৰিছিল, সেয়ে এই অঞ্চলটো বান ৰাজ্যৰো অন্তৰ্ভুক্ত আছিল বুলি ক'ব পৰা যায়। একেদৰে কুসুমটোলাত থকা পিঠাগুৰি দৌল আৰু শুকনা পুখুৰীয়ে আৰিমত্ত ৰজাৰ ৰাজত্বও যে এই অঞ্চলত আছিল সেই সম্পৰ্কত নিশ্চিত ধাৰণা দিয়ে। বাৰ শতিকাৰ আগভাগত চুতীয়া সকলৰ আৰু আহোম ৰাজত্বৰ পূৰ্বে ব্ৰহ্মপুত্ৰৰ উত্তৰপাৰে ঠন ধৰি উঠা বাৰভূঞাৰ ৰাজত্বইও অঞ্চলটোৰ এক অংশ সামৰি লৈছিল বুলি ইতিহাসত উল্লেখ আছে। জামুগুৰিহাটৰ দক্ষিণাঞ্চলৰ পাচিগাঁৱৰ ওচৰৰ বিশাল হুকাই পথাৰ আৰু ইয়াত থকা ডাঙৰ পুখুৰীটোৱে জামুগুৰিৰ দক্ষিণ অঞ্চলৰ ব্ৰহ্মপুত্ৰৰ পাৰত হুকাই ৰজাৰ ৰাজত্ব চলিছিল

বুলিও অনুমান কৰা হৈছে। গতিকে বিভিন্নজন ৰজাৰ ৰাজত্ব কালত সেই সময়ৰ সমাজ ব্যৱস্থাৰ বিভিন্ন সাংস্কৃতিক উপাদানৰ সুঁতি পৰৱৰ্তী সময়লৈ প্ৰৱাহিত হৈছিল বুলিব পাৰি। জামুগুৰিৰ সেই সময়ৰ ইতিহাসলৈ লক্ষ্য কৰিলে দেখা যায় যে সেই সময়ত জামুগুৰিহাটৰ পশ্চিমাঞ্চল, যাক পুৰণি কালত ঘিলাধৰীয়া' বুলি জনা গৈছিল, তাৰেই এক সুবিস্তৃৰ্ণ এলেকাজুৰি অন্তৰ্ভুক্ত আছিল দক্ষিণ দিশৰ সুপ্ৰাচীন ইতিহাসে গৰকা বকুলগুৰি অঞ্চল। এই বকুলগুৰি অঞ্চললৈ বিভিন্ন সময়ত উজনিৰ বা ব্ৰহ্মপুত্ৰৰ দক্ষিণপাৰৰ নিকটৱৰ্তী অঞ্চলৰ বহু মানুহ জীৱনজীৱিকাৰ সন্ধানত আহি নিগাজীকৈ বসবাস কৰিবলৈ লৈছিল। তেতিয়া জীয়াভৰলী নৈখন চামধৰা গড়ৰ বহু পশ্চিমলৈ আছিল। কিন্তু পৰৱৰ্তী সময়ত জীয়াভৰলীৰ তীব্ৰ পূৱমুখী আগ্ৰাসন আৰু ভয়াৱহ বান-গৰাখহনীয়াত সেই ঐতিহাসিক প্ৰাচীন অঞ্চলটো বিলুপ্ত হ'ল । প্ৰাপ্ত তথ্যমতে, সেই বকুলগুৰি অঞ্চলতে এতিয়াৰ জামুগুৰিহাটৰ প্ৰায়কেইখন গাওঁ যেনে মুঢ়াদ'ল, কাঠবাৰী, বেবেজীয়া, পানীগাঁও, চামধৰা, বগাকুৰা আদি অন্তৰ্ভুক্ত হৈ আছিল। এই গাঁৱৰ মানুহবোৰে উনৈশ শতিকাৰ মাজভাগত বৰ্তমানৰ ঠাইত পূৰ্বৰ গাঁওসমুহৰ নামকৰণৰেই নতুনকৈ থিতাপি লৈছিল । কেৱল এয়াই নহয়, ডৌকাচাপৰি, কৰতিপাৰ, টলকাবাৰী আদি গাঁৱৰ পূৰ্বপুৰুষসকলো সেই অঞ্চলৰেই আছিল বুলি ইতিহাসে প্ৰমাণ দিয়ে। আমি এইখিনি ইতিহাসৰ অৱতাৰণা এইবাৰেই কৰিবলগীয়া হৈছে যে সেই বকুলগুৰি আৰু ইয়াৰ নিকটতম পাঁছিগাঁৱৰ ৰাইজ সেই ১৭৯৭ চনতেপতা 'বাৰেচহৰীয়া ভাওনা' ভাগৰ প্ৰধান উদ্যোক্তা আছিল । নিশ্চিতভাৱে সেই কালত তেওঁলোকৰ শস্যে-মৎস্যে, ঘৰে-বাৰীয়ে এক উৰ্ভেনদী পৰিৱেশ আছিল। লগতে আছিল এক প্ৰাণোচ্ছল

সাংস্কৃতিক পৰিমণ্ডল। আৰ্থিক-সমাজিক এক স্বচ্ছল অৱস্থা নাথাকিলে, এক সুউচ্চ সাংস্কৃতিক বাতাবৰণ নাথাকিলে ভগৱত প্ৰেমৰ প্ৰতিদুৰ্বাৰ আকৃষ্ট জাগ্ৰত নহ'লে বাৰেচহৰৰ দৰে অনুষ্ঠানৰ পাতনি তৰা সম্ভৱ নহয়।

বাৰেচহৰীয়া ভাওনাৰ অতীতৰ বিষয়ে জানিব বিচাৰিলে দুই ধৰণৰ বাখ্যা পোৱা যায়। প্ৰথম বাখ্যা মতে নগাওঁ, কলিয়াবৰ অঞ্চলত প্ৰচলিত হেজাৰী ভাওনাকে 'বাৰেচহৰীয়া ভাওনা'ৰ আদিৰূপ বুলি কোনো কোনোৱে ক'ব খুজি তাৰ বাখ্যাও তেওঁলোকে ডাঙি ধৰে যে - পুৰণি অভিভক্ত দৰং জিলাৰ চাৰিদুৱাৰ, নদুৱাৰ আৰু ছয়দুৱাৰ (বৰ্তমানৰ শোণিতপুৰ জিলা) একোটা বিস্তৃৰ্ণ অঞ্চল। এই 'দুৱাৰ' খ্যাত অঞ্চলবোৰত নিছিসকলৰ সঘন উপদ্ৰৱ হৈছিল আৰু সেই উপদ্ৰৱ প্ৰতিহত কৰাৰ বাবে একোটা সৈন্য গোট ৰখা হৈছিল। নিছিৰ অত্যাচাৰত উত্তৰপাৰৰ পৰা ব্ৰহ্মপুত্ৰৰ দক্ষিণ পাৰলৈ যোৱা আৰু দক্ষিণপাৰে মানৰ আক্ৰমণত তিস্তিব নোৱাৰি পুনৰ উত্তৰ পাৰলৈ অহা লোকসকলৰ কাৰণেই একালত নগাঁও আৰু দৰঙীয়া ৰাইজৰ মাজত ভালেমান নতুন সম্পৰ্ক গঢ়ি উঠে। কেৱল সেয়ে নহয়, উত্তৰ পাৰৰ কিছু লোক দক্ষিণত ৰয় আৰু দক্ষিণৰ কিছু লোকে আহি উত্তৰপাৰে বসতি স্থাপন কৰে। ইয়াৰ ফলত এক মিশ্ৰিত সংস্কৃতি কম দিনৰ ভিতৰতে গঢ় লৈ উঠিল। গাওঁ হিচাপেও কোনো কোনো অঞ্চল হয় উত্তৰ পাৰৰ পৰা দক্ষিণ পাৰলৈ উঠি গৈছিল, নতুবা দক্ষিণ পাৰৰ পৰা উত্তৰ পাৰলৈ উঠি আহিছিল। ইয়াৰ প্ৰমাণ - উত্তৰ পাৰ আৰু দক্ষিণপাৰৰ একে নামৰ গাওঁবোৰ। যেনে সৰুভগীয়া, বৰভগীয়া, মাধৱ, ডৌকাচাপৰি, কৰতিপাৰ, চেঁচা,

পানীগাওঁ, বেবেজীয়া, ঘাঁহি আদি। তাতোকৈও ডাঙৰ কথা হ'ল, কোনো কোনো পৰিয়ালৰ একেটা ঠাল দুয়োটা পাৰতে আজিও আছে। আন এক তথ্য মতে, প্ৰথমতে এখন ভাওনা চাৰিখেলীয়া ৰূপত বৰদোৱা অঞ্চলত অনুষ্ঠিত হৈছিল। বৰদোৱাৰ বালিসত্ৰৰ সত্ৰাধিকাৰ স্বৰ্গীয় শীৰেন্দ্ৰ নাৰায়ণ দেৱাধিকাৰ প্ৰভুৰ মুখৰেও ৰাইজে এসময়ত জানিব পাৰিছিল যে, যোগ চিনটোৰ আৰ্হিত ৰভা পাতি চাৰিখন ৰভাৰ তলত চাৰিখন ভাওনা একেলগে পতাৰ ব্যৱস্থা সেইঠাইত পুৰণিকলীয়াই আছিল ।"কলিয়াবৰত হেজাৰী ভাওনাৰ প্ৰথম বস্তি প্ৰজ্বলন কৰিছিল শাকমুঠিৰ শয়েক ভূঞাসকলে। তেওঁলোকে চতাই আলিৰ পশ্চিম দিশৰ বিস্তীৰ্ণ পথাৰত কেইবাখনো গাঁও লগ লাগি পতা সমাজখনে দৌল উৎসৱত চাৰিখনীয়া ৰভাৰে ভাওনা পাতিছিল। আহোম ৰাজ্য বিস্তাৰৰ সময়ত অর্থাৎ ১৫৫২ ৰ চুখামফাৰ ৰাজত্বৰ পৰা ৰাজ্য পৰিচালনাৰ সুবিধার্থে সলালগোঁহাই বিষয় সৃষ্টি কৰা হৈছিল। তেখেতৰ শাসনভাৰপৰিছিল ব্ৰহ্মপুত্ৰৰ দক্ষিণে কলিয়াবৰ, উত্তৰে চাৰিদুৱাৰ আৰু নদুৱাৰলৈকে। এই সলালগোঁহাইৰ পৃষ্ঠপোষকতাতে শাকমুঠিৰ ভূঞাসকলে দৌল উৎসৱত একেলগে ভাওনা কৰিছিল। একেজন বিষয়াৰ তলত থকা হেতুকে কলিয়াবৰৰ হেজাৰী সংস্কৃতি বাৰেচহৰীয়া ৰূপ লৈ জামুগুৰিলৈ বিয়পিল বুলি ক'ব পাৰি।" [৩]

আনহাতে দ্বিতীয় ব্যাখ্যা মতে, কুঁজিদাহৰ বংশাৱলীৰ পৰা সংগ্ৰহ কৰা তথ্য অনুসৰি নগাঁৱৰ হাতীচোং গাঁৱৰ লগত জামুগুৰিহাটৰ কেইবাখনো গাঁৱৰ সম্পৰ্ক আছে। বংশাৱলীৰ ইতিবৃত্ত অনুসৰি ৰামৰায় ভূঞাৰ পুত্ৰ সনাতন ভূঞা (ৰাজখোৱা) গুৰুজনা মাজুলীৰ পৰা

ঘুৰি অহাৰ পাছত, কিছুদিন মাজুলীতে থাকি তাৰ পৰা আহি চাৰিদুৱাৰ অঞ্চলত(জামুগুৰিহাটৰ পৰা বৰ্তমান প্ৰায় ত্ৰিশ কিলোমিটাৰ উত্তৰে) বসবাস কৰে। তেওঁৰ সাতজনকৈ পুত্ৰৰ জন্ম হয়- ৰত্নগিৰি, পাতলৰ গিৰি, সুন্দৰগিৰি, খাতলগিৰি, হুকাইগিৰি, নোমলগিৰি আৰু মদনগিৰি। চাৰিদুৱাৰ অঞ্চলত থকা জ্যেষ্ঠপুত্ৰ ৰত্নগিৰি আৰু তিনিজন ভায়েকৰ লগত মাটি বাৰী সংক্ৰান্তীয় কথাত নিছিসকলৰ লগত কাজিয়া লগাত আৰু নিছিসকলে বিভিন্ন উপদ্ৰৱ, অত্যাচাৰ আৰম্ভ কৰাত ৰত্নগিৰিয়ে যথেষ্ট ধৈৰ্য আৰু সহিষ্ণুতাৰে কাজিয়াখন মিত-মাত কৰিবলৈ প্ৰচেষ্টা কৰিছিল। উক্ত সময়তে এদিন ৰঙাই নামৰ এজন লোকক নিছিয়ে কাটি টুকুৰা-টুকুৰ কৰাত ৰত্নগিৰিৰ ভায়েকহঁতে এটা ভোজ পাতি মিত্ৰতা কৰাৰ প্ৰয়াস কৰি কেইজনমান নিছিক ভোজলৈ মাতি অত্যাধিক মদ খুৱাই, থকাঘৰৰ ভিতৰতে জুই লগাই দিয়ে। দুজন নিছিক সেই জুইয়ে পুৰি মাৰে আৰু আন কেইজন আধামৰা হয়। সেইবাবে ৰত্নগিৰি আৰু ভায়েকহঁতে ৰাতিৰ ভিতৰতে জামুগুৰিয়েদি পলাই আহে আৰু আহোতে লগত মাধৱৰ মূৰ্তিটো লগত লৈ আহে। নিছিসকলে তেওঁলোকৰ পাছলোৱা বুলি উমান পোৱাৰ লগতে মুৰ্তিটো কঢ়িয়াই অনাৰ শক্তি হেৰুৱাই পেলোৱাত মুঢ়াদ'ল অঞ্চলত মুৰ্তিটো এৰি থৈ ৰাতিয়েই ব্ৰহ্মপুত্ৰ পায়হি । পিচত নাঁৰেৰে ব্ৰহ্মপুত্ৰ পাৰ হৈ কুৰঁৰীটোল অঞ্চলত কেইদিনমান থাকিবলৈ লয় । ৰত্নগিৰি কুৰৱীটোলৰ পৰা হাতীচোং অঞ্চললৈ যায়। (উল্লেখযোগ্য যে, বাৰভূঞাৰ নাতি এইজন ৰত্নগিৰিকে ৰজাই সন্দেহৰ চকুৰে চাবলৈ ধৰি চোৰাংচোৱা ৰখাৰো ব্যৱস্থা কৰিছিল।) কিছু দিনৰ পিছত ভায়েক পাতলৰগিৰি আৰু সুন্দৰ- গিৰিও গৈ ৰত্নগিৰি থকা হাতীচোং অঞ্চল

পায়গৈ। ৰত্নগিৰি আৰু পাতলৰগিৰি দুয়োগৰাকী লোক গীত-মাত, নাচ-বাগত পাৰ্গত আছিল- যাৰ ফলত অঞ্চলটোৰ ৰাইজৰ মাজত তেওঁলোকৰ জনপ্রিয়তা বাঢ়িবলৈ ধৰে। উল্লেখযোগ্য যে, ৰৰদোৱা অঞ্চলৰ চাৰিখেলীয়া ভাওনাত ৰত্নগিৰি আৰু পাতলৰগিৰিয়েও গীত-মাত অভিনয় আদিত যোগ দিছিল । কিছুকাল যোৱাৰ পাছত হুকাইগিৰিৰ তিনিটা ল'ৰা বসন্ত ৰোগত আক্রান্ত হৈ মৃত্যু হোৱাত সেই ঠাই ত্যাগ কৰি হুকাই গিৰি উত্তৰপাৰলৈ গুছি আহে । নোমলগিৰিয়ে কিছুদিন মিছাৰ ওচৰত বাস কৰে। তাতো বেছিকাল অতিবাহিত নকৰি উত্তৰপাৰলৈ আহে আৰু উত্তৰপাৰৰ ৰৰভগীয়া অঞ্চলত, পাতলৰ গিৰিয়ে পাতলৰচুক অঞ্চলত আৰু হুকাইগিৰিয়ে হুকাইপথাৰৰ ওচৰত (পাঁছিগাওঁ) বাস কৰিবলৈ ধৰে। উল্লেখযোগ্য যে হুকাইগিৰিয়ে খন্দোৱা হুকাইপুখুৰী আজিও পাঁছিগাওঁ অঞ্চলত বিৰাজমান।

কালক্রমত এই তিনিও ককাইভাই লগ লাগি কঢ়ালৰ বংশৰ পাগবন্ধা বৰুৱাৰ সৈতে আলচ কৰি 'চাৰিখেলীয়া ভাওনা'ৰ আৰ্হিৰ দৰেই এটা সামূহিক ভাওনা অনুষ্ঠান পতাৰ সিদ্ধান্ত লয়। এওঁলোকৰ উৎসাহ উদ্দীপনাত আন কেইবাখনো গাঁৱে পাছলৈ সহযোগ কৰে। কেইবাখনো গাঁৱৰ সহায়-সহযোগ পাই 'ৰঘুদলনী' পথাৰত একৈশখন খলাৰে (মতভেদে চৈধ্যখন) এটা মণ্ডপ সাজি ১৭৯৭ চনত এই ভাওনা অনুষ্ঠিত কৰে। এই ভাওনাভাগে ৰাইজক সংঘবদ্ধ হোৱাৰ এটা ডাঙৰ সুযোগ আনি দিয়ে । তেতিয়াৰ দিনত নোহোৱা-নোপোজা এনে এটা অনুষ্ঠান বা উৎসৱৰ গুৰি ধৰাৰ বাবে হুকাইগিৰিয়ে সামাজিক প্রতিষ্ঠা লাভ কৰিবলৈ সক্ষম

হয়। এয়াই আছিল বাৰেচহৰীয়া ভাওনা উদ্‌যাপনৰ আৰম্ভণী। কথিত আছে যে, বৃহৎ অঞ্চলটোৰ বিভিন্ন সামাজিক সমস্যাৰ লগতে সমূহীয়া ভাওনা উৎসৱ আদি পতাৰ বিষয়ে আলোচনা কৰিবলৈ পাছিগাঁৱত এটা সমুহীয়া গৃহ নির্মাণ কৰিছিল। তাৰ খুটা কেইটা আছিল আহঁত গছৰ। কালক্রমত ঘৰটো ভাঙি গ'ল যদিও তাৰ খুটা কেইটা গছ হৈ বহু কাললৈ বাছি আছিল। সেই ঠাই ডোখৰ 'সভা কৰা আহঁত'হিচাপে জনাজাত।

বাৰেচহৰীয়া ভাওনা শব্দটোৰ কোনো অভিধানিক অর্থ পোৱা নাযায়। ৰাইজৰ মুখ বাগৰি অহা এই শব্দ বিভিন্ন গাঁও অথবা বিভিন্নজনৰ মহামিলনৰ থল বুলি গণ্য কৰা হয়। ১৭৯৭ চনত আৰম্ভণি হোৱা বাৰেচহৰীয়া ভাওনা বর্তমানলৈকে মুঠ ২৭ বাৰ অনুষ্ঠিত হৈছে। ৰঘুদলনী পথাৰত পাতনি মেলা এই বাৰেচহৰীয়া ভাওনা ইয়াৰ পিছত ১৮০৭ চনত পাছিগাঁৱৰ খুনখোৱাহাটৰ উত্তৰৰ পথাৰত অনুষ্ঠিত হয়। তৃতীয়বাৰৰ বাবেও সেই একে স্থান ৰঘুদলনিতে এই ভাওনা উৎসৱ ৰাইজে ৰাজহুৱাভাবে পাতে। অৱশ্যে চাৰিখেলীয়া আহিৰে মাত্র ছখন ৰভা কৰিয়েই এইবাৰ ভাওনা অনুষ্ঠিত কৰে । শুনা- মতে ইয়াৰো নেপথ্যত এটা কাহিনী আছে-- সেয়া হৈছে জীয়া ভৰলীৰ প্রবল গৰাখহনীয়া আৰু বানপানী। জীয়া ভৰলীয়ে গৰা খহাই আৰম্ভ কৰা সন্ত্রাসৰ ফলত ৰাইজৰ উৎসৱ পালনৰ মনোবল যেনেকৈ কমিল, সেইদৰে ভৰলী গোঁসানীক সন্তুষ্ট কৰাৰ পৰিকল্পনা চলিল। কিন্তু কেৱল পূজাৰে সন্তুষ্ট কৰিব নোৱাৰা ভৰলীৰ কাষৰ সেই ৰঘুদলনিৰ লেখীয়া ঐতিহাসিক স্থান এৰি পিছলৈ এই ভাওনাই বেলেগ বেলেগ স্থানলৈ গতি কৰিলে । অর্থ- নৈতিক দুৰাৱস্থা আৰু

নতুনকৈ আহি বহা এই গাওঁ বোৰৰ অস্থিৰতাৰ হেতু বহু বছৰলৈকে এই ভাওনাসবাহ পতাৰ পৰা মানুহ বিৰত থাকিব লগা হৈছিল। পৰৱৰ্তী কালত এইভাওনা উত্তৰ দিশলৈ গতি কৰাৰ তথ্য পোৱা যায়। বিশেষতঃ উত্তৰপাৰে ক্ৰমান্বয়ে জনবসতি ঘন হোৱাত আৰু সেই সেই অঞ্চলৰ ৰাইজৰ প্ৰৱল দাবীত ১৮১২ চনত বৰভগীয়া গাঁৱৰ ফাকুৱা পথাৰত, ১৮১৭ চনত পুনৰ ৰঘুদলনি পথাৰত, ১৮৮৫ চনত ঘিলাধৰীয়া পথাৰত, ১৮৯৫ চনত শ'লগুৰি গাঁৱৰ পশ্চিম দিশে থকা ডোমৰ বাকৰিত (বৰ্তমানৰ পাঞ্চজন্য ক্ষেত্ৰ), ১৯০০ চনত কাঠৰবাৰীৰ ঢাকৰি পথাৰত, ১৯০৫ চনত পকামুৰা পথাৰত, ১৯১০ চনত বৰহমপুৰ আৰু সৰুভগীয়াৰ মাজৰ বালি পথাৰত, ১৯১৭ চনত পকামুৰা পথাৰত ১৯১৯ চনত পাতলৰচুক গাঁৱৰ পশ্চিম মূৰত থকা বাকৰিত, ১৯২১ চনত পকামুৰা পথাৰত বাৰেচহৰীয়া ভাওনা অনুষ্ঠিত হয়। উল্লেখ্য যে, ১৯২১ চনলৈকে উদযাপিত হোৱা ভাওনা উৎসৱৰ লগত জড়িত থকা প্ৰায়বোৰ গাঁৱেই মাহেকীয়া পন্থাৰ অনুগামী আছিল। সেই সময়তেই এই উৎসৱক 'বাৰেচহৰীয়া' আখ্যানেৰে চিহ্নিত কৰা হৈছিল।

"সেই ভাওনাৰ সময়লৈকে প্ৰায়বোৰ গাঁও মাহেকীয়া পন্থাৰ অনুগামী আছিল । তেতিয়াই এই ভাওনাক 'বাৰেচহৰীয়া' নামেৰে নামকৰণ কৰা হয়। উল্লেখযোগ্য যে এই ভাওনাৰ সময়ত জাতীয় কংগ্ৰেছত যোগ নিদিয়া গাঁওসমূহক এৰা পেলোৱাৰ সিদ্ধান্ত লৈছিল। কিন্তু এই সিদ্ধান্তই কংগ্ৰেছ অনুষ্ঠানক প্ৰতিক্ৰিয়া কৰিব বুলি অমিয় কুমাৰ দাস, চন্দ্ৰ শৰ্মা আৰু লক্ষীধৰ শৰ্মাৰ্ক পঠিয়াই দি ৰাইজৰ মাজত মিলা-প্ৰীতি কৰোৱাইছিল। এই ভাওনাৰ সময়তে জামুগুৰিত ৰায়ত সভাৰ জন্ম হয়।" [৪]

উল্লেখযোগ্য যে, এই ভাওনাৰ সময়তে জামুগুৰি ৰায়ত সভাৰো জন্ম হয়। ১৯২৮ চনত পুনৰ পকামূৰা পথাৰতে এই উৎসৱ অনুষ্ঠিত হয়। এই ভাওনা উৎসৱৰ সময়ৰে পৰা ধৰ্মীয় ক্ৰিয়া-কাণ্ডসমূহক কেন্দ্ৰ কৰি ভিন-ভিন পন্থা, মতানৈক্য আদি সমস্যাবোৰৰো উদ্ভৱ হ'বলৈ ধৰে। ১৯৩৩ চনত পকামূৰা পথাৰত এই ভাওনা উৎসৱ পতা হয়। তাৰ পিছৰে পৰা অসহযোগ আন্দোলনৰ ফলত উদ্ভৱ হোৱা সমস্যা আৰু ৰাইজৰ মানসিক অস্থিৰতাৰ কাৰণে বহু বছৰলৈ এই ভাওনা উৎসৱ পাতা বন্ধ হৈ পৰে।

সম্পূৰ্ণ ষোল্ল বছৰৰ মূৰত ১৯৪৯ চনত আকৌ পকামূৰ পথাৰতে এই ভাওনা উৎসৰ অনুষ্ঠিত হয়। বহুবছৰৰ মূৰত এই অনুষ্ঠানটি অনুষ্ঠিত কৰিব লগা হোৱাত সংগঠক হিচাপে গোলোক বৰা, মাণিক চন্দ্ৰ হাজৰিকা, পদৰাম বৰা, কুশৰাম বৰা, নৰেণ পাঠক আদি লোকে বিশেষ আগভাগ ল'বলগা হৈছিল। এইবাৰৰ ভাওনা উৎসৱ ২১খন খলাৰে দুদিনীয়াকৈ যথেষ্ট আড়ম্বৰেৰে পতা হৈছিল আৰু তালৈ জিলাৰ উপায়ুক্ত মহোদয়ক নিমন্ত্ৰণ কৰি ৰাইজে এই আপুৰুগীয়া অনুষ্ঠানটি দেখুৱাই কিছু পৰিমাণে হ'লেও প্ৰচাৰৰ প্ৰথম প্ৰচেষ্টা হাতত লৈছিল। প্ৰচাৰ পত্ৰিকাৰ জৰিয়তে অন্যান্য অনুষ্ঠানসমূহৰ বিষয়াবৰ্গ, চতিয়া, চাৰিআলি, কলাবাৰী, গহপুৰ, নগাওঁ আৰু তেজপুৰ আদি অঞ্চল ভালেমান লোকক নিমন্ত্ৰণ জনাই ৰাইজে সেৱা ধৰাৰ সুযোগ লৈছিল। বাৰেচহৰক বিশ্বজনীন কৰাৰ এয়া ভিত্তিবৰ্ষ আছিল বুলি ক'লে নিশ্চয় অত্যুক্তি কৰা নহ'ব। এই অনুষ্ঠানটিৰ উদযাপন সমিতিৰ

সভাপতি আছিল ডৌকাচাপৰি সত্ৰৰ ডেকা অধিকাৰ বিক্ৰম চন্দ্ৰ দেৱ গোস্বামীদেৱ। যুটীয়া সম্পাদক আছিল গোলোক বৰা আৰু ভোগেশ্বৰ ভূঞা। গায়ন কৰা মাণিক হাজৰিকা । এখেত একেৰাহে ১৯৪৯-৭৫ চনৰ ভাওনাৰ আগলৈকে গায়ন বৰৰ দায়িত্বত আছিল (১৯৪৯ চনৰ ভাওনাত বিশেষ অসুবিধাবশতঃ অনুষ্ঠানত যোগদান কৰিব নোৱাৰাত কুশৰাম বৰা দেৱে গায়ন বৰাৰ দায়িত্ব লৈছিল)। পাঁচ বছৰৰ মূৰতে অর্থাৎ ১৯৫৪ চনত ২১খন খলাৰে এই ভাওনা মহোৎসৱ পকামূৰী পথাৰৰ সলনি ফুটুকাতলীত (গান্ধীপথাৰ) দুদিনীয়া কৈ উদযাপন কৰা হয়। ১৯৬১ চনত বাৰেচহৰীয়া ভাওনাৰ স্থায়ী স্থান হিচাপে নির্বাচন কৰা হৈছিল পকামুৰা পথাৰ। তেতিয়াৰেপৰাই ১৯৬৫, ১৯৬৯, ১৯৭৫, ১৯৭৯, ১৯৮৬, ১৯৯৩, ১৯৯৯, ২০০৭, ২০১৩ ,২০১৮ আৰু শেহতীয়াভাৱে ২০২৩ চনত ঐতিহাসিক পকামুৰা পথাৰতে অসমীয়াজাতিৰ আৱেগ 'বাৰেচহৰীয়া ভাওনা মহোৎসৱ অনুষ্ঠিত হৈছে ।

২.০৩ বাৰেচহৰীয়া ভাওনাৰ বৈশিষ্ট্যঃ-

বাৰেচহৰীয়া ভাওনা আমাৰ জাতীয় সংহতি-ঐক্যৰ এবিধ অভিনৱ সম্পদ স্বৰূপ। শংকৰদেৱ- মাধৱদেৱৰ আদর্শত ঠন ধৰি উঠা বৈষ্ণৱ ধর্মীয় পৰম্পৰা ৰক্ষা কৰি তেৱাসৱৰ প্রতি শ্রদ্ধা তর্পন কৰাৰ লগতে অসমীয়া সংস্কৃতিৰ বৰপেৰালৈ কিঞ্চিত বৰঙণি আগবঢ়াই সত্রীয়া সংস্কৃতিৰ প্রচাৰ, প্রসাৰ আৰু ৰক্ষণাবেক্ষণ দি । সমাজত ঐক্য- সংহতিৰ ভেঁটি স্থাপন কৰি সামাজিক বান্ধোন সুদৃঢ় কৰা জামুগুৰিহাটৰ ঐতিহ্য-গৌৰৱ অক্ষুন্ন ৰাখা বাৰেচহৰীয়া ভাওনা ৰ কেইটিমান উল্লেখযোগ্য বিশেষত্ব উল্লেখ কৰা হ'ল :-

(ক) নাট নিবার্চনৰ বৈশিষ্ট্য:-

বিষয়বস্তুৰ পৰা চাবলৈ গ'লে ভাগৱত পু�ৰাণ, ৰামায়ণ, মহাভাৰত ইত্যাদিৰ পৰা সংগ্ৰহ কৰা কাহিনী, উপ-কাহিনীৰ নাটেই বাৰেচহৰীয়া ভাওনাতো অভিনয় কৰা হয়। নাট নিবার্চনৰ ক্ষেত্ৰত শংকৰদেৱ, মাধৱদেৱ, দৈত্যাৰি ঠাকুৰ, ৰামচৰণ ঠাকুৰ, গোপাল আতা আদিৰ নাটকেই লোৱা নহয়। বৰঞ্চ সম-সাময়িক লিখকৰ অংকীয়া নাটৰ আৰ্হিত ৰচনা কৰা নাটো অভিনীত হৈ আহিছে। একুৰিৰ অধিক খলাৰ বাবে প্ৰয়োজনীয় নাট আৰু দৰ্শকবৃন্দৰ ৰুচিৰ প্ৰতি লক্ষ্য ৰাখি নাটবোৰ গ্ৰহণ কৰা হয়। উল্লিখিত নাটকৰ ৰচকৰ নাটে চাহিদা পূৰ্ণ কৰিব নোৱাৰা বাবেও এনে নাট গ্ৰহণ কৰা হয়।বাৰেচহৰীয়া ভাওনাৰ বাবে নিৰ্বাচিত নাটবোৰত সাধাৰণতে যুদ্ধ-বিগ্ৰহ বেছি থকা দেখা যায়। যুদ্ধ-বিগ্ৰহৰ তুলনাত গীত-মাত কম থকা পৰিলক্ষিত হয়। অৱশ্যে মূল ৰস ৰূপে ভক্তিৰসেই প্ৰৱাহিত হৈ থাকে। সম্ভৱত ভাওনাখনিক অধিক প্ৰাণৱন্ত আৰু অধিক গতি প্ৰদানৰ উদ্দেশ্যেৰেই এই কৌশল অৱলম্বন কৰা হয় ।

(খ) অভিনয়ৰীতিৰ বৈশিষ্ট্য:-

অভিনয়ৰ দিশত বাৰেচহৰীয়া ভাওনাৰ ৰীতি সুকীয়া। মূল ভাগৱত সিংহাসনলৈ লক্ষ্য কৰি ঠিক পশ্চিমৰ খলাখনক প্ৰথম খলা বুলি ধৰি বাকী সোঁহাতৰ বোৰ ক্ৰমান্বয়ে গণনা কৰা হয়। দূৰণিৰ পৰা আমন্ত্ৰিত অতিথি তথা ভকত, গোঁসাই, মহন্ত সকলক যথাৰীতিৰে আপ্যায়িত কৰি উঠাৰ পিছত প্ৰথম খলাত ডবা- শংখ বৰকাঁহ বাজি উঠাৰ পিছতেই বাকীবোৰ খলাতো ক্ৰমানুসাৰে বাজি উঠে। একেলগে বাজি উঠা এই মাংগলিক ধ্বনিয়ে মৰতত বৈকুণ্ঠপুৰী ৰচনা কৰে। তাৰ পিছতেই বৰমেধিৰ নিৰ্দেশত তিনি-চাৰিশ গায়ন-বায়ন সভাত প্ৰৱেশ কৰি এখনৰ পিছত আনখন খলা পৰিভ্ৰমণ কৰে । প্ৰতিখলাৰ পৰা যোৱা আৰম্ভ হৈ মূল গায়নৰ কণ্ঠৰ পৰা নিসৃত হয় –

"মেষাং শ্রীমৎ যশোদাসুত পদকমলে নাস্তি ভক্তিনৰানম্
যেষাং মাভিৰ কন্যা প্রিয় গুণ-কথনে নানুৰক্তাৰ সজ্ঞাং।
যেষাং শ্রীকৃষ্ণ লীলা ললিত গুণ কথনে যস্য কর্ণৌ ন তৃপ্তৌ।
ধিতাং ধিতাং ধিতাং ধিগেতাং কথয়তি কীর্তনস্থো নিয়তাং মৃদঙ্গঃ।"

ইয়াৰ পৰৱর্তী পর্যায়ত প্রথম খলাৰ পৰাই আৰম্ভ কৰি খলাসমূহত গায়নবায়নে 'ঢোপাক'দিয়া আৰম্ভ কৰে । তাৰ পিছত নিয়মানুযায়ী সোঁহাতেৰে প্রত্যেক খলাতেই তিনিপাককৈ দিয়াৰ পিছত নিজৰ খলালৈ আহি গাণিকাৰ কাম সম্পন্ন কৰে । গায়ন-বায়নৰ এই অপূর্ব সমূহীয়া 'ঢেৰাপাক'ৰ দৃশ্য বৈশিষ্ট্যমণ্ডিতই নহয় উপভোগ্যও। এই পর্বৰ পিছত অগ্নিগড়েৰে সূত্রাধাৰৰ প্রৱেশ ঘটে। অংকীয়া নাটৰ সকলো নিয়ম মানি চলাৰ দৰেই বাৰেচহৰীয়া ভাওনাতো সূত্রধাৰে সমস্ত দায়িত্ব পালন কৰাৰ উপৰিও ভাৱৰীয়া, গায়ন-বায়ন আদিক লৈ সকলোবোৰ খলা পৰিভ্রমণ কৰিব লাগে। তাৰ পিছত নিয়মতেই নাট আৰম্ভ হৈ সমাপ্তিৰ পথলৈ গতি কৰে।

৩.০০ বাৰে চহৰীয়া ভাওনাৰ কাৰিকৰী দিশ (কলচি)

বাৰেচহৰীয়া ভাওনাৰ কাৰিকৰী দিশ মূলত মণ্ডপ নির্মাণতে নিহিত হৈ আছে । এই মণ্ডপ নির্মাণৰ কৌশল আকৌ বিশেষভাৱে তাৎপর্যপূর্ণ । বাৰেচহৰীয়া ভাওনাৰ মণ্ডপ ভাগ তিনিটা মূল ভাগৰ সমষ্টি— (১) গম্বুজ (২) কলচি (৩) খলা সমূহ। ইয়াৰে প্রত্যকৰে কাৰিকৰী

অথবা নির্মাণৰ পদ্ধতি সুকীয়া সুকীয়া । এই তিনিভাগৰ একক সমষ্টিয়েই হ'ল বাৰেচহৰীয়া ভাওনাৰ মণ্ডপ।

বাৰেচহৰীয়া ভাওনা মণ্ডপৰ গম্বুজৰ ওপৰত যিটো কলচি স্থাপন কৰা হয় ইয়াৰ নির্মাণ কার্য অতি কষ্টকৰ আৰু গুৰুত্বপূর্ণ। কলচিটো নির্দিষ্ট জোখ-মাপত নির্মাণ কৰা হয় । কলচিটো বাঁহৰ মিহি কামী আৰু কাঠীৰে তৈয়াৰ কৰা হয়। বাৰেচহৰীয়া ভাওনা মহোৎসৱৰ মণ্ডপভাগ থলুৱা সামগ্রী বাঁহ, ছোৱা গছ, তামোল গছ, খেৰ, খাগৰি আদিৰে নির্মাণ কৰা হয় । ইয়াৰ আকাৰ কলিৰ সৈতে ফুলি থকা পদুম ফুলৰ দৰে হয় ।

গম্বুজৰ ওপৰত স্থাপন কৰা কলচিভাগ নির্মাণ কৰিবৰ কাৰণে প্রধান সামগ্রী হিচাবে ১৮ ফুট দীঘল এডাল শকত পৃৱঠ বাঁহ , এই বাঁহডালক ধর্ম দণ্ড বোলা হয়। এই ধর্ম দণ্ডডালক পাঁচ ভাগত বিভক্ত কৰা হয়। ধাৰক মণ্ডল, মধ্য মণ্ডল, সূর্য মণ্ডল, চন্দ্র মণ্ডল আৰু একেবাৰে ওপৰভাগক শীর্ষ মণ্ডল হিচাপে । এই শীর্ষ মণ্ডল আকৃতি এটা পদুম ফুলৰ কলিৰ দৰে। ধর্ম দণ্ডডালৰ ধাৰক মণ্ডলৰ তলত চাৰি ফুট ৰখা হয় । এই চাৰি ফুট অংশ গম্বুজৰ শীর্ষত থকা ফুটাত সুমুৱাই ৰখা হয় যাতে কলচিভাগ গম্বুজৰ ওপৰত থিয় হৈ থাকে। ধর্ম দণ্ডডালৰ চাৰি ফুট বাদে ওপৰত থাকিল ১৪ ফুট। এই চৈধ্য ফুটক তিনিটা ভাগত ভাগ কৰা হয় । একেবাৰে তলত দুই ফুট ৰখা হয়। ইয়াক ধাৰক মণ্ডল বোলা হয়। এই ধাৰক মণ্ডলে কলচিভাগ গম্বুজৰ তললৈ সোমায় যাব নোৱাৰাকৈ ধৰি ৰাখে। ধাৰক মণ্ডলৰ ওপৰত ৯ ফুট ৰখা হয় । এই ৯ফুটক মধ্য মণ্ডল বোলা হয়। মধ্য মণ্ডলৰ ওপৰত ৩ ফুট ৰখা হয়। এই তিনি ফুট সূর্য মণ্ডল, চন্দ্র মণ্ডল আৰু শীর্ষ মণ্ডল।

ধাৰক মণ্ডলৰ উচ্চতা ২ ফুট। এই ২ ফুটৰ মধ্যত ধৰ্ম দণ্ডডালক উত্তৰা-দক্ষিণাকৈ দুটা খোলনী দি ফুটা কৰা হয়। এই ফুটা দুটাত ২/, ফুট দীঘল দুডাল কামী সুমুৱাই ৰখা হয়। বাঁহৰ মিহি শলিৰ দৰে কাঠি তৈয়াৰ কৰি কাঠিবোৰ মেৰিয়াই পাঁচ ফুট পৰিধিৰ এটা বৃত্তাকাৰ ঘেৰ তৈয়াৰ কৰি ফুটাত সুমুৱাই ৰখা কামীত ৰছিৰে বন্ধা হয় যাতে কোনো ফালে লৰিব নোৱাৰে । এই বৃত্তাকাৰ ঘেৰটোৰ ওপৰে তলে মিহি কাঠিৰে পাচিৰ আকাৰত দুটা অৰ্দ্ধ বৃত্তাকাৰ ঘেৰ তৈয়াৰ কৰি বিপৰীত মুখীকৈ ঘেৰ দুটাৰ মাজত ফুটা কৰি দণ্ডডালত সুমুৱাই দি ৰছিৰে বন্ধা হয় । এই মণ্ডলটোৱেই ধাৰক মণ্ডল। এই ধাৰক মণ্ডলে কলচিভাগ গম্বুজৰ ভিতৰলৈ সোমাই যাব নোৱাৰাকৈ গম্বুজৰ ওপৰত থিয়কৈ ৰাখে।

ধাৰক মণ্ডলৰ ওপৰৰ ভাগ মধ্য মণ্ডল। এই মণ্ডলৰ উচ্চতা ৯ ফুট। এই ৯ ফুটক দুটা ভাগত ভাগ কৰা হৈছে। তলৰ অংশত চাৰি ফুট আৰু ওপৰৰ অংশত পাঁচ ফুট ৰখা হয়। এই চাৰি ফুট আৰু পাঁচ ফুটৰ মাজত ধৰ্ম দণ্ডডালত উত্তৰা-দক্ষিণাকৈ আৰু পূবা-পশ্চিমাকৈ চাৰি দিশে খোলনী দি সমান জোখৰ চাৰিডাল কামী লৰচৰ কৰিব নোৱাৰাকৈ বন্ধা হয় । কামীৰে মিহি মিহি শলি কৰি পকাই গোঠনি দি (দুলীৰ ওপৰত দিয়া ঘেৰটোৰ দৰে) বাৰ ফুট পৰিধিৰ বৃত্তৰ আকাৰত এটা ঘেৰ তৈয়াৰ কৰা হয়। এই বৃত্তাকাৰ ঘেৰটো চাৰিও দিশে ধৰ্ম দণ্ডত ৰখা কামীত ৰছিৰে বন্ধা হয় । ইয়াৰ বাদেও ওপৰৰ পাঁচ ফুটতকৈ ক্ৰমে ওপৰলৈ সৰুকৈ ছয় ফুট পৰিধিৰ ঘেৰ তৈয়াৰ কৰি একে পদ্ধতিৰে বন্ধা হয়। এনেদৰে

কলচিভাগ তললৈ আৰু ওপৰলৈও ক্ৰমে সৰু হৈ ওপৰ ভাগ সূর্য মণ্ডল আৰু তলৰ ভাগ ধাৰক মণ্ডলত মিলি যাব। ধর্ম দণ্ডডালৰ ন ফুটৰ ওপৰত তিনি ফুট ৰখা হৈছে। একেবাৰে শীর্ষত ১ ফুট বাদ দি বাকী দুই ফুটত দুই ফুট পৰিধিৰ দুটা বৃত্তাকাৰ ঘেৰ তৈয়াৰ কৰি দণ্ড ডালত ৰছিৰে বন্ধা হয়। এই দুটা মণ্ডলক সূর্য মণ্ডল আৰু চন্দ্র মণ্ডল বোলা হয়। একেবাৰে শীর্ষত থকা এক ফুটক শীর্ষ মণ্ডল বা চুৰা বোলা হয়। শীর্ষ মণ্ডলটো এটা পদুম ফুলৰ কলিৰ আকৃতিৰ। সৰু সৰু মিহি বাঁহৰ কাঠিৰে পদুমৰ কলিৰ দৰে তৈয়াৰ কৰি শীর্ষ দণ্ডত বহুৱা হয়। এয়ে শীর্ষ মণ্ডল। এই পদুম কলিটো ধর্ম দণ্ডত ৰছিৰে মজবুতকৈ বান্ধিব লাগিব যাতে বতাহে লৰাব নোৱাৰে। কলচিভাগ নির্মাণ কৰা মূল হৈছে মূলত বাঁহ আৰু ৰছী।

মধ্য ভাগৰ ন ফুট আবৃত কৰিবৰ কাৰণে মিহি মিহি বাঁহৰ কাঠি তৈয়াৰ কৰি দুই মূৰ পাতলকৈ চাচি ওপৰৰ ফালে সূর্য মণ্ডলত আৰু তলৰ ফালে ধাৰক মণ্ডলত সুমুৱাই মধ্য ভাগ ডাঙৰকৈ আৰু দুই মূৰে ক্ৰমে সৰুকৈ মিহি বাঁহৰ শলি তৈয়াৰ কৰি ঘেৰ কেইটাত ৰছিৰে মজবুতকৈ বন্ধা হয়।

কলচিভাগ বন্ধা হোৱাৰ পাছত প্রতি ভাগে ভাগে বগা কাপোৰেৰে আবৃত কৰা হয়। তাৰ পাচত প্রতি ভাগতে বগা কাগজ আঠা লগাই মিহি কৰি শেষত সোণোৱালী ৰঙৰ তিৰবিৰাই থকা কাগজৰে আঠা লগাই সোণোৱালী ৰঙৰ কৰি ৰাইজৰ সহযোগত গম্বুজৰ ওপৰলৈ তুলি কলচিৰ তলত থকা দণ্ডডালৰ চাৰি ফুট অংশ গম্বুজৰ শীর্ষত থকা ফুটাত সুমুৱাই গম্বুজৰ ভিতৰ ফালে যোগ চিনৰ আকাৰত বান্ধি ৰখা বাঁহত ৰছিৰে টানকৈ বন্ধা হয় যাতে বতাহেও

লৰাব নোৱাৰে। এনে কাৰিকৰী জ্ঞানেৰে দক্ষ শিল্পী সকলে কলচি ভাগ নিৰ্মাণ কৰি আহিছে।

কলচি ভাগৰ পাঁচোটা ভাগৰে সুকীয়া সুকীয়া পাঁচোটা মণ্ডলৰ আধ্যাত্মিক আৰু তাত্বিক দিশ আছে সেই সমূহ তাত্বিক দিশ হ'লঃ-

ধাৰক মণ্ডলঃ- ধাৰক মণ্ডলে কলচিভাগ গম্বুজৰ ভিতৰলৈ সোমাই যাব নোৱাৰাকৈ গম্বুজৰ ওপৰত ধৰি ৰাখে বাবে ধাৰক মণ্ডল বোলা হয়। সমুদ্ৰ মন্থনৰ সময়ত ভগৱন্তই কুৰ্ম ৰূপ ধাৰণ কৰি মন্দভাগ পৃষ্ঠভাগে ধৰি ৰাখিছিল।

কুৰ্ম অৱতাৰে ভৈলা ক্ষীৰো দধী তিৰে।

লক্ষ প্ৰহৰৰ পথ জুৰিলা শৰীৰে।।

কৰিলেও পৰিস্তুতি সুৰাসুৰ নাগে।

ধৰিলা মন্দগিৰি প্ৰভু পৃষ্ঠ ভাগে।।

মধ্যমণ্ডলঃ- মধ্য মণ্ডলত ধৰ্ম দণ্ডডাল ৯ ফুট দীঘল। ৯ ফুটক ন-বিধ ভক্তি ৰূপে ধৰা হয় । এই ৯ ফুটত ১২ ফুটত এটা বৃত্তাকাৰ ঘেৰ আছে। এই ১২ ফুটক বাৰ বৈষ্ণৱ বুলি ধৰা হয়। ছয় ফুটত এটা বৃত্তাকাৰ ঘেৰ আছে। এই ছয় ফুটক ছয় ভক্ত জ্ঞান কৰা হয়।

ন ফুটৰ বৃত্তাকাৰ ঘেৰটো ৬৪ ডাল মিহি কামীৰে আবৃত কৰা হয়। এই ৬৪ ডাল কামীক চৌষষ্ঠি কলা ৰূপে ধৰা হয়।

সূর্য আৰু চন্দ্র মণ্ডলঃ- সূর্য আৰু চন্দ্রই বিশ্ব ব্রহ্মাণ্ডক তাপ আৰু পোহৰ দিয়ে। সেইদৰে সূর্য মণ্ডল আৰু চন্দ্র মণ্ডলে বাৰেচহৰীয়া ভাওনা মণ্ডপৰ ওপৰত অৱস্থান কৰি বাৰ্চেহৰীয়া ভাওনা মহোৎসৱস্থলী দ্বিতীয় বৈকুণ্ঠপুৰী জ্যোতিষ্মান কৰি ৰাখে।

চন্দ্র-সূর্য যেন আছে প্রকাশি।

ন জাতি যাত পশি দিন ৰাত্রি।।

কোটি সূর্য যেন আছে প্রকাশি।

স্মৰণে দহয় পাতক ৰাশি।।

শীর্ষ মণ্ডলঃ- অন্তিম ভাগ হ'ল শীর্ষ মণ্ডল বা চুৰা। পদুম ফুলৰ কলিৰ দৰে। এই পদুম কলিটি শীর্ষত স্থাপন কৰা হৈছে। ভগৱান বিষ্ণুৰ হাতত থকা পদুম কলিটিৰ দৰে পদুম কলি শীর্ষত স্থাপন কৰা হৈছে। এই পৱিত্র ধর্মীয় ধাৰণাৰে কলচি ভাগ নির্মাণ কৰা হয় ।

৪.০০ উপসংহাৰঃ-

কুসংস্কাৰৰে নিমজ্জিত তমসাৰ পৰা অসমীয়া সামাজখনক মহাপুৰুষ শংকৰদেৱে তেওঁৰ দার্শনিক চিন্তা ধাৰাৰে নৱ বৈষ্ণৱ আন্দোলনৰ সোঁত প্রবাহিত কৰি সমন্বয়ৰ সম্প্রীতি তথা সমতাৰ বুনিয়াদ গঢ়াৰ উদ্দেশ্যেৰে ঈশ্বৰ ভক্তি আৰু ধর্ম উপাসনাৰ সামূহিক পৰিত্রস্থান হিচাপে অসমীয়া সমাজত 'নামঘৰ' প্রতিষ্ঠা কৰিছিল । গুৰুজনাৰ নামঘৰ কেৱল উপাসনা গৃহই নহয় ই এক বহুমূখী সামাজিক অনুষ্ঠান ।

গুৰুজনাৰ আদর্শ তথা জাতি বর্ণ সম্প্রদায় নির্বিশেষে সকলো শ্রেণীৰ লোকে নামঘৰৰ সকলো অনুষ্ঠানতে সমানে অংশ গ্রহণ কৰিব পাৰে । এই নামঘৰকে গুৰুজনাই প্রথম ৰংগমঞ্চ হিচাপে ব্যৱহাৰ কৰি ভাওনা অনুষ্ঠিত কৰিছিল । গুৰুজনাৰ এই ভাওনা সৃষ্টিৰাজিয়ে সেই সময়ৰ পৰা বর্তমান সময়লৈকে অসমীয়া কলা সংস্কৃতিৰ ঘাই খুঁটিটো শক্তিশালীৰূপে বান্ধি অসমীয়া জাতিৰ সাংস্কৃতিক দিশটো চহকী কৰি থৈ গৈছে । দেশ-বিদেশত শংকৰদেৱৰ অতুলনীয় সৃষ্টিৰাজিয়ে অসমীয়া নামটো উজলাই ৰাখিছে । গুৰুজনাই গাঁৱে গাঁৱে গৈ নামঘৰ সাজি বৈষ্ণৱ ধর্মৰ প্রতি যি মাহাত্ম্য প্রতিষ্ঠা কৰিছিল সেই মাহাত্ম্য প্রত্যেকজন অসমীয়াই অনুভৱ কৰে ।

গুৰুজনাৰ যাউতিযুগীয়া নামধৰ্মৰ প্ৰভাৱ আৰু আদৰ্শৰেৰে জামুগুৰিহাটৰ বাৰেচহৰীয়া ভাওনাই জন্ম লাভ কৰিলে । গুৰুজনাৰ এই নামধৰ্মৰ আদৰ্শৰে জামুগুৰিহাটৰ শংকৰীধৰ্মৰ ৰাইজে বৃহৎ ক্ষেত্ৰৰ ভাওনা অনুষ্ঠিত কৰি অহা বাৰেচহৰীয়া ভাওনা অন্যতম ।২২৬ বছৰীয়া গৌৰ্ৰোজ্জ্বল ঐতিহ্য বুকুত বান্ধি লৈ চলি অহা শংকৰদেৰৰ প্ৰাণ পাই উঠা অংকীয়া ভাওনাৰ অন্তৰ্গত অন্যতম বৈশিষ্ট্যমণ্ডিত বাৰেচহৰীয়া ভাওনাৰ গৌৰৱময় কথা অসমৰ সাংস্কৃতিক পথাৰ খনত বিৰাজমান । বাৰেচহৰীয়া ভাওনাৰ বিষয়ে বহুতো কাকতে- পত্ৰে অথবা আলোচনী তথা স্মৃতি গ্ৰন্থ আদিত লেখা-মেলা পোৱা যায় যদিও সম্পূৰ্ণৰূপত বিশ্লেষণাত্মকভাৱে পোৱা নাযায় যিটো বৰ্তমান সময়ত বহুতেই আৱশ্যক ।

'বাৰেচহৰীয়া ভাওনাৰ পটভূমি আৰু বৈশিষ্ট্যসহ কাৰিকী দিশৰ এক সমীক্ষাত্মক অধ্যয়ন' শীৰ্ষক গৱেষণা প্ৰকল্পটিৰ গৱেষণাৰ ক্ষেত্ৰত জামুগুৰিহাটৰ ভৌগোলিক পৰিচয়ৰ পৰা আৰম্ভ কৰি ৰঘুদলনী পৰা বিভিন্ন পৰ্যায়ৰ মাজেৰে কেনেদৰে পকামূৰা পথাৰ পালেহি তাৰ সাম্যক জ্ঞানেৰে গৱেষণা প্ৰকল্পটি প্ৰস্তুত কৰা হৈছে । গৱেষণা প্ৰকল্পটিত অৱতৰণিকাৰ পৰা আৰম্ভ কৰি উদ্দেশ্য-লক্ষ্য , পদ্ধতি , পৰিসৰ , পূৰ্বকৃত সাহিত্যৰ আভাস আদিও আলোচনা কৰা হৈছে ।

গৱেষণা প্ৰকল্পটিত প্ৰথমে জামুগুৰিহাটৰ ভৌগোলিক পৰিচয় বিষয়ে আলোচনা কৰি অবিভক্ত শোণিতপুৰ জিলাৰ বাৰেচহৰীয়া ভাওনা অনুষ্ঠিত হোৱা জামুগুৰিহাটৰ মানচিত্ৰ সংযোগ কৰি এই অধ্যায়টো আলোচনা কৰা হৈছে ।

দ্বিতীয়তে 'বাৰেচহৰীয়া ভাওনাৰ পটভূমি' শীৰ্ষক অধ্যায়টোত বাৰেচহৰীয়াৰ অৰ্থৰ পৰা আৰম্ভ কৰি উদ্ভৱ বিকাশ , বৈশিষ্ট্যৰ বিষয়ে জনসমাজক জ্ঞাত কৰোৱাৰ মানসেৰে এই অধ্যায়টোত বিষয়সমূহ উল্লেখ কৰা হৈছে ।

তৃতীয়তে বাৰেচহৰীয়া ভাওনাৰ আমি দেখা যি সুন্দৰ মণ্ডপ , যিয়ে ভক্তপ্ৰাণ ৰাইজক মোহিত কৰে এই মণ্ডপ নিৰ্মাণৰ কলচি কৰাৰ কাৰিকৰী দিশ সমূহ উল্লেখ কৰি এই অধ্যায়টো সুন্দৰ ৰূপত সমাপ্তি ঘটোৱা হৈছে ।

২২৬ বছৰ গঢ়কা বাৰেচহৰীয়া ভাওনা শংকৰী কলাকৃষ্টিৰ এক উজ্জ্বল নিদৰ্শন । এই বাৰেচহৰীয়া ভাওনাই কেৱল জামুগুৰিহাট অঞ্চলটিলৈ যে ঐক্য সংহতি কঢ়িয়াই আনিছে তেনে নহয় সমগ্ৰ ৰাজ্য খনলৈ ঐক্য সংহতিৰ লগতে গৌৰৱ কঢ়িয়াই আনিছে । 'বাৰেচহৰীয়া ভাওনা' সমগ্ৰ অসমৰে একমাত্ৰ সুকীয়া মঞ্চ ৰীতিৰে ভাওনা অনুষ্ঠিত কৰা ভাওনা অনুষ্ঠান ।

পৰিশিষ্ট

(ক) প্রসংগটীকাঃ-

১। শইকীয়া , ধর্মকান্ত (সম্পাঃ):- স্মৃতিগ্রন্থ , বাৰেচহৰীয়া ভাওনা -১৯৭৯ , পৃষ্ঠা - ৭

২। শইকীয়া , ধর্মকান্ত (সম্পাঃ):- স্মৃতিগ্রন্থ , বাৰেচহৰীয়া ভাওনা -১৯৭৯ , পৃষ্ঠা - ৭

৩। হাজৰিকা , হিমাশ্রী :- এগুটি ভাওনা কৰি পাৱয় সকল , পৃষ্ঠা - ৫৭-৫৮

৪। বৰুৱা , গজেন (সম্পাঃ):- বাৰে চহৰীয়া ভাওনা পুস্তিকা , পৃষ্ঠা - ১২

(খ) গ্ৰন্থপঞ্জীঃ-

(১) গোস্বামী , প্ৰেম নাৰায়ণ (সম্পাঃ) :- স্মৃতি গ্ৰন্থ: বাৰেচহৰীয়া ভাওনা মহোৎসৱ , গুৱাহাটী ,বাৰেচহৰীয়া ভাওনা মহোৎসৱ-২০১৮ উদ্‌যাপন সমিতি , ২০১৮

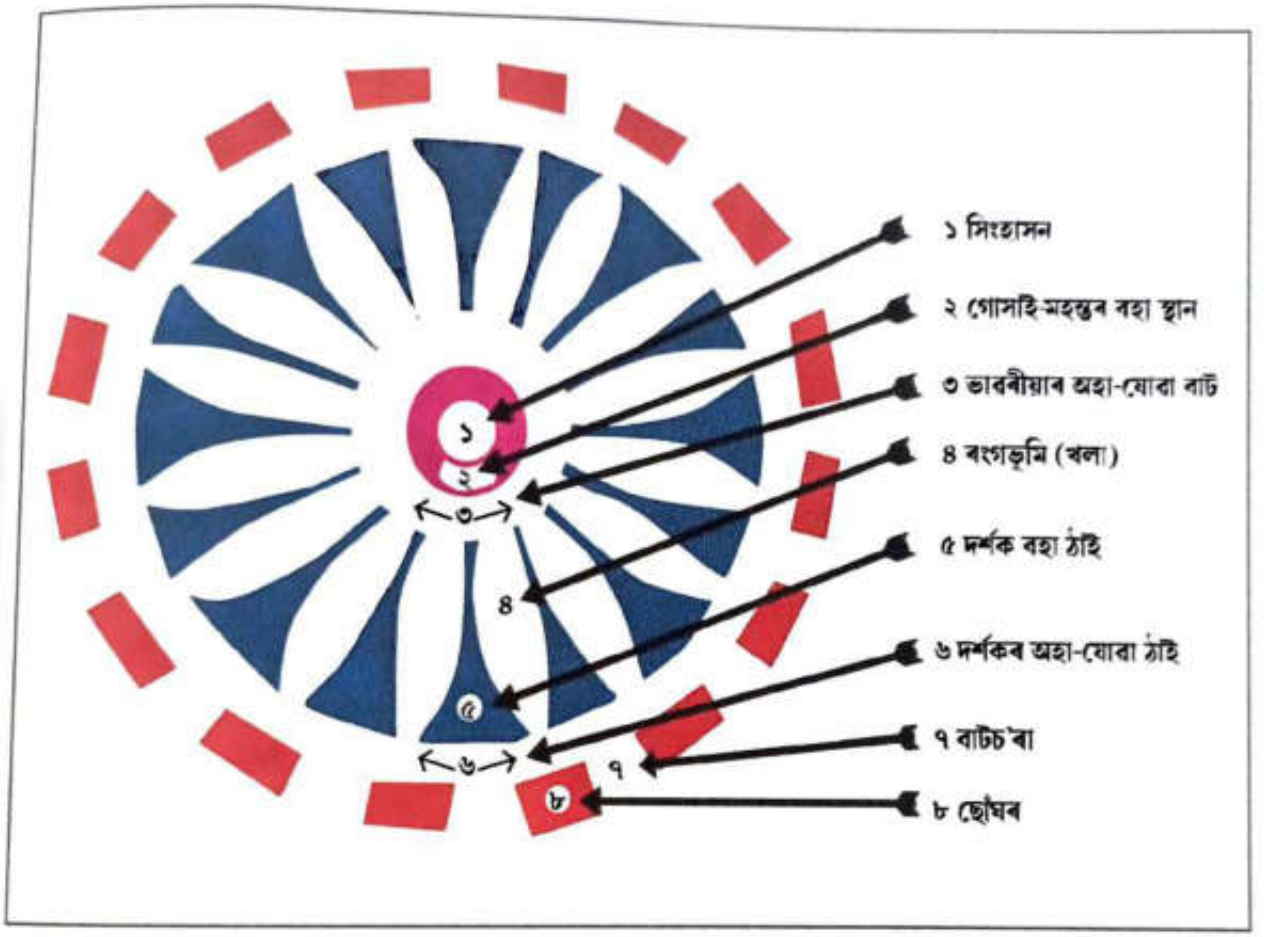
(২) বৰুৱা , প্ৰহলাদ কুমাৰ(সম্পাঃ) :- ভাওনা সমীক্ষা , যোৰহাট , লক্ষী গগৈ , ১৯৯০

(৩) শইকীয়া , নাৰায়ণ (সম্পাঃ) :- জামুগুৰিহাটৰ বাৰেচহৰীয়া ভাওনা ,গুৱাহাটী , অজন্তা দাস , এপ্ৰিল ২০০৭

:- স্মৃতি গ্ৰন্থ: বাৰেচহৰ ,গুৱাহাটী , বাৰেচহৰীয়া ভাওনা মহোৎসৱ উদ্‌যাপন সমিতি - ২০২৩ , ২০২৩

(গ) আলোকচিত্রঃ-

বাৰেচহৰীয়া ভাওনাৰ মণ্ডপ নির্মাণৰ আৰ্হি (উৎস ইণ্টাৰ নেট)



জামুগুৰিহাটৰ বাৰেচহৰীয়া ভাওনাটি কেইবাখনো নাট একেটা মঞ্চতে কেনেদৰে অভিনয় কৰা হয় তাক ওপৰৰ মণ্ডপ নির্মাণৰ কৌশলৰ দ্বাৰা বুজোৱা হৈছে। ১ নং স্থানত সিংহাসন, ২ নং স্থানত সিংহাসনৰ চাৰিওকাষে গোঁসাই মহন্ত সকল বহে। ৩ নং ঠাইডোখৰ হৈছে ভাৱৰীয়াসকলৰ অহা-যোৱা কৰা বাট। ৪ নং স্থান বঙ্গভূমি অথবা স্থানীয় ভাষাত খলা। ৫ নং স্থানত দর্শক বহে। ৬ নং স্থানত দর্শকসকলে ঘূৰি-ঘূৰি বিভিন্ন খলাত অনুষ্ঠিত ভাওনা ইচ্ছানুযায়ী উপভোগ কৰিব পাৰে। ৭ নং স্থানত থকা বাটচ'ৰা দর্শক-ভাৱৰীয়াসকলৰ মূল প্ৰৱেশ-প্ৰস্থানৰ বাট। ৮ নং স্থানত ছোঁঘৰ।

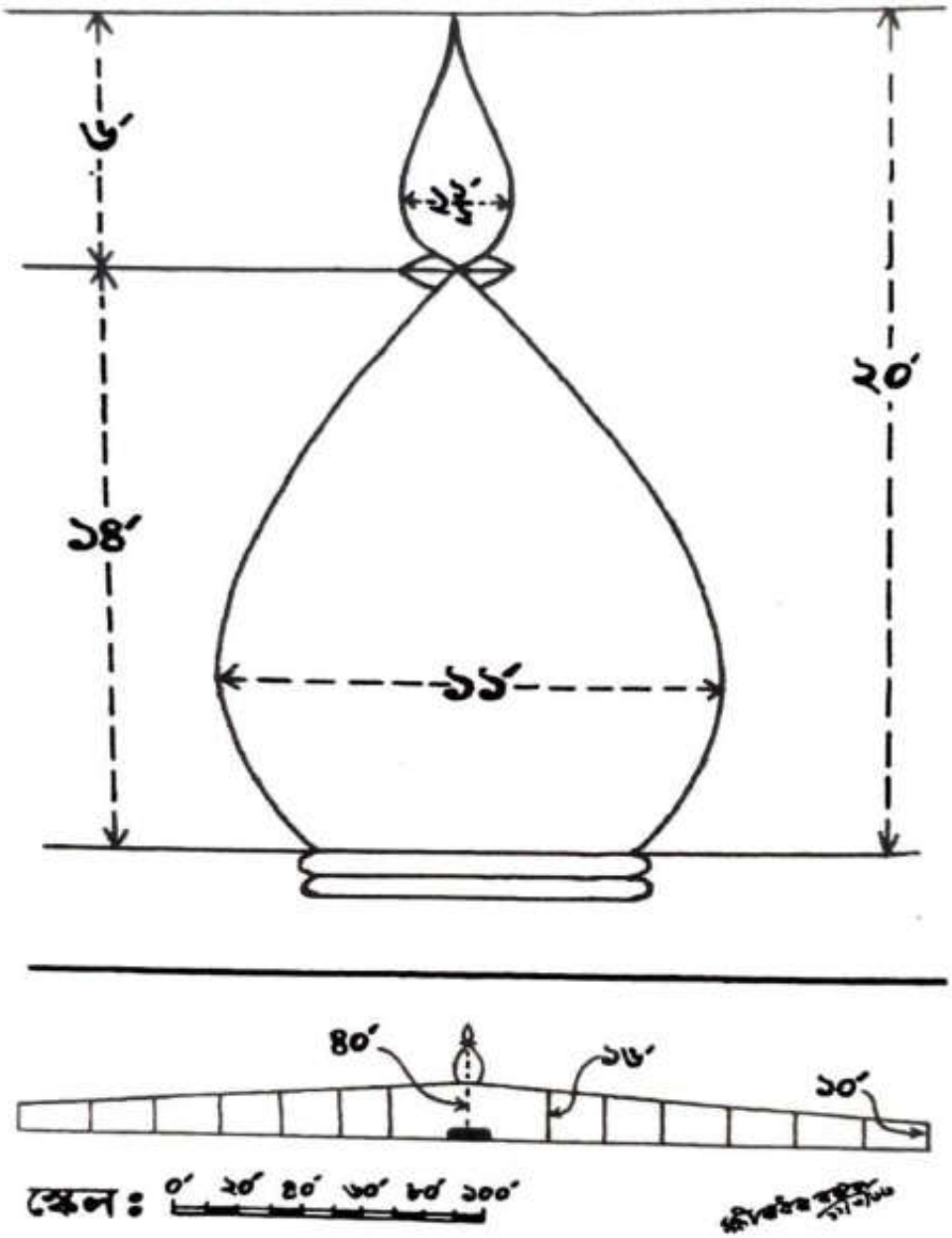
ছোঁ ঘৰ

বাৰেচহৰীয়া ভাওনাৰ মূল বাট চ'ৰা

প্রতি খন খলাৰ প্ৰৱেশ পথত থকা বাট চ'ৰা

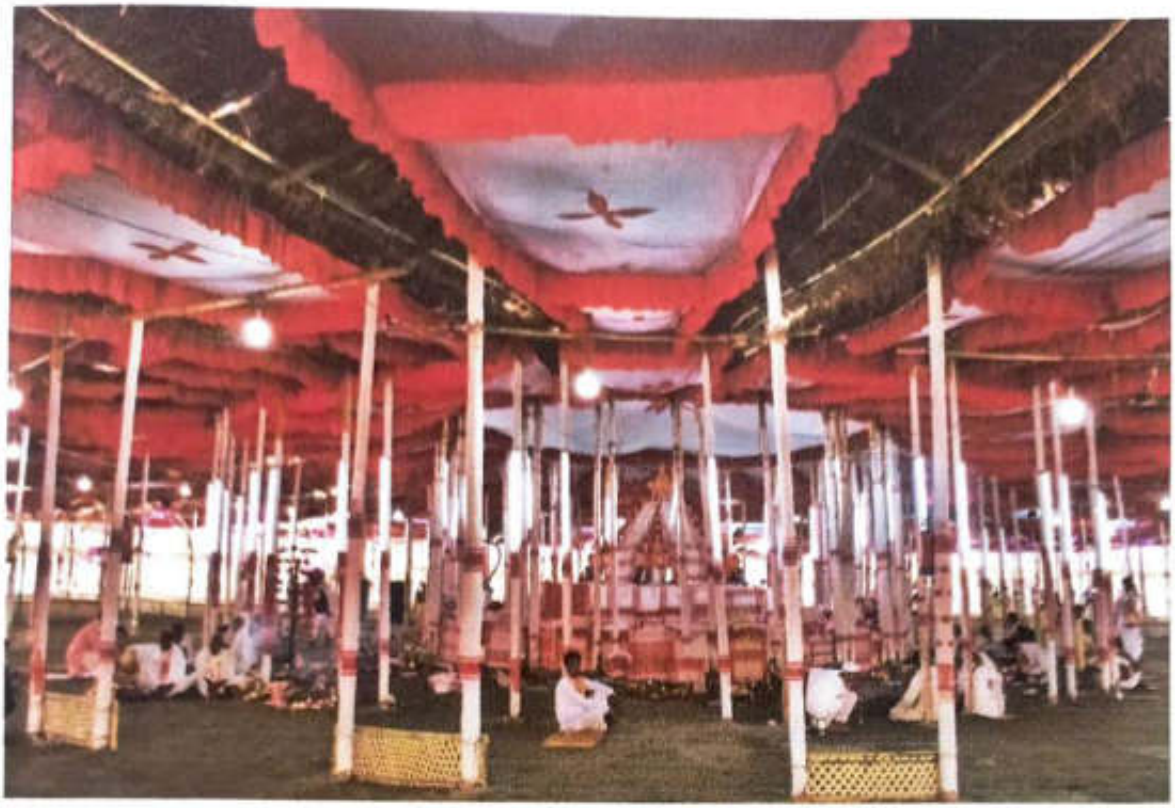
দুয়োফালে ছোঁ ঘৰ মাজত বাট চ'ৰা

গম্বুজ আৰু চুড়াৰ নক্সা



মূল মণ্ডপৰ প্ৰস্থচ্ছেদ-চিত্ৰ

উৎসঃ- ১৯৯৩ চনত প্ৰকাশিত স্মৃতিগ্ৰন্থ (ক্ষীৰধৰ বৰুৱাৰ প্ৰবন্ধ) ৰ পৰা লোৱা হৈছে ।



বাৰেচহৰীয়া ভাওনাৰ মণিকূট

বাৰেচহৰীয়া ভাওনা প্ৰদৰ্শন কৰা খলাসমূহ

ক্ষেত্র অধ্যয়নৰ সময়ত কেমেৰাত আৱদ্ধ কৰা কিছু আলোকচিত্র

(ঘ) তথ্যদাতাৰ **তালিকাঃ-**

ক্রমিক নং	নাম	বয়স	ঠিকনা	ফোন নম্বৰ	ফটো
১	খগেন্দ্র কাকতি	৮৯	জামুগুৰিহাট	৯৩৯৪২১৬৫৩৭	
২	বুবুল বৰা	৬৬	জামুগুৰিহাট	৬০০৫৬৫৭৮৪	
৩	প্রদীপ কাকতি	৬৫	জামুগুৰিহাট	৯৫৩১৩৯৮৭৪৩	

৪	কুমুদ ভুঞা	৬৮	জামুগুৰিহাট	৭৫৭৭৯৮৪৩২৬	

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Population dynamics and conservation status of *G. sibeswarii* - an endemic species of Assam, India.

A DISSERTATION SUBMITTED TO THE GAUHATI UNIVERSITY FOR THE PARTIAL FULFILMENT OF THE MASTER DEGREE OF SCIENCE IN BOTANY

Submitted by-

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CERTIFICATE

This is certified that M.Sc. Dissertation entitled "Population dynamics and conservation status of *G. sibeswarii* - an endemic species of Assam, India." is a bonafide work done by Koushik Daimari, M.Sc. 4th Semester, Department of Botany, Darrang College bearing Roll No: PS-211-225-0022 during the session 2022-23.

I have great pleasure in forwarding this dissertation work of Koushik Daimari which has been completed under my guidance and supervision and the results presented in the dissertation are original and is of individual findings.

Date:

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Sincerely,

Koushik Daimari

Roll No.: PS-211-225-0022

CONTENT

CHAPTER 1

Introduction

India is known for its rich and diverse biodiversity, encompassing a wide range of ecosystems and species. From the lofty peaks of the Himalayas to the coastal regions of the Arabian Sea and the Bay of Bengal, India's varied topography supports an incredible array of flora and fauna. The country is home to several biodiversity hotspots, making it one of the world's mega diverse nations. India has tremendously rich plant diversity. India has 12 biogeographical provinces, 5 biomes and 3 bioregion domains (Cox, 1993). The floral diversity in India is mainly concentrated in the 4 biodiversity hotspots, namely Eastern Himalayas, Western Ghats, Indo-Burma region and Sundaland. The North-East India is a part of Indo-Malayan biodiversity hot-spot except Assam. It is the geological gateway for much of India's flora and fauna. The region is one of the richest in the world in biological values (Chakravarty, 2012). It has the richest reservoir of plant diversity (Mao, 2000). The 3 state Assam falls under this zone for its biological diversity (Barbhuiya, 2009). Assam is a part of Eastern Himalaya biodiversity hotspot. The state is not only rich in biodiversity but also has the distinction of having rich ethnic diversity and rich flora and fauna Assam and is an ideal area of interest for researchers (Baruah, 2018). A total of 4273 species comprising of 1448 genera, distributed in 272 families of vascular plants were recorded from Assam, which represents about 25.12% of the total flora of India (Chowdhuri, 2005). For the availability of all type of tropical condition, Assam shows the unique phytodiversity including medicinal aromatic plants and spice plants and since the very earlier decades, people of Assam traditionally use different types of plants for their health care purpose. Especially the Tribal communities living in remote hamlets of the country are still deeply influenced by the traditional systems of medicines against various disorders rather than the allopathic medicines (Borpujari, 2015).

Garcinia is an evergreen polygamous tree and shrub distributed in tropical Asia, Africa and Polynesia. The genus is named after French botanist Laurent Garcin (1683-1751) (Flora and Fauna web, 2021). This genus consists of several species which are widely used as a source of edible fruits, timber, resin and other natural products and are also utilized in the treatment of various ailments in Indian ayurveda. The genus *Garcinia* L. in the family Clusiaceae comprises

nearly 250 species of woody plants, with a pantropical distribution, and high species diversity in tropical Asia (Rogers & Sweeney, 2007; Nimanthika & Kaththriachchi, 2010). 41 species and 5 varieties are currently recognized in India, of which 35 species and all varieties occur in natural environments, while the rest are introduced into cultivation (Maheswari, 1964; Singh 1993; Srivastava 1994; Sabu et al. 2013). In India, *Garcinia* species are distributed mainly in three tropical phyto-geographical zones: Northeast India, Western Ghats and Andaman & Nicobar Island. Northeast India hosts 17 species, of which 2 species and 1 variety are endemic to the region (Shameer, 2016). Among those 17 species, in Assam 16 species and 4 varieties have been reported and they are mostly grown in wild. In Assam the genus *Garcinia* is known by the common vernacular name "Thekera". In Northeast region, the sundried slices of fruits are used for culinary purposes and folk medicine. *G. pedunculata, G. cowa, G. lanceaefolia* are the most important species of North Eastern part of India.
In addition, many *Garcinia* plants have long been used as ethno medicines for treating various human ailments (Shameer, 2016). Members of *Garcinia* are used after childbirth medication, for menstrual problems, dysentery and fever in traditional system of medicine. The sun dried slices of the fruits are used for culinary purposes and as folk medicine by the indigenous community of the state. Some species like *G. xanthochymus, G. indica,* and *G. cowa* are cultivated in certain parts of India. *G. pedunculata, G. kydia, G. cowa* and *G. lanceifolia* are the most important species in Northeastern part of India (Baruah, 2021) *G. pedunculata* commonly known as 'borthekera' is used for local consumption (Baruah, 2012). It was reported that the old dried fruits are good for dysentery, digestive and cooling. Ripe fruit of *G. xanthochymus* are eaten raw or cooked with other vegetables by the people of Dhubri district of Assam. Jadhav et al. (2011) reported that *G. indica* is a good remedy against dysentery and mucus diarrheal. *Garcinia* fruit is popular for its antioxidant and antibacterial activities (Negi, 2008), *Garcinia* is the source for a natural diet ingredient (-) hydroxycitric acid. HCA, (1,2-dihydroxypropane-1,2,3-tricarboxylic acid) which is an anti- obesity compound present in the fruit rind and leaves of *Garcinia.*

Although, *G. pedunculata, G. cowa, G. lancifolia*and *G. morella*are commonly found and cultivated; some of the *Garcinia* species like *G. sopsopsia, G. anomala, G. acuminate, G. atroviridis, G. kydia and G. assamica* restricted only a few pockets of forest of Assam. However, lack of awareness, coupled with habitat destruction, leads to genetic erosion of this forest resource and many species are threatened.

A plant population survey is an essential component of many ecological studies and can be particularly important for a dissertation focusing on plant ecology or related fields. Plant population surveys provide valuable information about the spatial distribution of plants within a particular habitat or ecosystem. Population surveys allow estimating the abundance and density of plant populations. This information is crucial for understanding population dynamics, including growth rates, reproductive success, and potential impacts of environmental factors or human activities. Plant population surveys provide the foundational data necessary for developing effective conservation and management strategies. By understanding the status of plant populations, it is helpful identify areas in need of protection, evaluate the success of conservation interventions, and inform land management practices to maintain or enhance plant diversity and ecosystem services. For reintroduction and plant conservation purposes ecologist use techniques like root layering, hormone treatment etc. These techniques are used when the population is not greatly rich.

Germination is defined as the emergence of the radicle through surrounding structures (Bewley, 1997; Baskin & Baskin, 2004; Finch-Savage & Leubner-Metzger, 2006).The completion of seed germination represents a key ecological and agronomic trait, determining when plants enter ecosystems (Bewley & Black, 1994; Wilkinson et al., 2002). As such it is highly regulated by both internal and external cues that determine the dormancy status and the potential for germination (defined as the final percentage of germination). Higher-plant seed development is divided into two major phases: embryo and endosperm development (or morphogenesis); and seed maturation (West & Harada, 1993; Gutierrez et al., 2007).

Air layering is an asexual propagation method which is widely used for propagation method. The stem is sliced during this procedure and a piece of the bark is also taken off. On top of this, a plastic sheet is wrapped around a layer of moss or soil. The moss layer aids in retaining moisture, and the plastic prevents an excessive buildup of moisture in the area. Root-inducing hormones are frequently used in air layering. The plant planted once the roots have grown sufficiently. Because the process occurs in branches hanging above the ground or "in the air" it is called "air layering."

Garcinia sibeswarii is hitherto known only from the semi evergreen vegetation of Dulung Reserve Forest, Assam at elevations between 100-300 m. Locally, the plant is known as '*Gela thekera*' (Gela- rotten and thekera- vernacular name for *Garcinia* in Assamese language), thereby indicating that the fruit is not generally preferred for human consumption. Sometimes the aril of the fruit is seldom taken by local people, as it is fibrous and somewhat sour to bitter in taste. But the fruits are highly relished by the primates such as the Rhesus macaque (*Macaca mulatta*) and the rare Assamese macaque (*Macaca assamensis*), very common in the area. Most of the fruits are plucked and eaten at maturity. But the seeds remain undigested and natural regeneration is primarily from the feces of these primates. The species is considering as potential candidate for crop improvement programs of *Garcinia* species.

G. sibeswarii is restricted only in Dulung reserve of forest of Assam and are becoming threatened (Shamer et al., 2021). So, the present work is intended with the aim to study the population dynamics and conserve this species of *Garcinia* using macro-propagation techniques.

Objectives of the study :

1. To study the population structure of *G. sibeswarii* of Dulung reserve forest of Assam.
2. To conserve the target species using seed propagation and air layering technique.

CHAPTER 2

2. Review of Literature

The genus *Garcinia L.*, one of the largest genera in the family Clusiaceae, encompasses over 400 species distributed worldwide. These species are predominantly found in tropical and subtropical regions, including South Africa, Madagascar, and various tropical areas across Asia and the Americas (Li, 2007). *Garcinia* species belong to the family Clusiaceae (formerly known as Guttiferae), and they are native to the southern regions of the Philippines. The plants are evergreen trees or shrubs with monopodial branches. The plants of this genus produce yellow or white latex in plant parts like pericarp, twigs and leaves (Nazre, 2018). Typically, plants are functionally dioecious, with opposite leaves, berry- like fruits and notable large seeds (Crepet, 1998; Li, 2007). The genus *Garcinia* was given its name by Linnaeus in honour of Laurentius Garcin (1683-1751), a Frenchman who served as a ship's doctor in the East Indies. He provided the initial description of the fruit from a tree discovered in the Moluccas, known as the "mangoustan." Linnaeus subsequently named this tree *G. mangostana* in his 1753 publication, and it became the designated type species for the entire genus (Jones, 1980).

In India, the genus *Garcinia* is richly represented by 43 species and 5 varieties of which 4 varieties are occur in wild condition (Anderson, 1874; Maheswari, 1964; Sarma, 2016; Mohanan, 1997; Sabu, 2013). These *Garcinia* species grow abundantly in semi-wild conditions across various states. Out of the 37 indigenous *Garcinia* taxa, India is home to 16 species and 4 varieties that are endemic to the country. In India, *Garcinia* species are primarily distributed across three distinct Phyto-geographical zones: North East India, the Western Ghats, and the Andaman and Nicobar Islands. Among these species, 17 are specifically found in the north eastern region of India of which 2 species and 1 variety is endemic to this region. Within the Western Ghats, there are a total of 9 species and 2 varieties of *Garcinia*, out of which 7 species and 2 varieties are endemic to the region. On the other hand, the Andaman and Nicobar Islands serve as the habitat for 15 taxa of *Garcinia*, including 6 species and 1 variety that are endemic to the islands (Kanjilal, 1934; Kar, 2008; Shameer & Rameshkumar, 2016; Brahma, 2022). Kanjilal

et al., (1934) reported 9 species of *Garcinia* during undivided Assam. According to Choudhury et al., (2005) 15 species of *Garcinia* have been reported from Assam out of which *G. acuminate*, *G. anomala* and *G. keeniana* are reported to be endangered (Choudhury, 2005). Begum et al., (2014) also reported two new verities of *G. morella* from Tinsukia district, Assam. Borah et al., (2016) also reported in his study that *G. keeniana* which was earlier recorded in the region is not reported at present due to its very less distribution.

Garcinia spp. has been found to have many beneficial properties due to which it is used as traditional medicine to heal stomach disorders, fever, malaria and typhoid. It is also claimed by villagers to help cure symptoms like headache, fatigue, nausea, vomiting and concentration difficulties. Village people usually drink them to reduce or prevent the after-effect of alcohol consumption. In addition to that, scientific investigations have revealed many other therapeutic properties of it being a dietary antioxidant, having hypoglycaemic, hypolipidemic, ant carcinogenic, and ant mutagenic activities. The fruit is used in culinary practices as spice and locals cook the raw fruit with fish. The preserved fruit is used to make refreshing drinks during hot weathers. The phytochemical analysis of *Garcinia gummi-gutta* revealed the presence of several bioactive molecules such as xanthones, benzophenones and organic acids. The fruit contains 10% to 30% (-) hydroxycitric acid (HCA), a well-known hypo- lipidemic agent and an important constituent of food supplement for weight management. The species is a rich source of the bioactive cambogin (isogarcinol) (Anju et al., 2016). *Garcinia sibeswarii*, has also shown significant pharmacological properties that include anti- oxidant, anti-microbial, anticancer, and cardiovascular protection (Khamthong et al., 2017). Thus, *Garcinia* spp. could be an important resource for novel therapeutic agents in today's growing need of functional and neautraceutical demands to aid various lifestyle diseases and metabolic syndrome like dysglycemia, high blood pressure, elevated cholesterol, obesity, cardiovascular diseases and diabetes. *Garcinia cambogia* and *Garcinia gummi-gutta* is already in the market as a popular weight loss supplement. Besides traditional uses, few restaurants in Assam also serve refreshing drinks and dishes made of *Garcinia*. Moreover, use of *Garcinia* spp. as commercial functional food or as food ingredients is not popular except its limited use in traditional food.

In India, *Garcinia* is represented by 35 species distributed in Konkon region of Maharashtra, Goa, coastal areas in Karnataka and Kerala and evergreen and semi evergreen forests of North Eastern States, West Bengal, Andaman and Nicobar Islands (Maheswari, 1964, Singh, 1993; Parthasarathy et al., 2013). The species *cowa* is native to North East India and distributed in Assam, Mizoram, Arunachal Pradesh, West Bengal and Orissa. Kanjilal & Das (1934) reported 9 species of *Garcinia* distributed throughout the then undivided Assam. Choudhury et al., (2005) in his study on the status of vascular plants reported 15 species of *Garcinia* from Assam. The same study also highlighted that among the species of *Garcinia* in Assam *G. acuminate*, *G anomala* and *G. Morella*, *G. sopsopia, G. pedunculata* and *G. xanthochymus* were available from Assam and different parts of North East India. The distribution and diversity of *Garcinia* species in Assam was reported by many researchers. In Sontipur district of Assam 8 species of *Garcinia* namely *G. xanthochymus*, *G. cowa, G. sopsopia, G. lancaifolia, G. acuminata, G. pedunculta, G. gummi-gutta* and *G. spicata* were reported. (Kar et al.,2008). The number and species of *Garcinia* recorded from different Reserve Forests under the study were not same. Seven numbers *Garcinia* species were recorded from gibbon wildlife sanctuary such as *G. pedunculata, G. cowa, G. kydia, G. morella, G. dulcis, G. xanthochymus, G. sopsopia*. In Jeypore reserve forest 6 *Garcinia* species i.e. *G. morella, G. xanthochymus, G. pedunculata, G. cowa, G. kydia, G. sopsopia* and *G. atroviridis* were recorded. Six *Garcinia* species i.e. *G. pedunculata, G. dulcis, G. xanthochymus, G. kydia , G. cowa* and *G. atroviridis* from Jokai reserve forest. In Sola reserve forest it was *G. pedunculata, G. cowa , G. kydia, G. xanthochymus* and *G. sopsopia*. From Tikupani and Tipong reserve forest 4 species of *Garcinia* were recorded. However, except *G. kydia, G morella* other species were different. In Tinkupani reserve forest other *Garcinia* species were *G. cowa* and *G. dulcis*. Tipong reserve forest was recorded for habitat of *G. spicata* and *G. pedunculata* also. Hologaon reserve forest was habitat of 3 species i.e. *G. kydia, G. xanthochymus and G. pedunculata. G. xanthochymus* and *G. pedunculata* were recorded from Doiang-Tengani, Abhoipur and Kukuramora reserve forest 2 species i.e. *G. kydia*, and *G. xanthochymus* were recorded. Whereas, in Nambor reserve forest, the only species recorded was *G. xanthochymus* . All reserve forests with different species of *Garcinia* were found to have common plant species such as *Actinodaphne obovata, Artocarpus chama, Ailanthus integrifolia, Altingia excelsa, Albizia lucidior, Biscofia javanica, Bombax ceiba, Castanopsis armata, C. indica, Cinnamomum glanduliferum, Dipterocarpus retusus, Dillenia indica, Dysoxylum*

excelsum, Magnolia hodgsonni, M. insignis, M. kingii, Magnolia champaca, Mesua ferrea, Terminalia bellerica. T. Myricarpa and Vatica lanceifolia.

2.1 Seed germination

According to rigorous botanical definitions, a seed is an ovule that has advanced after fertilization and is covered in a seed coat while also housing an embryo and reserve tissue. 'Germination' is the process through which the radical and plumule of a seed embryo emerge, leading to the development of a seedling. Different types of vegetation require different conditions for germination, which depend on ecological aspects including air, water, temperature, light or darkness, dormancy, etc. Thus, planting seeds properly based on those herbal ecological aspects aids in improving germination rates along with an increase in the proportion of high-quality and quantity production. Seed germination is a complicated manner that is regulated by means of many coordinated physiological, biochemical, and molecular biological activities (Ren et al., 2020, Zhang et al., 2020). Environmental stressors inclusive of water deficit, multiplied salinity, and extreme temperatures exert adversative outcomes on the germination of seeds through physiological and biochemical alteration including ionic toxicity, osmotic pressure, hormonal imbalance, and oxidative stress (Anaya et al., 2018, Bu et al., 2018, Shabala et al., 2003). Charles Darwin's interest in seed germination was a focus within his wide interest in plant development. He published several papers about the above findings in the Gardeners 'Chronicle and Agricultural Gazette (including Darwin, 1855a,b,c,d). Late germination has been the focus of seed research for many decades (summarized in recent reviews, e.g. FinchSavage and Leubner-Metzger, 2006; Holdsworth et al., 2008; Nonogaki et al., 2007; North et al., 2010).Most mature angiosperm seeds consist of an embryo surrounded by covering layers such as the maternal testa (seed coat) and the triploid endosperm. Seeds exhibit species-specific differences in their structure and the composition of their storage compounds (Obroucheva and Antipova, 1997; Linkies et al., 2010). Charles Darwin already worked with some species that would later become model species in seed biology, namely lettuce, on which the red/far red light-induced reversibility of phytochrome effects was discovered (Borthwick et

al., 1952), and cress, radish, and cabbages, which are members of the Brassicaceae family for which the first plant genome was sequenced (Koornneef and Meinke, 2010).

Both inductions of seed dormancy and onset of germination are crucial physiological states of seed which determine the success of field establishment after sowing in several crop plants. Seed dormancy and germination are mainly regulated through several physiological processes and environmental factors. Though contrasting in their expression, both processes are equally important for the management and planning of crop cultivation. A low degree of dormancy is seen to be of vital advantage in preventing in situ germination in various crop species, for example, Spanish-type groundnut (Nautiyal et al. 1993, 2001), wheat, maize, and rice. On the other hand, a deep dormancy would prevent normal germination even under favourable conditions, resulting in poor crop stand. There are reports that interaction between environmental factors (i.e., light, temperature, water status) and growth hormones (i.e., abscisic acid, gibberellic acid and ethylene) play an essential role in dormancy vs. germination. Germination may be seen as a chain of processes transforming a quiescent embryo into a metabolically active one and developing well-differentiated tissues (viz., apical meristems, root and shoot), which are essential for establishing a healthy seedling. The germination process starts with the imbibition of water, followed by a metabolically active phase, during which a series of biochemical reactions take place providing energy and supporting the cellular processes leading to radicle emergence and seedling growth. The metabolically active phase begins with enzyme activation, hydrolysis and mobilization of stored food reserves. After mobilization of reserve food material, embryo growth is initiated followed by the weakening and rupture of the seed coat to make way for radicle emergence. These are crucial steps directly related to the seedling establishment and, thus, crop productivity. This chapter discusses fundamental processes underlying regulation of seed dormancy and germination, including the external environmental and internal hormonal factors.

Irrespective of the number and structure of the cotyledons, two types of seed germination are seen in nature based on their fate upon germination. It is basically of two types as could be seen in bean and pea seeds. Although these seeds are similar in structure and are from the same taxonomic family. These two forms of seed germination and seedling emergence are commonly known as epigeal and hypogeal. As literary meaning of epigeal is defined as germination above

ground, is a characteristic feature of bean seed and is considered more primitive than the hypogeal germination, which is below into the soil (King Keith 2003).

2.2 Hormone treatment by IAA and IBA

Propagation of the difficult-to-root plant species becomes commercially feasible with the establishment of the optimal propagation method. A key step in vegetation is adventitious root formation. Losses occur because of the poor quality of the root system or the shoot and because of poor or slow rooting (De Klerl et al., 1999). The process of adventitious root formation is influenced by a number of internal and external factors (Davis et al., 1988). Among internal factors, the most important role is ascribed to phytohormones, especially the auxins. It is generally accepted that auxins have a certain role in the rooting initiation (Davis et al., 1988; Hartman et al., 1997). Divisions of the first root initial cells are dependent on either endogenous or applied auxins (Hartman et al., 1997). IAA is generally regarded as the major auxin, universally found in higher plants, that plays a certain role in adventitious rooting (Davis et al., 1988; De Klerk et al., 1999). There is no direct evidence that the synthetic auxins might substitute for a natural one in cells (Davis et al., 1988), but they can reach the plant's IAA-pool. IAA is the main auxin in most plants, while IBA is the most common exogenously applied plant growth regulator (Davies, 1995; De Klerk et al., 1999). IBA has a weak auxin activity, but is relatively stable and insensitive to the auixn degrading system (Epstein & Ludwing-Muller, 1993; Norstrom et al., 1991; Riov, 1993). It has even greater ability to promote adventitious root formation than IAA (De Klerk et al., 1999; Ludwing-Muller, 2000; Spethmann & Hamzah, 1988), probably because of the higher stability of IBA. IBA is especially in *in* vivo condition, where auxin is taken up during a brief initial period. IAA is rapidly oxidized by the plant tissue, while IBA conjugates (especially indole-3-3acetyaspartic acid) serve as the source of auxin during the later stages of rooting (Epstein and Ludwig-Muller, 1993; Nordstrom et al., 1991). Some evidences suggest IBA acts as an auxin on its own, not through its conservation to IAA (Ludwig-Muller, 2000).

2.3 Air Layering technique

Misra and Jaiswal (1993) studied the propagation of Anthocephalus Chinensits soon by air layering with the aid of indole butyric acid. Sharma and Grewel (1989) studied propagation in Litchi chinensis sonn. In trials with cultivars Calcutta and Dehradun one year old shoots were air

layered in sphagnum moss at weekly intervals. Bolt and Joubert (1980) recommended air layered litchi trees for orchard establishment in 10 years trials; they compared marcoted vs grafted trees. The percentage of trees, which established was higher with grafted trees. Root growth was much better with grafted trees. It has been recommended that marcotted tree should be kept in the nursery for at least six months after removal from parent trees. Kadman (1983) studied propagation in sub tropical fruit trees by air layering. The branch to be air layered was girdled and a prepared peat moss bag wrapped immediately around the girdled portion. Sharifuddin (1983) studied the effect of pruning and the survival of detached rooted air layers in litchi. It was observed those sixty days after air layering the detached plants were pruned heavily, moderately or lightly and were then potted and kept in shade. Khabou et al. (1999) took hardwood cuttings of different diameters and lengths from structural or sub structural units of adult trees of 7 olive cultivars between November and April. Cuttings were scarified at the base and/or soaked for a few seconds in IBA at 1500-3000 ppm, before assessment of rooting. The optimum diameter of cuttings was 15–20 mm, regarding treatment of cuttings before rooting.

CHAPTER 3

3. Materials and methods

3.1 Study area: Dulung reserve forest is one of the most beautiful natural landscapes of Lakhimpur district under Kadam Revenue Circle. The reserve forest is situated at 270 25' 17.80" N, 940 10' 59.40'' E, and 110 m alt. The Reserve Forest covers three beats under Lakhimpur Forest Division. Geological existence of hills to the north of it, several water bodies like streams and marshes have added to the beauty to the natural environment of the Reserve Forest. Moreover, this reserve forest is the habitat of wild elephant, hog, wild boar, leopard cat, deer, porcupine, slow loris, polecat, pangolin, various species of reptiles, butterflies. The important species of avifauna found in the Reserve Forest are the Himalayan Griffon (*Gyps himalayensis*), Rufous-breasted Blue Flycatcher (*Ficedula hodgsoni*), Slaty Flycatcher (*F. tricolor*), Ferruginous Flycatcher (*Muscicapa ferruginea*), Chestnut-headed Tesia (*Cettia castaneocoronata*) and many others. A village named Dulung is also located in the jurisdiction of the Reserve Forest. The aggressive people from across the border have unabatedly caused massive deforestation and destroyed forest resources in the Reserve Forest.

3.2 Plant material: Dioecious, evergreen, medium sized trees, up to 10 m high. Bark greenish brown; exudation milky; branches horizontal spreading, branch lets terete to slightly angled, glabrous. Leaves 17–20 × 10–12 cm, ovate-oblong, dark green, shiny, coriaceous, glabrous, acute or acuminate at base, acute or very shortly and abruptly acuminate apex, margin sub-repand and entire; midribs conspicuous on both sides; lateral veins conspicuous, more than 40 pairs; exudate canals conspicuous on both surfaces; slender, adaxially ligulate at the base. Male flowers tetramerous, 2–3 cm diameter; petals free, pale yellow, ovate-orbicular, concave, coriaceous, membranous on margins; stamens numerous, inserted on fleshy white, 4-lobed torus,

wavy on margins; anthers brownish-white, rudimentary pistil columnar, with a convex, peltate, reddish stigma. Female flowers tetra-merous, pale greenish-yellow, solitary, terminal, sepals free, imbricate, orbicular, margin membranous; petals 4, free, imbricate in pairs, pale greenish-yellow, concave, coriaceous, membraneous on margin; staminodes absent; ovary sub-globose, 4-locular, pale greenish; style very short; stigma red, sticky, peltate, convex, entire, recurved on edges. Fruits sub-globose to globose, 8–10 cm in diameter, smooth, green, turning yellow on ripening, crowned by the disclike remnant stigma and with the green leathery sepals at base. Seeds 3–4, oblong, reticulate-noduled and rough on surface, covered with brownish-white, fibrous aril.

3.3 Survey of the plant species and population status: Field survey was carried out to locate the plant during the period from 2022-2023 in Dulung reserve forest. To record the current existing population status, a wide range of field study was made the locations from where the species was reported. Total population of the species was ascertained through direct count of all the individuals considering saplings (>1 m height) and matured individuals (≥1.37 m height) in each 200 m × 200 m grid of occurrence within the predicted localities. A total of 12 quadrates of 20m×20m for its large quadrates were considered. The density, frequency and abundance of the plant species was calculated with the following formulas,

$$\text{Density} = \frac{\text{Total number of Individuals in all sampling units}}{\text{Total number of sampling units studied}}$$

$$\text{Frequency} = \frac{\text{Number of sampling units in which the species occur}}{\text{Total number of sampling units studied}} \times 100$$

$$\text{Abundance} = \frac{\text{Total number of individuals of a species in all quadrats}}{\text{Total number of quadrats in which the species occured}}$$

3.4 Hormone treatment: The experiment took place in the botanical garden of the department of Botany Darrang College Tezpur, Assam; which is located at 26.6378° N, 92.7970° Eand 349 ft. above sea level. For treatment, two different hormones IAA and IBA with different concentrations were used to stimulate germination. We consider seeds for each treatment. Each seed group of experimental seeds was soaked for 24 hours in solutions of IAA and IBA for

breaking the dormancy and was placed in soil media. After treating we immediately put the seeds in running water. For both the chemicals firstly we prepared standard solutions. After that seeds are soaked in IAA in two different concentrations i.e. 30% (T1), 50% (T2) and for IBA concentrations are 30% (T3), 50% (T4) respectively. Same numbers of seeds of each species were also considered for germination without any treatment i.e. control (T5). Finally, seeds of all the treatments placed on filter paper moisture with 3% fungicide solution (Captan) for about 15 minutes. All the treated seeds are placed in soil media immediately. The experimental seed beds were maintaining in an area where direct sunlight is not effect. Watering was done at an interval of two days for 14 days. From germination measurement we took an interval of 7days.

3.5 Preparation of Media:

Soil media: Seeds are placed in soil media, which is prepared along with cow dung and sand i.e. 50 % soil + 25% cow dung + 25% sand. Seeds beds of 29 m X 23 m are prepared for each concentration. The seeds are deep just below 1 cm in propagated media. The experimental propagated materials are placed in net house of the Botanical garden of Darrang College.

3.6 Air Layering:

Air-layering was applied in the mid April 2023. A total of 30 twigs of *G. sibeswarii* were considered for air layering. For each tree, three branches were randomly selected. 1-1.5 cm ring of bark was removed for its selected air layering branch. Rootex hormone was directly applied to the wounds with a brush and immediately covered with cow dung and soil mixture, and is wrapped with a black polyethylene sheet.

3.7 Reintroduction of *Garcinia sibeswarii* in Natural habitat:

3 month old saplings of *G. sibeswarii* transferred to the field for reintroduction as a forestation program. A numbers of seedlings are also planted in Darrang college campus.

CHAPTER 4

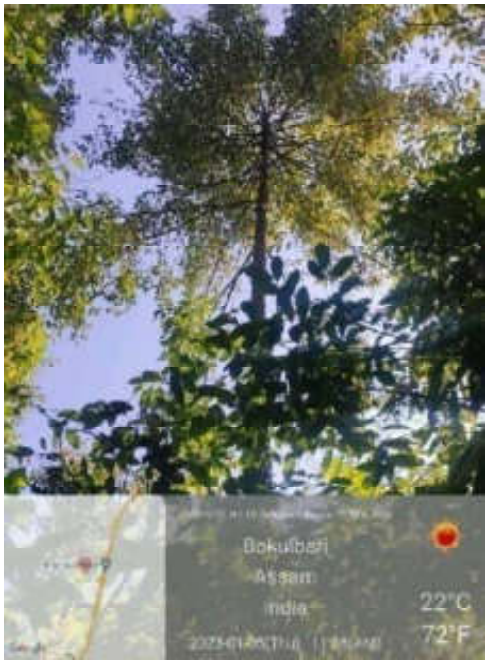
4. RESULT

4.1 Population survey

Broad-scale destruction and fragmentation of native vegetation is commonly visible phenomenon throughout the world. For conservation strategies, species with a limited distribution are of greater importance than with a wide distribution. Habitat destruction and fragmentation are the root causes of related conservation problems. Through field visits in our study sites, the population size of the species was recorded considering the density, frequency of occurrence and abundance of *G. sibeswarii*. A total 12 quadrates were considered in the study sites. The observation tabulated below depicted the mean density of *G. sibeswarii* in Dulung Reserve Forest as 2.44, frequency of occurrence 91.11 and abundance in relation to other associated species as 2.69 (Table 1).

In the area, density and abundance was very less possibly due to very low population sizes. However, the frequency was revealed significantly high suggesting that the *G. sibeswarii* were distributed within a smaller range of geographical locations in the area.

4.1.1 Associated tree species: The Asia famous medicinal plant, locally known as 'Siya Nahar' (*Media ferrea*) is the main dominant plant in Dulung Reserve Forest. In addition to it, various species of invaluable timber trees like Titasonpa (*Telaum phellocarpa*), Segun (*Tectona grandis*), Jutuli (*Allingia excelsa*), Gomari (*Gmelina arborea*), Gandhasoroi (*Cinnamomum glanduliferum*), Bon-Bogori (*Ziziphus rugosa*), Bon-Chom (*Phoebe lanceolata*), Kuji thekera (*G. Morella*), Bor thekera (*G. pedunculata*) and kowa thekera (*G. cowa*) are also associated with G. Sibeswari in Dulung reserve forest of Assam.



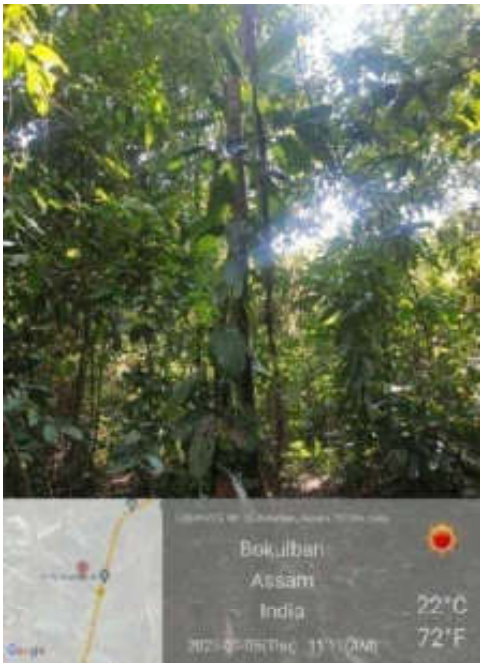


Fig : *G. sibeswarii* along with associated tree species

Grid No (200m x 200m)	No. of adult plants of *G. sibeswarii*	No. of saplings of *G. sibeswarii*	No. of seedlings of *G. sibeswarii*	Total No. of *G. sibeswarii*	No. of associated tree species	Total No. of all the plants	Total No of Quadrates of occurrence of *G. sibeswarii*	Density	Frequency	Abundance
1	2	18	14	34	334	368	12	2.83	100	2.83
2	1	10	22	33	426	459	12	2.75	100	2.75
3	2	21	2	25	434	459	10	2.08	83.33	2.5
4	1	18	13	32	490	522	11	2.66	91.66	2.90
5	1	13	11	25	339	364	9	2.08	75	2.77
6	1	19	18	38	410	440	11	3.16	91.66	3.45
7	0	13	5	18	390	408	10	1.5	83.33	1.8
8	3	11	10	24	330	354	11	2	91.66	2.18
9	1	25	3	29	230	259	12	2.41	100	2.42
10	4	22	8	34	260	294	12	2.83	100	2.83
11	3	24	9	36	354	390	12	3	100	3
12	2	16	6	24	348	372	11	2	91.66	2.18
13	0	13	4	17	389	406	12	1.41	100	1.41
14	2	18	7	27	498	525	9	2.25	75	3
15	4	29	11	44	356	400	10	3.66	83.33	4.4
Mean								2.44	91.11	2.69

(Table: 1)

The graphical representation of the species are given (Fig: 1) show that density of *G. sibeswarii* and frequency and abundance.

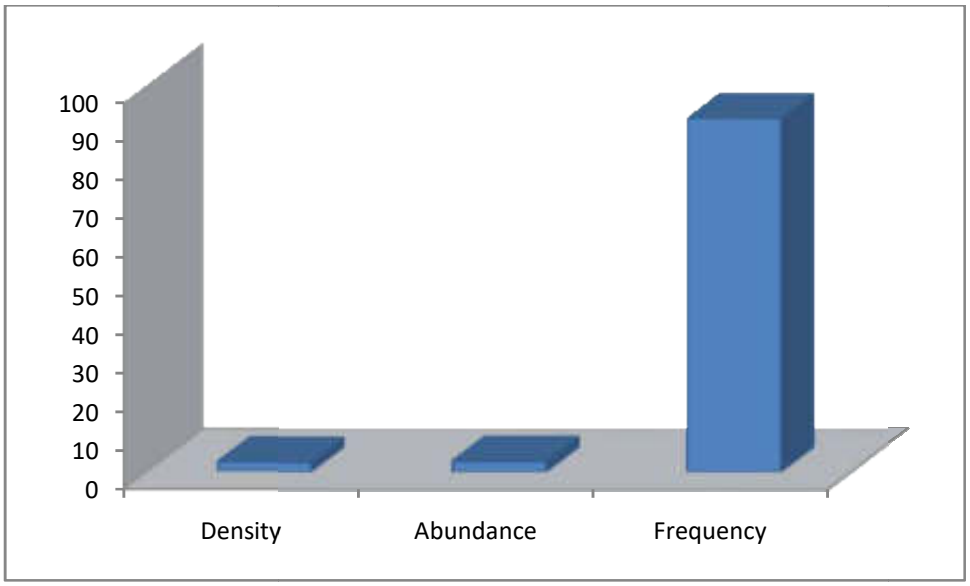


Fig: 1 Graphical representation of population survey of *G. sibeswarii*

4.2 Seed Germination

The germination time and percentage of *G. sibeswarii* seeds that germinated during the hormone treatments experiment were both significantly altered. It was discovered that treated seeds germinated more quickly than untreated seeds. The technique created here for treating seeds was discovered to be quite effective in terms of germination. The species' natural seed germination takes longer than expected, probably as a result of the hard seed coatings' non-permeability and prolonged seed dormancy. Germination of seeds were started after 28 days of sowing in seed beds and continued to 56 days. It was observed that T2 and T4 show (8.33%) of germination up to 28 days. It was observed that T5 shows no any germination till 35 days. In T1 and T5 no germination was observed in 28 days and in T3 it shows (16.66%) in 28 days. In 35 days T3 shows (25%) followed by (16.66%) in T2 and T4, in T1 at 35 days it shows (8.33%). In 42 days T3 shows (41.66%) followed by (13.33%) in T2 and T4, in T1 at 42 days it shows (25%).T5 shows (16.66%) in 42days. In day 49, T3 shows (75%), T1 shows (50%), T2 shows (58%), T4 shows (66.66%) and T5 shows (33.33%). At the end, at 56 days it was observed that T3 shows higher percentage of germination (100%) followed by T2 and T4 (91.66%), T1 (83.33%) and T5

(58.33%) respectively. In our investigation 30% IBA shows excellent response for developing rooting for the seeds of *G. sibeswarii* followed by 50% IAA and 50% IBA, 30% IAA and Control respectively.

Table: 2

TREATMENT	GERMINATION PERCENTAGE (%)					
	DAY 28	**DAY 35**	**DAY 42**	**DAY 49**	**DAY 56**	**MEAN**
T1	0	8.33	25.00	50.00	83.33	33.33
T2	8.33	16.66	33.33	58.00	91.66	41.59
T3	16.66	25.00	41.66	75.00	100	51.66
T4	8.33	16.66	33.33	66.66	91.66	43.32
T5	0	0	16.66	33.33	58.33	21.66

Seed germination percentage of *G. sibeswarii* in different day's interval and its mean value for different concentration of IBA & IAA.

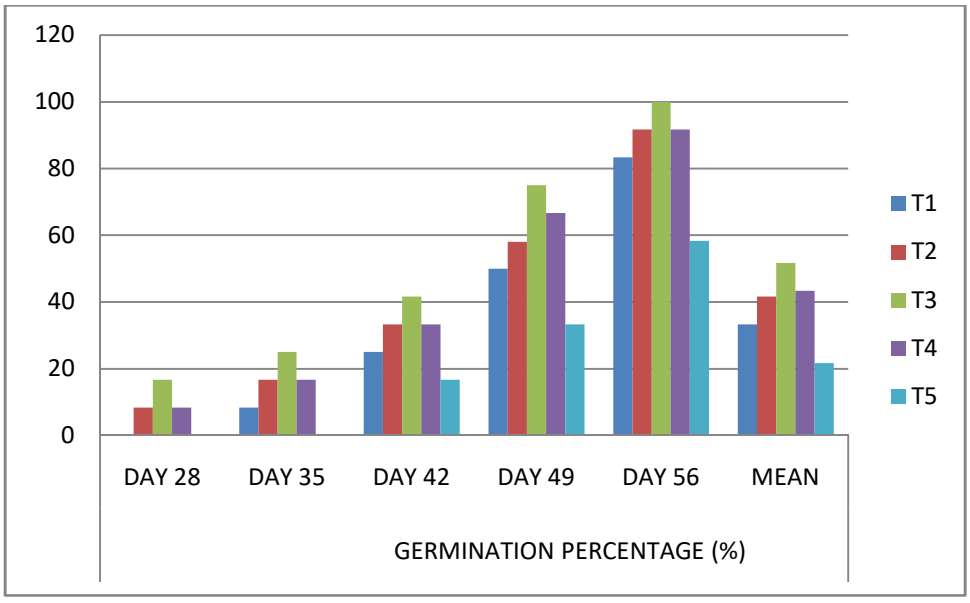


Fig: 2 Graphical representation of seed germination percentage of *G. sibeswarii*

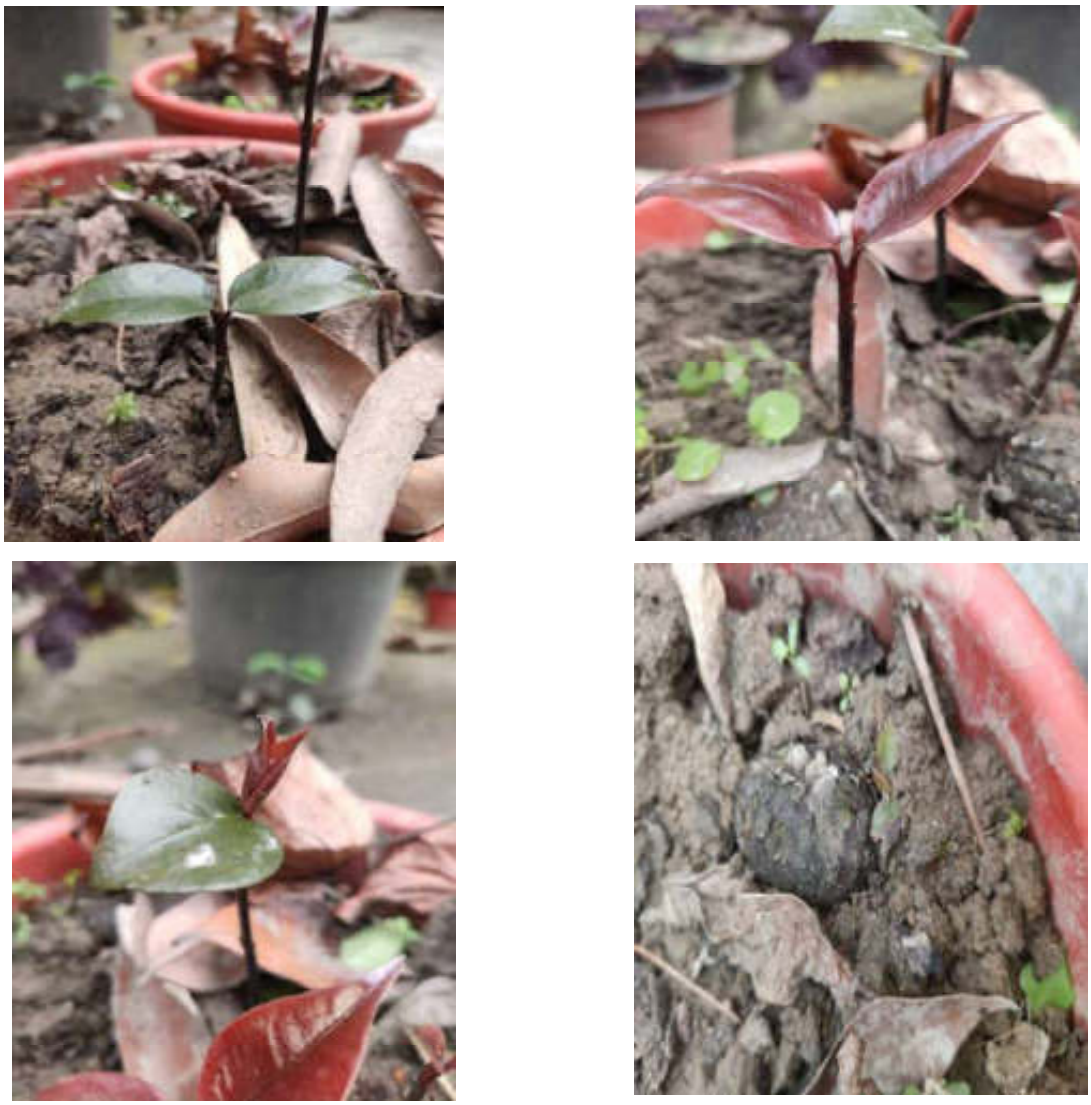


Fig : Seed germination percentage in different concentration of IBA & IAA.

4.3 Transferring saplings to the field for reintroduction and Post monitoring:

A total of 20 healthy samplings of *G. sibeswarii* were transferred to the field for reintroduction following the IUCN guidelines. We selected Takla Pahar near ouguri forest beat office; Tezpur of Sonitpur district, Assam, as a sites for reintroduction. Planting is done with the onset of monsoon. The reintroduce saplings are monitored for 30 days.

Fig: Reintroduction of the Garcinia sibeswarii in A. B. ffdd

4.4 Raising of sapling through air-layering:

Successful initiation of roots in stem though air layering was recorded after 45 days. The investigation showed that out of the total samples air-layered, rootex hormone showed successful developing of roots for 13 no. of samples. The root developing air layering samples were carefully removed from the mother tree and reintroduce in Dulung reserve forest of Assam.

Fig: Air layering of the plant species *Garcinia sibeswarii* in Dulung reserve forest

Discussion & Conclusion

The population stock of *G. sibeswarii* in its natural habitats has been depleting very fast due to certain factors such as habitat fragmentation, over-exploitation and other anthropogenic activities. Therefore, improvement of conservation status is urgently needed for these important plants. These species highly potential to medicine of several serious disease, but now days for highly harvesting of its fruits and seed for various uses it is becoming disappearing day by day from the forest of Assam . In our study site Dulung reserve forest of Lakhimpur district population stock depleting day by day for the interfering in the forest by the local people such as unethical activity such collecting wood etc. In the population survey of this species in the study

site Dulung reserve forest, the results are not too good. For the *G. sibeswarii* density 2.44, frequency 91.11 and abundance is 2.69.

The common plant species associated in Dulung reserve forests with species of *Garcinia* recorded were Titasonpa (*Telaum phellocarpa*), Segun (*Tectona grandis*), Jutuli (*Allingia excelsa*), Gomari (*Gmelina arborea*), Gandhasoroi (*Cinnamomum glanduliferum*), Bon-Bogori (*Ziziphus rugosa*), Bon-Chom (*Phoebe lanceolata*). So seriousness of extinction of the species we are taken a step by reintroduction of the species using hormone treatment as well as by natural seed germination technique for conserve the livestock of these species . In the hormone treatment *G. sibeswarii* show a positive response in different concentration of IBA & IAA, where in natural condition it's takes longer time probably due the high dormancy of this species of *Garcinia*. For the transferring of the saplings to the field for the reintroduction , reinforcement and post monitoring , a total 20 healthy saplings transferred to the predicted site in the field for reintroduction as well as Darrang college campus . Saplings were monitored 30 days interval. The main reintroduction site was Takla Pahar near Ouguri Forest Beat Office; Tezpur of Sonitpur district, Assam, India. The *G. sibeswarii* has the high promise for both therapeutic and ecological usefulness. People have been using this species for traditional uses for several years. Further researches in the *Garcinia sibeswarii* will be a significant accomplishment for the benefit in medicinal field.

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Diversity of *Garcinia* in Hollongapar Gibbon Sanctuary, Jorhat, Assam.

A DISSERTATION SUBMITTED TO THE GAUHATI UNIVERSITY FOR THE PARTIAL FULFILMENT OF THE MASTER DEGREE OF SCIENCE IN BOTANY

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This is certified that M.Sc. Dissertation entitled "Diversity of *Garcinia* in Hollongapar Gibbon Sanctuary, Jorhat, Assam" is a bonafide work done by SubhasishSaikia, M.Sc. 4th Semester, Department of Botany, Darrang College bearing Roll No: PS-211-225-0032 during the session 2022-23.

I have great pleasure in forwarding this dissertation work of SubhasishSaikia which has been completed under my guidance and supervision and the results presented in the dissertation are original and is of individual findings.

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Sincerely,

Subhasish Saikia

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CONTENT

CHAPTER 1

1. INTRODUCTION

Hollongapar Gibbon Wildlife Sanctuary, also commonly known as Gibbon wildlife Sanctuary is located South of the Brahmaputra River in the Jorhat district of Assam, India. It is situated in close proximity to the Naga Hills and the town of Mariani. The sanctuary covers an area of 19.49 km^2. The area is within the Indo-Burma Biodiversity Hotspot at an elevation ranging from 100 to 120 meters (Chetia and Kalita, 2012). The forest is classified as "Assam plains alluvial semi-evergreen forests" with some wet evergreen forest patches (Champion and Seth, 1968). The average rain fall is about 249 cm (Ghosh, 2007). It is the home of India's only gibbons – the hoolock gibbons. The forest was identified as an Eden of primates, supporting hoolock gibbons and six other primate species, and is home to a further 34 mammal species (Chetry, 2001). It has got the status of Reserve Forest in 1881 and then in 1997, the Hollangapar Reserve Forest was upgraded to Gibbon Wildlife Sanctuary. In 2004 the area was renamed as Hollangapar Gibbon Wildlife Sanctuary. It is the only protected habitat in India to be named after a primate species and the first protected area in the country where the hoolock gibbon is the target species for conservation. The area is situated amidst tea gardens and villages. With the establishment of tea plantation from 1880-1920 the forest became fragmented into reserve forest such as Dessoi, Dessoi valley and Tiru Hills. The tea gardens and human settlement fragmented the forest and the reserve become isolated from the foothills of Patkai range. In 1887 the construction of a railway track through the sanctuary also fragmented the area into two parts (i.e., Compartment iand Compartment ii). Currently the sanctuary is fragmented into 5 segments (Chetry, 2022). The Sanctuary is rich in vegetation and is composed of several canopy layers. The upper canopy consists plants like

Dipterocarpus, *Artocarps, Amoorawallichi* etc., middle canopy is dominated by plants like *Mesua ferrea, Vaticalanceafolia, Gmelina sp.* and evergreen shrubs and herbs make up the lower canopy and ground layers. The plant *Garcinia* occupies middle canopy with other plants like *Terminalia belerica, Dillenia indica, Conarium resiniferum, Vaticalanceafolia* etc.

The genus *Garcinia* L., is the second largest genus within the family Clusiaceae, comprises nearly 260 species (Mabberley, 1997). The centre of diversity of the genus is considered to be the Malesian region, with some species reaching India and the Micronesian Islands, and further extends to tropical Africa and the Neotropics (Jones, 1980; Nazre, 2006). In India, the genus is represented by 44 species and 5 varieties, which are distributed in Konkon region of Maharastra, Goa, coastal areas in Karnataka and Kerala and evergreen and semi evergreen forests of North Eastern States, West Bengal, Andaman and Nicobar Islands (Maheswari, 1964; Singh, 1993). Of which 38 species and all varieties occur in wild, while the rest are introduced into cultivation. 15 species and 4 varieties among these are endemic to the country (Anderson, 1874; Maheshwari, 1964; Singh, 1993; Sarma et al., 2016; Shameer et al., 2017; Sabu et al., 2013;Mohanan, 1997). North East India hosts 17 species, of which two species are endemic (Sarma et al., 2016; Kanjilal et al., 1934; Singh, 1993). The genus *Garcinia* is economically important, as a source of edible fruits, the much-valued antiobesity phytochemical Hydroxy Citric Acid (HCA), kokum butter, leoresins, essential oils and colouring materials (Rameshkumar et al., 2005). Ethno-botanical studies on the use of different species revealed that *Garcinia* spp. have been used by different communities throughout the world including India (Dike et al., 2012). The species *Garcinia* recently gained attention for the presence of a natural diet ingredient the di-hydroxy citric acid in the fruit rind and leaves (Parthasarathy et al., 2013). Antibacterial activity of extracts from various parts of different species of *Garcinia* are reported (Negi et al., 2008; Bora et al.,

2014). The fruits of *G. pedunculata* are rich source of ascorbic acid, phenol and flavonoid compounds (Mudoi et al., 2012).

In Assam the genus *Garcinia* is known by the common vernacular name '*Thekara*'. The different species of *Garcinia* in the state are known by different local names like Borthekara, Kujithekara, Kowthekara, Mamoithekara and Rupahithekara by different communities and have been found in different localities in wild or domesticated conditions. Although, *G. pedunculata, G. cowa, G. lancifolia*and *G. morella*are commonly found and cultivated; some of the *Garcinia* species like *G. sopsopsia, G. anomala, G. acuminate, G. atroviridis, G. kydia and G. assamica*restricted only a few pockets of forest of Assam (Barooah and Ahmed, 2014) Though different species of *Garcinia* are important multipurpose trees to the different societies of North East India, its value is not still realized like other forest trees of the region. *G. dulcis*, *G. sibeswarii*, *G. sopsopia*and *G. assamica*are restricted only a few pockets of forest of Assam and are becoming threatened. So, the present work is intended with the aim to conserve the selected *Garcinia* species in its natural habitats through regeneration and reinforcement in its native sites.

The population status of *Garcinia* is very poor in the forest of Assam. Lack of awareness, over-exploitation, tea-gardens are the major factor for degradation of this natural resource. Lack of knowledge, coupled with habitat destruction is leading to genetic erosion of this forest resource and many species are threatened (Cheek, 2004). To conserve this rare natural resource, it is very much essential to have accurate population data about it which is done by Population survey method. Population survey is a sensible approach in the study of forest resource for their conservation. Plant population survey is the process of collecting data about the naturally occurring native plant life (flora) and collection of plants (vegetation) from an area. It describes the state of a particular population of a species and how this state changes through time (Gibson, 2015). Following a population and recording demographic variables

for consecutive time steps allows us to build population models (Caswell, 2001). This demographic approaches thus contribute to generating more accurate projections of future vegetation responses and lead to more effective measures in mitigation, conservation, and restoration contexts (Elzinga et al., 1998). The present investigation is to find out the diversity of *Garcinia* as well as to find out the population status and its ecological importance in Hollongpara Gibbon Sanctuary, Assam.

CHAPTER 2

2. AIM AND OBJECTIVES

The aim of the present work is to survey, document and study the diversity of *Garcinia* species in Hollongapar Gibbon Sanctuary, Assam.

The main objectives of the study are -

1. To study the diversity of taxa of *Garcinia* in Hoollongapar Gibbon Sanctuary and to prepare a distributional map for the member of the genus.
2. To study the population status its species of the genus *Garcinia* occurring in Hoollongapar Gibbon Sanctuary.
3. To study the ethnobotanical and other uses of members of *Garcinia.*

CHAPTER 3

3. REVIEW OF LITERATURE

The genus *Garcinia L.*, one of the largest genera in the family Clusiaceae, encompasses over 400 species distributed worldwide. These species are predominantly found in tropical and subtropical regions, including South Africa, Madagascar, and various tropical areas across Asia and the Americas (Li,2007).*Garcinia* species belong to the family Clusiaceae (formerly known as Guttiferae), and they are native to the southern regions of the Philippines. The Malaysian region serves as the primary centre of diversity for *Garcinia* species, where numerous species are concentrated. Some species have also spread to regions including India and the Micronesian islands, while others have expanded their distribution to tropical Africa and the Neotropics (Rogers,2007; Sharma, 2013; Jones,1980;Nimanthika,2010). The plants are evergreen trees or shrubs with monopodial branches. The plants of this genus produce yellow or white latex in plant parts like pericarp, twigs and leaves (Nazre, 2018). Typically, plants are functionally dioecious, with opposite leaves, berry- like fruits and notable large seeds (Crepet,1998; Li,2007). The genus *Garcinia* was given its name by Linnaeus in honour of Laurentius Garcin (1683-1751), a Frenchman who served as a ship's doctor in the East Indies. He provided the initial description of the fruit from a tree discovered in the Moluccas, known as the "mangoustan." Linnaeus subsequently named this tree *G. mangostana* in his 1753 publication, and it became the designated type species for the entire genus (Jones, 1980).

In India, the genus *Garcinia* is richly represented by 43 species and 5 varieties of which 4 varieties are occur in wild condition (Anderson, 1874; Maheswari,1964; Sarma,2016;

Mohanan,1997; Sabu,2013), these *Garcinia* species grow abundantly in semi-wild conditionsacross various states. Particularly, they are found in regions such as Maharashtra, Goa, the coastal areas of Karnataka and Kerala, the evergreen forests of Assam, the Khasi and Jayantia hills, as well as West Bengal and Gujarat. Out of the 37 indigenous *Garcinia* taxa, India is home to 16 species and 4 varieties that are endemic to the country. In India, *Garcinia* species are primarily distributed across three distinct Phyto-geographical zones: North East India, the Western Ghats, and the Andaman and Nicobar Islands. Among these species, 17 are specifically found in the north eastern region of India, of which 2 species and 1 variety is endemic to this region. Within the Western Ghats, there are a total of 9 species and 2 varieties of *Garcinia*, out of which 7 species and 2 varieties are endemic to the region. On the other hand, the Andaman and Nicobar Islands serve as the habitat for 15 taxa of *Garcinia*, including 6 species and 1 variety that are endemic to the islands (Kanjilal, 1934; Kar, 2008; Shameer and Rameshkumar, 2016; Brahma, 2022).

Kanjilal*et al*., (1934) reported 9 species of *Garcinia* during undivided Assam. According toMalik *et al*., (2005) 15 species of *Garcinia have been reported* from Assam out of which *G. acuminate*, *G. anomala*and *G. keeniana*are reported to be endangered. Begum *et al*., (2014) also reported two new verities of *G. morella*from Tinsukia district, Assam. Borah *et al*., (2016) also reported in his study that *G. keeniana*which was earlier recorded in the region is not reported at present due to its very less distribution.

3.1 Morphological characterization

According to Maheswari (1964), *Garcinia* is an evergreen glabrous trees and shrubs, sometimes under shrubs (e.g., *G. buchneri*). The wood of *Garcinia* plants is moderately hard and has a close-grained texture. It can have a yellowish-white, red, or grey coloration. The exudate from the plant is often yellow and has a resinous consistency. Branches usually

opposite, horizontal or pendulous. Leaves are usually opposite or occasionally ternate, simple, with smooth margins, sub-membranous, very rarely stipulate, more or less lanceolate or oblong. Hairs often absent or simply unicellular. Crystals in mesophyll echinate or rarely in simple fascicles. Glands within the mesophyll are typically canal-shaped, rarely they may be ellipsoid or spherical in shape. Stomata neither prominent nor immersed, often absent above, accessory cells often broad. Mesophyll bifacial, rarely beyond 15 layers. Cuticle thick in xerophytic species. The flowers of *Garcinia* plants are polygamo-dioecious or pseudo-hermaphrodite, with the female or pseudo-hermaphrodite flowers generally being fewer in number. They can be found in the axils or at the tips of branches, occurring either individually or in clusters, forming cymes, fascicles, or panicles. These flowers are typically small to medium-sized, located beneath the ovary, and commonly possess diverse floral structures, with four or five whorls of petals. Sepals 4, decussate or 5, imbricate, rarely 2. Petals 4, alternate with the sepals, imbricate, seldom 5. Male flowers of *Garcinia* plants typically have an indefinite number of stamens, although occasionally there may be only a few (such as 4 in *G. tetrandra*). The stamens can be free or joined together at the base, forming one to five bundles or a single mass with four to five lobes. They are usually arranged around a rudimentary pistil. Large number of anthers are present which are erect or peltate, dehiscing by longitudinal slits, pores or circumscissile, sessile or on short thick filaments, bilocular, rarely tetra- and plurilocular. Rudimentary pistil absent or variously formed. Female flowers of *Garcinia* plants feature minute staminodes, which can vary in form and may be either free or fused together. The ovary is positioned superiorly and can have two or multiple chambers. The ovule is typically solitary and is either ana- or hemi-anatropous, with an erect or lateral orientation. The stigma is sessile or nearly sessile, broad and peltate-shaped, and can be smooth, furrowed, or adorned with tubercles. It may be undivided or divided into radiating lobes. The fruit of *Garcinia* plants is an indehiscent berry

with a leathery rind. The pulp of the fruit is juicy, vary in colour, and surrounds several large seeds. The seeds of *Garcinia* plants are oblong or ovoid in shape and are closely enveloped by the pulp, which can be mistaken for the aril.

3.2 Traditional uses of *Garcinia*:

The literature review highlights the global ethnobotanical knowledge surrounding *Garcinia* plants, illustrating their extensive utilization in traditional practices across different continents and cultures. The documented uses encompass medicinal, culinary, and cultural domains. The ethnobotanical uses of *Garcinia* species have been extensively documented worldwide, revealing their diverse applications in different cultures and regions. A comprehensive review of the literature highlights the significant ethnobotanical importance of *Garcinia* plants globally. In traditional medicine, *Garcinia* species have been utilized for various ailments. Although the *Garcinia* species are gaining much attention worldwide due to their potential bioactivities.

G. cambogia, also known as G. *gummi-gutta* is a valuable spice tree known for its sun-dried smoked rind, widely used as a flavour condiment, particularly in fish curries. The dried fruit rind acts as a bacteriostatic agent and is combined with salt for fish curing in India and Sri Lanka. (Lewis, 1964; Antony, 2015). It is also used as a digestive and a traditional remedy to treat bowel complaints, intestinal parasites and rheumatism (Semwal, 2015).

Fengke Lin et al.(2021) studied ethnobotany on *Garcinia* in China. The plant is used as traditional medicine to treat 41 types of human diseases and disorders, ranging from simple ailments such as cough and emesis to complicated disorders, including deficiency of spleen and kidney. The stems and leaves of *G. xanthochymus* is used as traditional medicines to

fight against worm and leech infection, while people also used the bark and fruit, respectively, for medicinal purposes. They are also used to cure detoxication, gastrointestinal discomfort, stomach ache, dysentery etc. The stem and leaf of *G. cowa* is used to cure Aphtha, burns and scalding, carbuncle, clearing heat, detoxication, eczema, expelling leech out of nose, gum pain, periodontitis, stomatitis.

Ethnobotanical studies on the uses of *Garcinia* in India have yielded valuable insights. *Garcinia* species have been extensively utilized in traditional practices across various regions. The literature review highlights the diverse ethnobotanical applications of *Garcinia* in India, shedding light on its medicinal, culinary, and cultural significance. Medicinally, different parts of *Garcinia* plants, such as the fruits, leaves, and bark, have been employed for their therapeutic properties. The fruits are commonly used in traditional remedies for digestive disorders, including diarrhoea, dysentery, and flatulence. Dry and fresh *Garcinia* fruit rinds are used as spice, condiment and garnish (Parthasarathy, 2010). People also use Garcinia as jam, curry mixture and fishy deodorizing. It has been used for anti-obesity treatment (Hemshekhar, 2011). Additionally, *Garcinia* extracts have been explored for their potential anti-inflammatory, antioxidant, and antidiabetic properties. Many species of *Garcinia* produce fruits with edible arils that can be eaten. They are rich in Carbohydrates, proteins, fats, vitamins and minerals (Krishnamurthy, 2011). The bark and leaves of certain *Garcinia* species have been traditionally utilized for their antimicrobial and wound-healing properties. *Garcinia* species hold cultural significance in various communities across India. They are often associated with rituals, festivals, and traditional practices. The plants are also valued for their timber, with the wood being used for furniture-making and other domestic applications. The literature review underscores the rich ethnobotanical heritage of *Garcinia* in India, emphasizing its numerous uses in traditional medicine, cuisine, and cultural practices.

In the Western Ghats, *G. gummi-gutta* is an economically important and widely cultivated fruit crop. Anilkumar et al. (2023) reported that *G. gummi-gutta* is widely used as a flavouring agent to garnish fish curry in southern India, particularly in Kerala and Karnataka. The fruit rind of *G. gummi-gutta* has traditionally been used to treat gastrointestinal problems, diarrhoea, and ulcers. South Indian people have been utilizing it traditionally as evidenced by its ethnobotanical properties. According to Sreenivasan and Rameshkumar (1959) *G. gummi-gutta* is traditionally used as a condiment for flavouring curries and as a fish preservative. The traditionally smoke-dried fruit rind of *G. gummi-gutta*, known as 'Malabar tamarind' was used for "Colombo curing" of fish (Sreenivasan, 1959). According to Shameer et al. (2016) the dried pericarp is used as a condiment and is used as an alternative of tamarind to impart a special flavour and taste to curries in Kerala. Also, the fruits are commercially important as a rich source of the much-valued anti-obesity phytochemicals. The people of central Kerala extract the value-added products from the fruits (Hemesekhar, 2011). The whole plant has been used traditionally for the treatment of edema, delayed menstruation, ulcers, open sores, haemorrhoids, fever, rheumatism, and also against intestinal parasites (Semwal, 2015). According to Watt (1890); the seeds yield an oil, which is used in medicine. The wood is grey, cross grained, shining, hard and also can be used in furniture making.

According to Jayaprakasha and Sakariah (2002), the dried fruit rind of *G. indica* impart a sweet-tangy taste to food and is widely used as flavouring agent in food preparations as substitute for tamarind. The fruit rind has also been utilized as a pink and purple food colouring agent (Kaur, 2012). According to Baliga et al. (2011), *G. indica* is generally known as 'kokum tree', 'wild mangosteen' or 'goa butter tree'. The fruits are used as a substitute for grapes in wine making. Dried fruit rinds and syrup can be found as reserve in every house

hold of Konkan region. A butter commonly known as “Kokum butter” is another important product obtained from the seeds of *G. indica* which is an important ingredient in cosmetic products like lip balms, lotions and soaps. Kokum juice from the rind is used against piles, colic problems, dysentery and diarrhoea. “Kokum drinks” which is made from the fruits of *G. indica*, served as a welcome drink in Goa during summer seasons. Konkani people of Goa and Maharashtra make “Bhirindisaar” which is a soup used as after-meal drink to relieve any gastric problems (Menezes, 2001). Kokum drink is used traditionally to heal wounds, fissures in hands and is supposed to restore elasticity of skin and used as a moisturiser (Thangaraj and Reddy, 1999). According to Jagtap et al.(2015) ,*Garcinia* is a rich source of active compounds. According to them*G. indica* have anti-cancer and anti-obesity properties. This plant also has kokum pigments which are useful in skin disorders for skin care. This plant also has anti-fungal, anti-ulcer, anti-obesity activities. The fruits are steeped in sugar syrup to make ‘Amrutkokum’, a healthy soft drink to relieve sunstroke, which is popular during summer. *G. indica* is loaded with B complex, vitamins and minerals which help to control heart rate and blood pressure. The fruit has long been used to combat digestive problems such as indigestion, flatulence, acidity and constipation.

Rameshkumar et al. (2005) reported that *G. imberti*, a Western Ghats endemic species has been used in treatment of skin disease, prevention of cardiovascular and cerebrovascular disease and tumours. This plant has anti-cancer, analgesic, anti-inflammatory, anti-bacterial, antioxidant, hepatoprotective, vascularizing activities.

G. travancorica is a rare and endemic species, distributed in the evergreen forests of Agastyamala region of southern Western Ghats of India. Aravind et al.(2016) did phytochemical study on this plant. According to them “Gamboge”, a gum resin obtained from

this plant, is used as an ointment. This gum is also used as a yellow dye, as an illuminant and in varnishes (Aravind,2016).

Murmu et al.(2016) did various study on fruit extract of *G. xanthochymus*. They reported that the fruits are highly acidic, bitter taste and contain several phytochemicals such as xanthones, flavonoids, saponins, tannins, alkaloids, lipids, benzophenones and biflavonoids. These compounds play major role for prevention of colon cancer and breast cancer. The fruit as a whole or its extracts are used in treatment of various ailments like diarrhoea, fever, stomach problems, skin diseases and sexual disorders. The plant is also used in treatment of various ailments of livestock. Tribal people use bark of the plant for homeopathic medicine.

Gogoi et al.(2016) reported that people of Golaghat, Dibrugarh and Sivasagar used *G. pedunculata*, *G. cowa*, *G. lanceaefolia* and *G. xanthochymus* as a source of medicine to cure dysentery and diarrhoea. Dry pericarp of *G. cowa* and *G. pedunculata* is used for curing diarrheal, dysentery and flatulence. The fruits of *G. pedunculata* were effective to cure jaundice.

Barukial and Sharma (2011) Studied on morphological and ethno-botany of six species of *Garcinia* found in the Brahmaputra valley and they found that the fruits of four species of *Garcinia* (i.e., *G. pedunculata, G. lanceaefolia, G.cowa*and *G. xanthochymus*) have digestive and anti-dysenteric properties.

Gogoi et al. (2016) studied the ethnobotanical uses of 4 *Garcinia* species viz. *G. pedunculata, G. cowa, G. lancefolia* and *G. xanthochymus*. According to them old dried fruits of *G. pedunculata* are good for dysentery and it is also a good source of antioxidant. It is used

for curing diarrheal, dysentery and flatulence. The fruits ofare effective to cure jaundice. In Bohagbihu, *G. pedunculata* is used for bathing purpose. The wood is rarely used for furniture.*G. cowa* have anti-malarial and antimicrobial activity. *G. cowa* is also used for curing diarrheal, dysentery etc.*G. lanceifolia* is used for treatment of headache. The leaves of *G. lanceifolia* is used as stomachic diabetic and the fruit is used for dysentery and diarrhoea. A decoction of fruit with salt, is swallowed for fever. The crude fruit extracts were reported to be antibacterial. *G. lanceifolia* leaves are used as vegetables, and the trunk and leaf of the fruit plant are utilized as wood and fodder, respectively. *G. xanthochymus* has been widely used as folk medicine for bilious conditions, diarrhoea and dysentery. The fruit juice has anti-scorbutic, anthelmintic and cardiotonic properties. Hence, it is applied in piles, dysentery, tumours. The wood of *G. xanthochymus*is used for making traditional rice mill 'Dheki', while the latex is utilized as a lubricant.

Buragohain(2011) also reported that genus *Garcinia* is also effective for diarrheal and jaundice. According to him, *G. cowa*, *G. pedunculata* and *G. lancifolia* have high medicinal value in Assam. Dry pericarp infusion of these species is used to treat diarrhoea, dysentery, and flatulence.

Sarma and Devi(2016) studied on ethnomedicinal properties of *G. pedunculata*. Their survey report revealed that *G. pedunculata* has been using by the people for healing different stomach related disorders viz., dysentery, jaundice and diarrhoea. They reported that the people of Kamrup, Nalbari, Barpeta, Dhemaji and Lakhimpur district use this plant species for curing dysentery, jaundice and diarrhoea. The study also revealed that fresh *G. pedunculata* fruit is not consumed as food items or medicine as it causes blood dysentery. The survey report indicated that it has been using traditionally by the people as an herbal medicine for health care in dried condition only. Kagyung et al. (2010) found that *G.*

pedunculata has been used for many ailments such as chronic catarrh, asthma, cough, bronchitis, fever, dysentery and as a cardiotonic. They reported that cold water infusion of dry pericarp is taken as antidiarrhoeic, anti-dysenteric, in dyspepsia and in flatulence.

Panthong et al. (2009) did a study on Cowaxanthone F which is a xanthone found in *G. cowa*. They reported that many parts of *G. cowa*have been used in traditional folk medicine. For example, the bark, latex and root have been used as an antifever agent while the fruit and leaves have been used for indigestion and improvement of blood circulation, and as an expectorant. Chowdhuri and Handique (2012) analysed the antibacterial and phytochemical constituents of various plant parts such as flower, leaves and fruits of *G. lancifolia*. The *G. lancifolia* fruit is used against dysentery and diarrhoea by many ethnic people of Assam. The antibacterial activity of fruit juice and pulp extracts proved the efficacy of the fruit against dysentery and diarrhoea.

Sharma et al. (2016) discovered a new species G. assamica which is closely related to G. nigrolineata from Assam, North-east. According to them the fruit of this species is edible and is used for making pickles by locals in Assam.

3.3 Phytochemical compounds

Extensive literature surveys have revealed that the genus *Garcinia* comprises over 400 species, making it a rich source of pharmacologically and medicinally important chemical entities. Some of these notable compounds include hydroxycitric acid, garcinol, isogarcinol, xanthochymol, isoxanthochymol, cycloxanthochymol, xanthone derivatives, bioflavonoids, terpenes, procyanidines, and various isoforms of guttiferone (Hemshekhar, 2011). These diverse compounds from the *Garcinia* genus hold great potential for pharmaceutical and

therapeutic applications, making them valuable subjects of further investigation and development. Various plant parts of *Garcinia*, including the bark, stem bark, fruit rind, pericarp, and leaves, have been utilized not only as culinary ingredients but also as remedies for treating a wide range of pathophysiological disorders. These plant parts have been traditionally employed for their therapeutic properties in addressing various ailments. These compounds have shown significant potential in exhibiting antioxidant, anti-inflammatory, antibacterial, antiviral, antiprotozoal, anti-ulcer, anticancer, and hypolipidemic properties.

3.3.1 Hydroxycitric acid (HCA):

Hydroxycitric acid (HCA) is the primary organic acid present in the fruit rind of *Garcinia* (Jayaprakasha and Sakariah, 2002). Malic acid, ascorbic acid, tartaric and citric acids are also present but to a lesser extent (Hemshekhar,2011). Lewis et al. (1964) successfully isolated hydroxycitric acid (HCA) from *Garcinia* fruit rind and identified it as (-)-HCA through chemical and spectroscopic studies. Shara et. al (2004) reported that HCA has gained recognition for its potential hypocholesterolaemia and anti-obesity properties. When administered prior to meals, HCA has been observed to induce weight loss in individuals with obesity and enhance energy metabolism. According to Ohia et al. (2002) HCA has been found to regulate food intake by suppressing appetite through its impact on brain serotonin levels. By potentially increasing brain serotonin levels, HCA can effectively reduce appetite, leading to decreased food intake and subsequent caloric restriction, ultimately resulting in a decrease in body weight. Asgar et al. (2007) studied on HCA and the findings indicate that HCA has demonstrated several beneficial effects. These include a reduction in food intake and body weight gain, as well as an attenuation of inflammation, oxidative stress, and insulin resistance.

3.3.2 Garcinol and derivatives:

Garcinol, a bioactive compound derived from *Garcinia* species, is a potent polyisoprenylated benzophenone derivative. Due to its structural resemblance to curcumin, garcinol exhibits strong antioxidant activity. This can be attributed to the presence of phenolic hydroxyl groups and a β-diketone moiety in its chemical structure (Mishra, 2006).It is a multitherapeutic agent having anti-oxidant, anti-inflammatory, anti-microbial and anti-cancer properties. garcinol could be used as a cancer preventing neutraceutical. Carcinogens typically induce genomic damage, transforming normal cells into cancerous cells. In this context, garcinol has the potential to selectively induce apoptosis in these abnormal cells, thereby contributing to cancer prevention (Hemshekhar, 2011).

G. morella is recognized for its extensive array of secondary metabolites, predominantly extracted from various parts of the plant such as the leaves, fruits, seeds, resin, and heartwood. The prominent phytochemicals identified from the plant were xanthones, benzophenones, flavonoids, phenolic acids, organic acids, triterpenoids, and fatty acids. According to Pandey et al. (2015) the leaf extract of *G. morella* revealed the presence of various flavonoids, including Amentoflavone, Apigenin, Epicatechin, Isoorientin, Isovitexin, Kaempferol, Luteolin, among others. Leaf also contain xanthones such as Gambogic acid and Mangostin. The leaf extract of *G. morella* exhibited the significant levels of prominent phenolic acids, including Caffeic acid, Ferulic acid, Protocatechuic acid, and Vanillic acid. Meanwhile, the seeds of *G. morella* were found to be rich in a diverse range of xanthones, such as Gambogic acid, Isomorellic acid, Isomorellin, and Morellic acid (Batova, 2010). According to Choudhury et al. (2017) the fruit of *G. morella* contains Garcinol which is a Benzophenone.

3.3.3 Xanthochymone and guttiferone isoforms:

Xanthochymol and guttiferone isoforms are polyisoprenylated benzophenone derivatives. Xanthochymol has been successfully isolated from various parts of different *Garcinia* species, including the stem bark, fruit rind, seed, and seed pericarps of *G. xanthochymus*, *G. mannii*, *G. staudtii*, and *G. subelliptica*. Isoxanthochymol and cycloxanthochymol have been isolated from multiple *Garcinia* species, including *G. xanthochymus*, *G. ovalifolia*, and *G. subelliptica*. Isomers of guttiferone, namely Guttiferone E, A, K, and H, have been isolated from the species *G. pyrifera* (Chattopadhyay, 2006). Xanthochymol and guttiferone isoforms exhibit significant potential as potent agents against cancer, microbial infections, and protozoal diseases. Additionally, these compounds could be therapeutically beneficial in preventing oxidative damage to platelets associated with cardiovascular disorders (Sang, 2002; Kumar, 2009; Protiva, 2008).

3.3.4 Xanthones and their derivatives:

The *Garcinia* genus is abundant with a diverse array of xanthones and their derivatives. Natural xanthones can be categorized into distinct groups based on the nature of their substituents. These groups include simple oxygenated xanthones, glycosylated xanthones, prenylated xanthones, as well as their derivatives such as xanthone dimers, xanthonolignoids, and miscellaneous compounds (Pinto, 2005). Various studies shows that the xanthones and its derivatives are effective as anti-oxidants, anti-inflammatory, anticancer, anti-viral, anti-bacterial and anti-fungal agents (Matsumoto, 2004; Itoh, 2008; Chen, 1996).

The gambogic acid, a major caged xanthone was proven to be the potent anticancer agent. Han et al. (2006), examined the cytotoxic properties against human leukaemia. According to Nie et, al, Gambogic acid and its derivatives have potent anti-tumour effect. Xanthones undoubtedly hold great promise and are expected to receive significant attention for their therapeutic potential in treating multifactorial diseases (Nie, 2009; Chen, 2008).

3.3.5 Flavonoids:

Garcinia also contains various flavonoids, which are a class of compounds known for their diverse biological activities. Flavonoids found in *Garcinia* have been widely acknowledged for their established properties such as anti-inflammatory, antioxidant, antiallergic, hepatoprotective, antithrombotic, antiviral, and anticarcinogenic effects.

According to Ko et. al (2003), Chalcones serve as precursors for the biosynthesis of flavonoids and isoflavonoids, making them structural analogs of garcinol. Numerous studies have demonstrated the potent effects of chalcones against various conditions such as inflammation, leishmania infection, mitosis regulation, invasiveness inhibition, and tuberculosis (Padye, 2009). Chalcones also exhibited anti-fungal, anti-malarial, anti-plasmodial, anti-tumor, anti-fibrogenic, antioxidant, multi-drug resistance activities (Lin, 2002; Go, 2005).

Adegbehingbe et al. (2008) evaluated the *G. kola* extracts for the anti-osteoarthritic properties. *G. kola* is rich in flavonoids and biflavonoid contents. These observations strongly suggest that *G. kola* possesses antiarthritic compounds and holds great potential as a therapeutic agent for the treatment of osteoarthritis and inflammation. Various findings strongly suggest that the isolated bioflavonoids from *G. kola* have the potential to serve as nutraceutical and pharmaceutical agents in the treatment of inflammation, oxidative stress-

induced diabetes, and cardiovascular diseases (Okoko, 2009; Nworu, 2008; Saito, 2005; Akpantah, 2005).

3.3.6 Other compounds

In addition to its multi-therapeutic agents, the genus *Garcinia* also encompasses a diverse array of nutraceuticals, including polysaccharides, pigments, benzophenanthridine alkaloids, and essential oils and fats. Polysaccharides extracted from the pericarp of *G. mangostana* have been isolated and extensively studied for their immunopharmacological activities (Chanarat, 1995).In a study conducted by Fukuyama et al. in 1997, a compound named Garsubellin A was isolated from the wood of *G. subelliptica*. It shows promising potential in the development of therapies for Alzheimer's disease. Moreover, it has demonstrated notable anti-inflammatory properties by effectively inhibiting the release of β-glucuronidase and histamine (Weng, 2003).

According to Fotie et al. (2007) the stem bark of *G. lucida* contains benzophenanthridine alkaloids, including dihydrochelerythrine and lucidamine B, which have demonstrated antiprotozoal activity. Moreover, the crude extract derived from *G. lucida* has shown promising antiprotozoal activity. These findings highlight the potential of these compounds and the crude extract as valuable sources for the development of antiprotozoal therapies.

CHAPTER 4

4. MATERIALANDMETHODES

4.1 Study area:

The study site was Hollongapar Gibbon Wildlife Sanctuary located in the Jorhat district of Assam, India. The geographical coordinates are 26°40'–26°45' N latitude and 94°20'–94°25' E altitude. The sanctuary covers an area of 19.49 km^2. The soil is sandy clay loam in texture, slightly acidic in nature having pH 5.1 and soil organic carbon content records 2.03%. The weather in the area may be classified as subtropical hot, wet monsoon periods (May-August) and cool dry winter (September to April). Winter rains are also not uncommon and the average temperature varies from 5°C (min) – 38°C (max) (Sarkar, 2014).

The site is fragmented into 5 segments i.e., compartment-i, compartment-ii, compartment-iii, compartment-ivand compartment-v. The railway track divides the Sanctuary into two main compartments (Compartment i&iikothalguri). Compartment i&ii is located near Kothalguri village, Compartment-iii is near Army camp MES, compartment-iv is near Bhogpur Gaon and compartment-v is near Meleng.

4.2 Taxonomical study

In our present work for identification of taxa of *Garcinia*,the taxonomical study includes the morphology of fruits and general appearance of tree and leaf nature. Secondary literaturewere also carried out for the study of floral morphology.

4.2.1 Fruits

The investigation has been carried out on fruit and seed morphology of Garcinia. Species were identified on the basis of following characters of fruits-

i. Fruit size
ii. Fruit shape
iii. Fruit texture
iv. Fruit colour

4.2.2 Appearance of tree and leaf structure:

Different plant species were identified by studying the general appearance of the plant. Garcinia species were characterized by their monopodial branching form. Species were identified on the basis of 3 main characters-

I. Branching pattern
II. Stem bark and inner bark structure
III. Colour of exudates

The study also included general leaf appearance of *Garcinia* species. Species were identified depending on the arrangement of leaf lamina; some possessed lamina with conspicuous secondary veins and the other with inconspicuous secondary veins. The arrangement of secondary veins divided into two patterns; loose and dense. Lamina size and nature of petiole were also distinguishing features for this study.

4.3 Field and herbarium method

The present study is based on extensive field work which involves collection and documentation of the members of *Garcinia* from different compartments of Hollongpara Wildlife Sanctuary, Assam covering. The collected specimens have been preserved as

herbarium specimen by following the conventional herbarium techniques (Jain and Rao, 1977). All the relevant data including habit, habitat, fruiting, ethnobotanical uses, etc. were recorded at the time of field work. The collected fruits were preserved in 4% Formaldehyde for further morpho-reproductive analysis. Due to time constraints and seasonal reasons, we were unable to collect flowers. Descriptions of flowers of most of the species were provided from the study of relevant literatures.

The specimens were studied and provisionally identified by comparing with relevant literatures and subsequently confirmed by consulting with DCBH herbarium, Darrang college, Tezpur and some from Kew Herbarium (K) and Florench herbarium (FL) (through online). The taxonomic treatment of the taxa includes the detailed description made from fresh and /or herbarium specimens along with original citations of both accepted names and synonyms. Photographs of live specimen in their natural habitats are also provided.

4.4 Distribution Map

The Distributional Map for 8 different species of *Garcinia* in different compartments of Hollongpara Gibbon Wildlife Sanctuary, Assam has been prepared on the basis of the collected data during the field survey.

4.5 Survey of the plant species and population status

Field survey was carried out to locate the plant during the period from 2022 to 2023 in 5 different compartments of Hollongpara Wildlife Sanctuary, Assam, India. Total population of the species was ascertained through direct count of all the individuals considering saplings (>1 m height) and matured individuals (≥1.37 m height) in each 200 m × 200 m grid of occurrence within the predicted localities. Total 12 number of 20m × 20m small quadrates were taken under the grids for data collecting.

The density, frequency and abundance of the plant species was calculated with the following formulas,

$$\text{Density} = \frac{\text{Total number of Individuals in all sampling units}}{\text{Total number of sampling units studied}}$$

$$\text{Frequency} = \frac{\text{Number of sampling units in which the species occur}}{\text{Total number of sampling units studied}} \times 100$$

$$\text{Abundance} = \frac{\text{Total number of individuals of a species in all quadrats}}{\text{Total number of quadrats in which the species occured}}$$

4.6 Ethnobotanical study

Field work relevant to the ethnobotanical information was undertaken during the period of our study. Field survey was carried out by interviews with local people, forest man, elderly people as well as traditional healers of the study site having knowledge of folk medicine and plants. Interview technique employed based on questionnaire to collect the data about the use of *Garcinia* members.

CHAPTER 5

5. RESULTS

A total of 8 species of *Garcinia* have been found in Hollongpara Wildlife Sanctuary and surrounding areas, Assam. The recorded species are distributed in 5 different compartments of the forest as well as near surrounding areas. The recorded *Garcinia* plant species are-

1. *G. cowa*Roxb. ex Choisy
2. *G. kydia*Roxb.
3. *G. lanceifolia*Roxb.
4. *G. lanceifolia*var.*oxyphylla*(Planch. et Lannessan)
5. *G. morella*(Gaertn) Desr.
6. *G. pedunculata* Roxb. ex. Buch.-Ham.
7. *G. sopsopia (*Buch- Ham) Mabb.
8. *G. xanthochymus*Hook.f. ex T. Anderson

5.1. Distribution

A total of 8 species of *Garcinia* were recorded from Hollongapara Gibbon Wildlife Sanctuary and near surrounding homesteads of the studied area. The studied area's humid ecological conditions were found to be the optimal habitat for a diverse array of *Garcinia* species. Among the 8 species recorded, *G. morella, G. sopsopiaG. cowa, G. kydia, G. pedunculata*and *G. xanthochymus*were found purely in wild condition of HollongaparaGibbon Wildlife Sanctuary. In the study sites, the recorded species of *Garcinia* were primarily of medium-sized trees. However, it is worth noting that *G. lanceifolia*, which is typically a small tree, was exclusively observed in cultivated conditions within homestead gardens near forests.

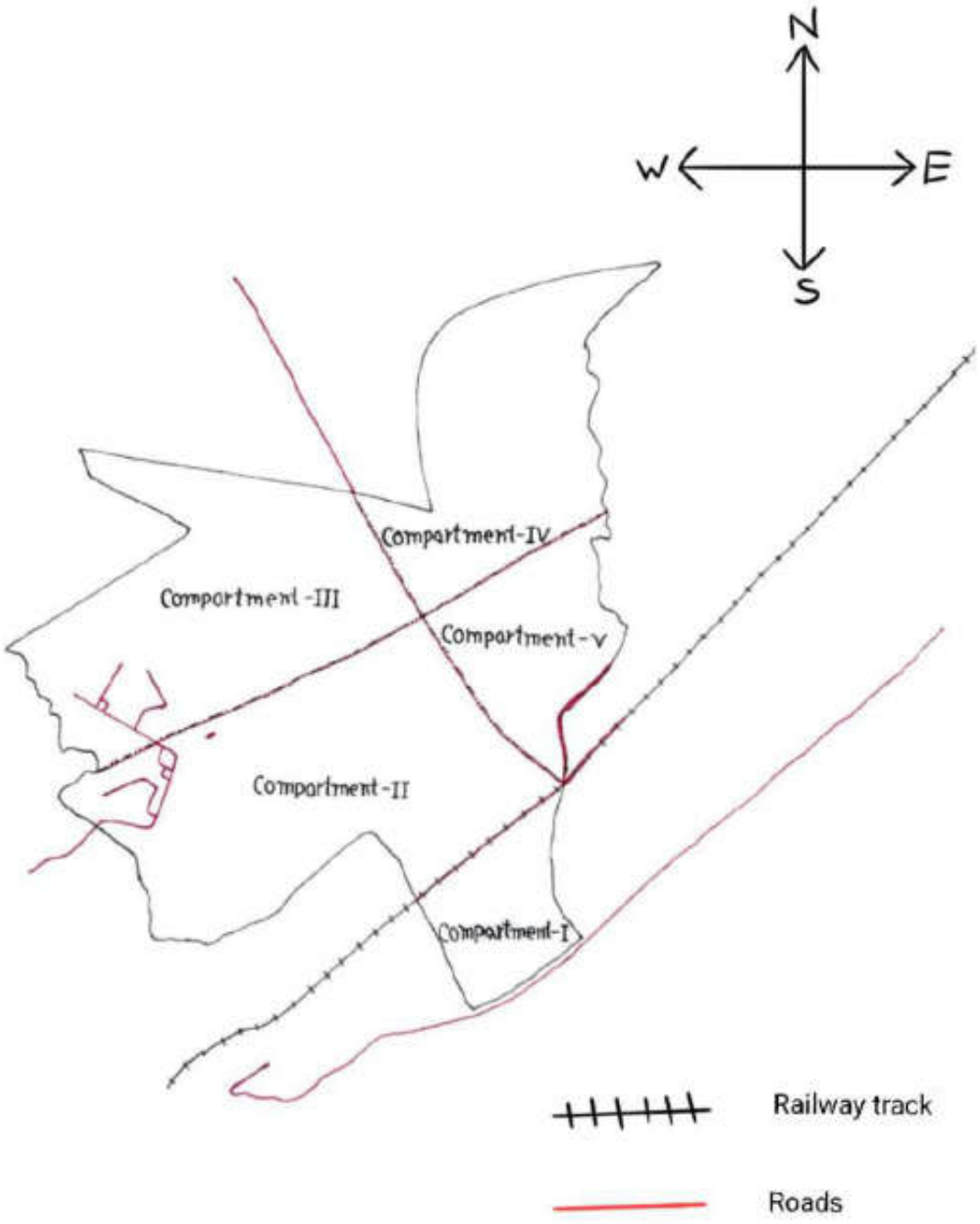

Fig. 1: Map of Hollongapar Wildlife Sanctuary

5.2. Diversity of *Garcinia* in Hollongapara Gibbon Wildlife Sanctuary with associated tree species

5.2.1*G. cowa*Roxb.

Vernacular name: Kauathekera

It is an erect evergreen tree or shrub, about 9-18 m hight and dioecious. Branches horizontal, young branches slender not angled, branchlets quadrangular, drooping. Bark brown-greyish outside, nearly smooth, inside red, soon turning reddish-brown. Bark smooth, surface greyish-brown; blaze creamy-yellow; exudation yellow, sticky, scanty.

Leaves: Leaves simple, opposite, decussate, estipulate; 8 – 13 cm long x 2.5 - 5 cm wider, both surfaces rather dull when dry. Veins slender, numerous, rather straight oblique, inarching with as intramarginal vein. Petiole 8 - 13 mm long, stout glabrous. Margin entire, glabrous, thickly coriaceous.

Male flower: Male flowers are small, yellow, borne in axillary or terminal in fascicles of 3-8, about 1 cm in diameter. Pedicels about 6 mm long. Sepals broadly ovate, fleshy, yellow. Petals twice as long as sepals, oblong. Stamens numerous on a convex fleshy receptacle, anthers bilocular, 4 cornered, oblong on very short filaments. Rudimentary pistil absent.

Female flower: Female flowers are also small but longer than male flowers, about 1.5 cm in diameter, terminal in fascicles of 2-3-5, pedicellate. Ovary sub-globose, 6 to 8-locular; stigma sessile, flat, deeply divided into 6 - 8, papillose, wedge-shaped rays. Staminodes in 4 clusters of 3 -8, unequal.

Fruit: Fruit is berry, 2-4 cm globular, depressed, non-mamillate, with 4 -8 vertical grooves, smooth, yellow in colour. Pericarp thin. Seeds 13-20 mm long, oblong with a soft aril.

Associated Tree species: *Actinodaphneobovata, Ailanthus integrifolia, Alstoniascholaris, Artocarpus chama, Castanopsisarmata, C. indica, Caralliabrachiata, Celestrusmonosperma,*

Cinnamomum glanduliferum, Dipterocarpus retusus, Lagerstroemia speciosa, Magnolia griffithi, M. kingii, Magnolia champaca, Mesua ferrea, Sapiumsebiferum, Syzigium sp., Terminalia bellerica, T. myriocarpa, Vaticalanceifolia

5.2.2 *G. kydia*Roxb.

Vernacular name: Thekera

It is an evergreen dioecious tree, normally 7.5-13 m in high. Branchlets are dark coloured when dry and not angled. Bark blackish brown in colour, rough and cracked, contains yellow milk which hardens into an inferior kind of gamboge. Wood white turning yellowish, rather heavy, coarsely fibrous, very perishable.

Leaves: Leaves opposite, 8- 15 cm long and 2 - 4 cm wider, ovate-oblong to lanceolate, acuminate, base acute, both surfaces shining, thinly coriaceous. Petiole 8-12 mm long.

Male flower: Flowers borne in small axillary or terminal pedunculate umbels of 3-5 or solitary, about 2 cm in diameter. Peduncles of the umbels 10 - 15 mm long. Pedicels thick, glabrous, clavate, about 6 mm long. Sepals 4, equal, ovate, obtuse, fleshy, yellow in colour. Petals 4, pale yellow, twice as large as the sepals, broadly ovate, blunt. Anthers numerous, square, bilocular, inserted into the slightly 4 lobed fleshy mass of conjoined filament.

Female flower: Flowers are solitary axillary and terminal, sessile. Sepals and petals are same as in the male. Staminodes 4, small, 3 or 4 -fid, alternate with the petals, the branches gland-tipped. Ovary globular, sessile, 6 to 8 lobed. Stigma subsessile with 6-8 spreading glandular rays.

Fruit: Fruit is berry about 2.5-4 cm in diameter, smooth, globular, purple-brown in colour. Fruit depressed with 6 – 8 deep vertical grooves near the apex and with a nipple -like protuberance from the depressed apex. Seeds 6 – 8 in number, oblong, about 20 mm long with soft aril.

Associated Tree species: *Actinodaphneobovata, Ailanthus integrifolia, Alstoniascholaris, Artocarpus chama, Castanopsisarmata, C. indica, Caralliabrachiata, Celestrusmonosperma, Cinnamomum glanduliferum, Dipterocarpus retusus, Dysoxylumexcelsum, Lagerstroemia speciosa, Magnolia griffithi, M. hodgsonii, M. nilagirica , M. kingii, Magnolia champaca, Mesua ferrea, Sapiumsebiferum, Syzigium sp., Terminalia bellerica, T. myriocarpa, Vaticalanceifolia, Amoorarahituka*

5.2.3 *G. lanceifolia*Roxb.

Vernacular name: Rupohithekera

It is an evergreen, small tree or glabrous shrub, bearing in clusters and grows up to a height of 5 metres commonly under evergreen dense forest. Bark is rugose and black in colour.

Leaves: Leaves simple, opposite or rarely ternate, lanceolate-ovate to oblong-oblong, base acute to obtuse, margins entire, apex acute to acuminate, leathery, coriaceous, glabrous on both sides, with translucent glands, midrib impressed above and prominent beneath, lateral veins 7-18 and irregular with parallel short veins between, veinlets reticulate, petiole slender with raised margins, exstipulate, rarely stipulate, dark green in colour.

Flower: Inflorescence axillary or terminal, in cymes, fascicles, solitary or paired. Flowers 4-5 merous, heterochlamydeous, dioecious, pseudo bisexual and female ones, always less, pedicel short or sessile.

Male flower: Flowers are solitary or germinate, born in terminal or axillary inflorescence. Dark yellow in colour. Sepal 4, fleshy, oblong, imbricate, decussate in pairs. Petals narrow, slightly oblique. Stamens 18 -40 in number in a globose mass. Filaments short or absent, anthers erect or peltate, 2 locule or rarely 4.

Female flower: Flowers are terminal or solitary axillary and bigger than the male flowers. Pedicels equally long as the flowers, thick, base 2-bracteate. Sepals 4, ovate, carnose, margin membranous. Petals 4, much narrower, carnose. Staminodes in four bundles of 4 - 8 each, connate at the base in a ring, irregular, opposite the sepals. Anthers ovate. ovary superior, globose, 2-12 locular, ovules lateral or erect, anatropous, style short or absent, stigma peltate, smooth or papillate.

Fruit: Fruit is fleshy berry about 25mm in diameter, obovoid, not grooved and orange-yellow to red in colour. Seeds 1-12, oblong ovoid, covered with juicy cream white pulp.

5.2.4 *G. lanceifolia var. oxyphylla*(Planch. *et* Triana) Lannessan

Leaves**:** Leaves 4.6 - 10.7 cm x 1.3 - 3.4 cm, coriaceous, oblanceolate with acuminate, acuteapex and cuneate base; apex 4 - 7 mm long. Mature fruit 3.1 – 3.5 x 4.3 – 5.5 cm,globose with concave apex, red colour; pulp 7 – 10.

Fruit: Fruits are fleshy berry, mature fruit obovate, orange white colour.

5.2.5*G. morella*(Gaertn) Desr.

Vernacular name: Kujithekera

It is a small to medium sized evergreen tree, about 10-17 m in high. Bark ochraceous or brownish-grey, 3-10 mm thick and smooth, blaze dark yellow, exudation dark yellow or orange yellow. Wood yellow, hard, mottled.

Leaves: Leaves 10-15 cm long and 4-8 cm wide, elliptic, ovate or obovate, thickly coriaceous, obtuse to shortly obtuse-acuminate, base acute, margin entire, glabrous, coriaceous. Midrib prominent below. lateral veins slender, 8 - I 2, obliquely parallel, arcuate, anastomosing below the margin. Petals 4, rotundate, larger than the sepals.

Male flower: Flowers are small, borne in axillary leafy fascicle, sessile or shortly pedicellate, white or creamy in colour. Sepals 4, orbicular, concave, outer pair smaller than the inner. Petals 4, rotundate, larger than the sepals. Stamens numerous, in a central sub-globose mass; anthers peltate, adnate, plurilocular, dehiscence circumscissile; filaments short, obconic. Pistillode absent.

Female flower: Female flowers are larger than the males. Flowers are solitary axillary, sessile or shortly pedicellate. Staminodes about 12 and connate at the base. Ovary glabrous, sub-globose and 4 locular. Stigma large, sessile, broadly 4 lobed, tuberculate, persistent, coronate, margin dentate.

Fruit: Fruit is berry, 20-30 mm broad, sub-globose, smooth, yellowish or light pink in colour. surrounded at the base by persistent sepals, crowned by flat tuberculate round stigmas. Fruits 4-seeded which are kidney shaped and dark brown in colour.

Associated tree species**:** *Magnolia griffithi, M. hodgsonii, M. nilagirica, M. kingii, M. champaca, Mesua ferrea, Sapiumsebiferum, Cinnamomum glanduliferum, Dipterocarpus retusus, ,Aqualariaagolacha, Amoorawallichi* .

5.2.6*G. pedunculata* Roxb.

Vernacular name: Borthekera

It is a large evergreen dioecious tree mostly found in forest and patch vegetations in wild conditions. It is about 20 m in high. They have fluted trunk with short spreading branches. Bark is spongy and wood is yellow in colour.

Leaves: Leaves are oblong and obovate-oblong, acute or obtuse, base cuneate, long attenuated in petiole, membranous, margin undulate-revolute, 12-40 cm long and 5-14 cm wide. Midrib conspicuous, prominent below. Lateral veins 10-30, 8-15 mm distant, regular and obliquely parallel. Petiole is 2 - 4.5 cm long.

Male flower: Male flowers are terminal trichotomous, pedunculate, bracteate. 8 - 12-flowered panicles, large, pale green in colour. pedicels long, stout, erect. Sepals 4, orbiculate, concave, fleshy, margin scarious, outer pair 9-IO x I 2 mm, inner pair 9x6 mm. Petals 4, obovate oblong, narrower as long as sepals. Stamens inserted at base of the receptacle, in a quadrangular, truncate, shortly stipitate mass; anthers tetragonal, bilocular, introrse.

Female flower: Female flowers are solitary, terminal and larger than the male. pedicel articulate at base, thick, tetragonous, 3 cm long. Staminodes 20-30 in 4 fascicles, connate below. Ovary is globose, stigmatic rays 8-12 in number and spreading.

Fruit: Fruits are 8-12 cm in diameter, large, globose, concave on both end and smooth. Green coloured fruit turns saffron-yellow once ripe. Seeds 8-10, large, reniform and have succulent aril.

Associated Tree species: *Mesua ferrea, Dipterocarpus retusus, Conarium resiniferum, Castanopsisarmata, C. indica, Artocarpus chama, Dysoxylumexcelsum, Vaticalanceifolia, Terminalia bellerica, T. myriocarpa, Magnolia champaca, M. griffithii, Alstoniascholaris, Pterospermumlanceafolium, Dillenia indica, Tetramelsmudiflora.*

5.2.7*G. sopsopia*(Buch- Ham) Mabb.

Vernacular name: Momaithekera

It is a medium sized, evergreen tree; about 10-20 m tall with oval lax crown. wood is moderately hard, greyish brown in colour. Bark greyish brown or reddish grey. Branchlets are decussately opposite, brittle, glabrous, terete. Latex usually resinous, thick, yellow in bark, and branches.

Leaves: Leaves simple, opposite, lanceolate-oblong to obovate, about 12-24 x 4.5-11 cm across. Base acute, margins repand or entire, apex shallow acuminate to deeply acute, subcoriaceous, membranous, glabrous on both sides. Midrib impressed above and prominent

beneath, lateral veins 8-12, about 1-2 cm apart, irregular with oblique parallel short veins between, arcuate, anastomosing near the margins, veinlets finely reticulate, petiole slightly dilated at the base, stout, about 1.5-2.5 cm long, exstipulate.

Flowers: Inflorescence axillary solitary, cymes or fascicles. Flowers heterochlamydeous, dioecious, pseudobisexual.

Male flower: Male flowers are axillary or terminal, paniculate or fascicled, white or cream coloured, slightly fragrant, pedicel sessile or subsessile. Sepals 4, imbricate, decussate in pairs, inner pair, thick, about 2.5 mm long, outer pair, green, about 2 mm long. Petals 4, imbricate, obovate-orbicular, distinctly concave, alternating with sepals. Stamens indefinite, inserted around subglobose, subsessile mass, rudimentary pistil absent, filaments short, anthers obovate, 2 loculed, dehiscing by 2 vertical slits

Female flower: Flowers are axillary or terminal, few flowered spicate racemes, similar but bigger than male flowers, sessile, with few or no staminodes. Filaments arranged in ring shape. Ovary superior, globose, 5 locular, stigma convex, sessile, papillate.

Fruit: Fruit fleshy berry, globose, 2.5-4.5 x 2-3.5 cm across, yellow, succulent, encased by persistent sepals and crowned by hemispherical granular stigma. Seeds 3-5, oblong-reniform, covered with juicy pulp with agreeable odour.

Associated Tree species: *Dipterocarpus retusus, Mesua ferrea, Vaticalanceifolia, Aqualariaagolacha, Amoorawallichi, Lagerstroemia speciosa, Tetramelsmudiflora, Dysoxylumexcelsum, Actinodaphne obovate, Ailanthus integrifolia, Alstoniascholaris.*

5.2.8*G. xanthochymus*Hook.f.

Vernacular name: Teportenga

The plant is medium-sized or tall, branched evergreen beautiful trees. Trunk straight and branches are drooping, angular, glabrous and often enlarged just below the axils of leaves.

The bark is blackish or dark grey in colour with white latex. Wood is yellowish-brown to dark greyish-brown in colour. Wood is very hard and moderately heavy. Branches numerous, slender, decussate, horizontal and twigs distinctly angled. Leaves greatly variable in form and size.

Leaves: Leaves usually 12-35 x 4- 10 cm in size, glabrous, opposite, linear-oblong or oblong-lanceolate, acute and acuminate and base cuneate. Margin thick, subrepand, coriaceous, dark green in colour and shining. Midrib prominent below, laterals irregular, sub-paralleled, arched, anastomosing at the apex. Petiole 1 -2.5 cm long and rugose.

Male flower: Flowers are white, small, solitary, fascicled, umbelled or panicled, polygamous or dioecious and about 1.5 cm in diameter. They arise in 4 to 10 flowered fascicles, axillary or from the axils of fallen leaves. Pedicels thickened, about 2.5 cm long. Sepals 5, rarely 4 and then often the fifth sepal disarranged and scale like, orbicular, concave, fleshy, unequal, apex ciliate. Petals 5, about 8 mm long, alternating with sepals, orbicular, spreading, incurved, green in colour. Stamens in 5 broad bundles of 3-5 each and are anti-petalous alternating with 5 fleshy glands. Anthers bilocular. (Murmu, 2016)

Female flower: Female flowers are mostly alike with the males. Staminodes few and complanate. Ovary ovoid, acuminate, usually 5 – locular. Stigmatic rays 5, oblong, spreading, entire.

Fruit: Fruit is berry, large, about 6.5 cm in diameter, sub globose, smooth and pointed at apex, dark yellow in colour. They consist plenty of yellow gum. Seeds 1 -4, oblong, embedded in a yellow aril-like pulp.

Associated Tree species: *Dipterocarpus retusus, Dysoxylumexcelsum, Eleocarpus serratus, Magnolia hodgsonii, Mesua ferrea, Sloaneasterculiacea, Albizia lucidior, Actinodaphne obovate, Ailanthus integrifolia, Alstoniascholaris*

A B

C **D**

E **F**

G **H**

Fig.-Different fruit of *Garcinia* species found in Hollongapar Gibbon Wildlife Sanctuary (**A.***G. pedunculata*, **B.***G. cowa*, **C.***G. kydia*, **D.***G. lanciefolia*, **E.***G. lanciefolia* var. *oxyphylla*, **F.***G. morella*, **G.***G. sopsopia*, **H.***G. xanthochymus*)

Fig.- Dry fruit samples of different species of *Garcinia*

G. cowa

G. kydia

G. morella

Fig. – Different flower of some species of *Garcinia*

5.3 Population survey

Broad-scale destruction and fragmentation of native vegetation is commonly visible phenomenon throughout the world. For conservation strategies, species with a limited distribution are of greater importance than with a wide distribution. Through extensive field visits in our study sites, the population size of the 6 species of Garcinia was recorded considering the density, frequency of occurrence and abundance. We considered 6 species of *Garcinia* because *G. lanceifolia* was not found in wild condition. A total 12 quadrates (20 m x 20 m in size) were observed in the study sites separately for each 6 species.12 quadrates were taken under the selected 200 m^2 grids. The observations tabulated below depicted the mean density, mean frequency and mean abundance of the 6 species.

5.3.1 Population size, density and abundance of *G. cowa*

After collecting data from 12 quadrates, we tabulated it and measured the mean density, frequency and abundance. From this study we found that mean density of *G. cowa* in the study is 2.2 whereas mean frequency and mean abundance are 86.81 and 2.55 respectively.

Table- 1

Grid No (200m x 200m)	No. of adult plants	No. of samplings	No. of seedlings	Total No. of Plant species	No. of associated tree species	Total No. of quadrates of occurrence	Density	Frequency	Abundance
1	8	3	17	28	432	10	2.3	83.33	2.8
2	5	7	12	24	468	9	2	75	2.67
3	1	16	7	24	467	11	2	91.67	2.18
4	3	17	15	35	456	12	2.92	100	2.92
5	1	6	5	12	443	5	1	41.67	2.4
6	5	12	5	22	428	12	1.83	100	1.83
7	1	23	9	33	396	12	2.75	100	2.75
8	0	16	12	28	398	11	2.33	91.67	2.55
9	2	7	15	24	429	10	2	83.33	2.4
10	7	12	29	48	436	12	4	100	4
11	2	11	13	26	434	11	2.17	91.67	2.36
12	4	12	2	18	403	10	1.5	83.33	1.8
Mean							**2.2**	**86.81**	**2.55**

5.3.2 Population size, density and abundance of *G. kydia*

From the study we found that mean density of *G. kydia* in the study is 2.42 whereas mean frequency and mean abundance are 96.53 and 2.53 respectively.

Table- 2

Grid No (200m x 200m)	No. of adult plants	No. of samplings	No. of seedlings	Total No. of Plant species	No. of associated tree species	Total No. of quadrates of occurrence	Density	Frequency	Abundance
1	7	15	2	24	335	9	2	75	2.67
2	3	14	27	44	301	12	3.67	100	3.67
3	4	32	6	42	452	12	3.5	100	3.5
4	6	15	3	24	421	11	2	91.67	2.18
5	4	12	0	16	328	10	1.33	83.33	1.6
6	8	14	0	22	462	12	1.83	100	1.83
7	2	4	6	12	423	18	1	150	0.67
8	14	28	0	42	463	12	3.5	100	3.5
9	3	7	0	10	452	8	0.83	66.67	1.25
10	6	19	23	48	455	12	4	100	4
11	7	23	7	37	434	12	3.083	100	3.08
12	6	12	9	27	452	11	2.25	91.67	2.45
Mean							2.42	96.53	2.53

5.3.3 Population size, density and abundance of *G. morella*

From the study we found that mean density of *G. morella*in the study is 2.03 whereas mean frequency and mean abundance are 84.72 and 2.45 respectively.

Table- 3

Grid No (200m x 200m)	No. of adult plants	No. of samplings	No. of seedlings	Total No. of Plant species	No. of associated tree species	Total No. of quadrates of occurrence	Density	Frequency	Abundance
1	6	7	0	13	434	9	1.08	75	1.44
2	7	5	5	17	423	11	1.42	91.67	1.55
3	11	9	14	34	443	12	2.83	100	2.83
4	8	7	15	30	464	12	2.5	100	2.5
5	3	6	10	19	427	7	1.58	58.33	2.71
6	8	9	17	34	434	9	2.83	75	3.78
7	6	0	10	16	472	10	1.33	83.33	1.6
8	4	7	9	20	435	10	1.67	83.33	2
9	7	12	10	29	463	8	2.42	66.67	3.63
10	5	9	12	26	431	12	2.17	100	2.17
11	7	8	19	34	389	10	2.83	83.33	3.4
12	7	4	10	21	384	12	1.75	100	1.75
Mean							2.03	84.72	2.45

5.3.4 Population size, density and abundance of *G. pedunculata*

From the study we found that mean density of *G. pedunculata* in the study is 2.68 whereas mean frequency and mean abundance are 91.67 and 2.99 respectively.

Table- 4

Grid No (200m x 200m)	No. of adult plants	No. of samplings	No. of seedlings	Total No. of Plant species	No. of associated tree species	Total No. of quadrates of occurrence	Density	Frequency	Abundance
1	7	15	2	24	439	9	2	75	2.67
2	4	24	9	37	345	7	3.08	58.33	5.29
3	7	18	33	58	383	12	4.83	100	4.83
4	6	10	16	32	465	12	2.67	100	2.67
5	4	12	8	24	364	11	2	91.67	2.18
6	7	9	9	25	454	12	2.08	100	2.08
7	5	19	10	34	450	12	2.83	100	2.83
8	3	12	0	15	392	11	1.25	91.67	1.36
9	8	17	18	43	432	12	3.58	100	3.58
10	8	15	7	30	438	12	2.5	100	2.5
11	4	19	8	31	423	12	2.58	100	2.58
12	5	18	10	33	464	10	2.75	83.33	3.3
Mean							2.68	91.67	2.99

5.3.5 Population size, density and abundance of *G. sopsopia*

From the study we found that mean density of *G. sopsopia*in the study is 1.36 whereas mean frequency and mean abundance are 63.19 and 2.17 respectively.

Table- 5

Grid No (200m x 200m)	**No. of adult plants**	**No. of samplings**	**No. of seedlings**	**Total No. of Plant species**	**No. of associated tree species**	**Total No. of quadrates of occurrence**	**Density**	**Frequency**	**Abundance**
1	2	7	0	9	435	4	0.75	33.33	2.25
2	3	16	4	23	338	11	1.92	91.67	2.09
3	5	22	0	27	445	12	2.25	100	2.25
4	4	5	0	9	438	6	0.75	50	1.5
5	4	9	0	13	421	6	1.08	50	2.17
6	7	12	1	20	428	9	1.67	75	2.22
7	3	11	4	18	435	8	1.5	66.67	2.25
8	3	6	2	11	430	5	0.92	41.67	2.2
9	2	3	2	7	396	3	0.58	25	2.33
10	4	14	3	21	459	9	1.75	75	2.33
11	3	12	4	19	468	7	1.58	58.33	2.71
12	2	16	1	19	425	11	1.58	91.67	1.73
Mean							1.36	63.19	2.17

5.3.6 Population size, density and abundance of *G. xanthochymus*

From the study we found that mean density of *G. xanthochymus*in the study is 2.15 whereas mean frequency and mean abundance are 79.17 and 2.68 respectively.

Table- 6

Grid No (200m x 200m)	No. of adult plants	No. of samplings	No. of seedlings	Total No. of Plant species	No. of associated tree species	Total No. of quadrates of occurrence	Density	Frequency	Abundance
1	2	14	10	26	325	12	2.17	100	2.17
2	6	9	19	34	334	12	2.83	100	2.83
3	6	7	16	29	358	12	2.42	100	2.42
4	7	8	24	39	429	11	3.25	91.67	3.55
5	9	8	12	29	424	10	2.42	83.33	2.9
6	2	17	0	19	394	9	1.58	75	2.11
7	0	8	0	8	324	3	0.67	25	2.67
8	2	1	7	10	373	4	0.83	33.33	2.5
9	6	9	23	38	396	10	3.17	83.33	3.8
10	9	12	21	42	389	12	3.5	100	3.5
11	2	7	15	24	424	10	2	83.33	2.4
12	4	8	0	12	423	9	1	75	1.33
Mean							2.15	79.17	2.68

From this study, we made a graphical presentation of mean density, mean frequency and mean abundance for each 6 species. The chart indicates the population status of each of the 6 species found in wild condition in study site (Fig. 2). From this population status we found that the distribution of *G. sopsopia* is very much rare whereas population of *G. pedunculata* is high among the 6 species found in wild condition.

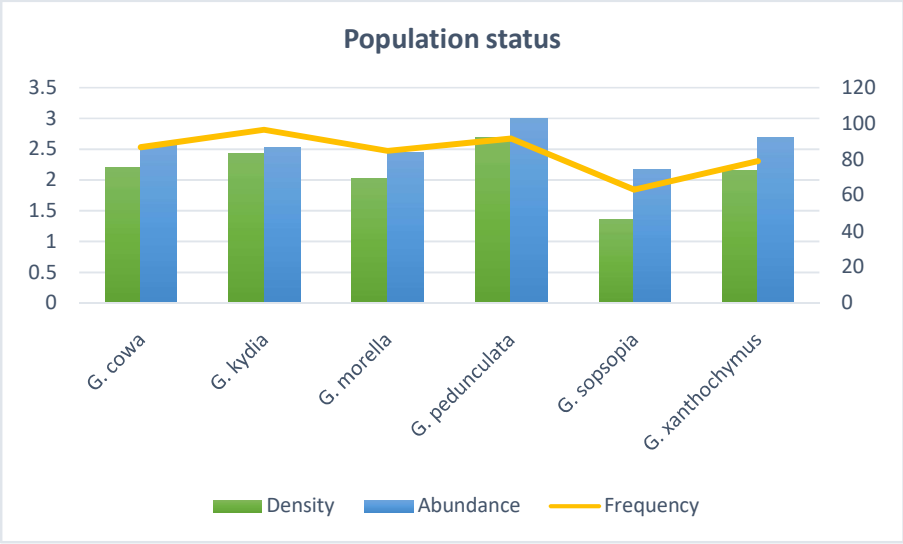

Fig. 2: Population status of 6 species of *Garcinia*

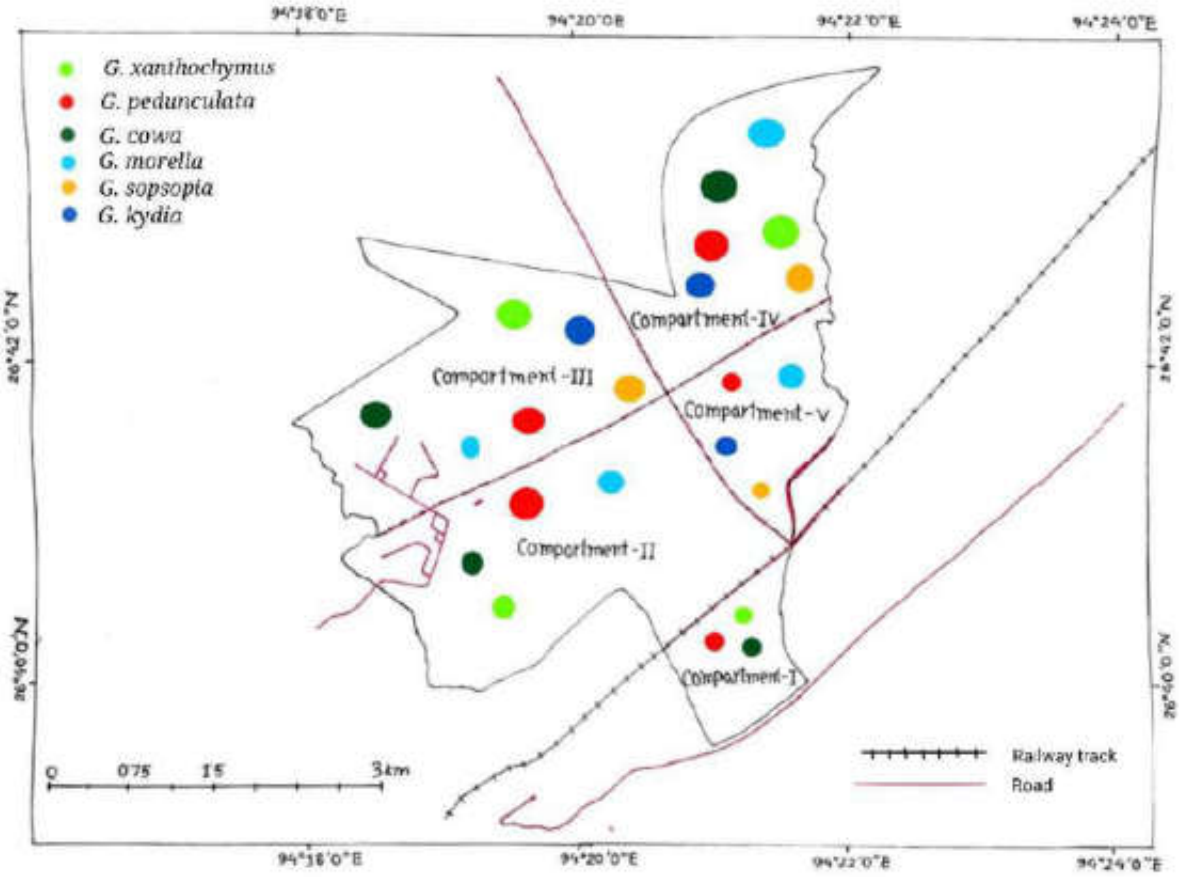

Fig. 3: Distributional map of Garcinia in Hollongapar Gibbon Wildlife Sanctuary

5.4 Ethnobotanical uses

Various traditional as well as ecological importance were noted down from the study site. We interacted with the local people and forest officers and collected uses of species of Garcinia. According to them Garcinia fruits are used extensively. The various uses of species of Garcinia are tabulated below (Table- 7).

Table- 7

SL. No.	Species name	Traditional uses	Ecological uses
1	*G. cowa*	Pericarps of the fruits are used as acidifying agents for traditional curry. Leaves are eaten along with small fish. The fleshy outer covers of seeds of ripe fruits are eaten as raw. The dried slices of fruit pericarp are preserved for its potent medicinal properties, it is used in ailments such as dysentery and constipation. The juice extracted from the dried fruit pericarp is consumed as a refreshing sherbet due to its tangy flavour. The extract of dry sliced fruit is also used as medicine for high blood pressure and stomach disorder for human as well as domestic animals. The fruits and leaves are used for the improvement of blood circulation, as an expectorant for the treatment of coughs and in indigestion and as a laxative. The root is used to treat fever. The stem is used for making various products.	Leaves, mesocarp as well as aril of the fruits are popularly eaten by Rhesus macaques and pig-tailed macaques**.**
2	*G. kydia*	Fruits are eaten raw or dried. Pericarps of fruit are used as acidifying agents for traditional curry.The juice prepared from the dry sliced pericarp is eaten as sherbet. The fruit is considered specifically useful for treating dysentery, constipation and also for external application in obstinate cases of headaches. Stem is used for making traditional rice husking implements 'Dheki' and some other useful product. It is also used a fuel wood.	Tender leaves, bark, mesocarp as well as aril of the fruits are popularly eaten by Rhesus macaques, pig-tailed macaques, **giant squirrels** and golden langur.
3	*G. lanceifolia*	Leaves are taken as vegetables. . Tender leaves and shoots are sub acidic in taste and eaten cooked by local people. The pericarps of fruits are eaten in raw and as pickles. The dry sliced prepared from pericarps are used as acidifying agent for traditional curry, medicine against stomach trouble. Fruit juice cures fever, jaundice and urinary troubles. The juice prepared from the dry sliced pericarp is drink as sherbet	Tender leaves are eaten by Pig-tailed macaques.

		during summer.	
4	*G. morella*	Fruits are eaten raw or dried. Sundried fruits used to cure dysentery, jaundice. Juice of fruits treat fever, diabetes and jaundice. Leaves are taken as vegetables.	**Leaves, mesocarp as well as aril of the fruits are popularly eaten by Hoolock gibbon, Rhesus macaques, pig-tailed macaques, giant squirrels.**
5	*G. pedunculata*	Fruits have been traditionally used as acidifying agents in curries and pickles, as well as for medicinal purposes to treat dysentery. Additionally, the vibrant outer covering of the seed coat is commonly utilized in the preparation of refreshing cold drinks, such as sherbet. Moreover, boiled unripe fruit has medicinal properties that make it effective in treating dysentery. It is also incorporated into traditional recipes and consumed as part of traditional cuisine. The unripe fruits are used in *Bohagbihu*festival. Stem is used for making traditional rice husking implements 'Dheki' and traditional houses. Fruit is also used as fixative or as a mordant for saffron dye	The arils of the fruits are eaten by Golden langur and Hoolock Gibbon. Tender leaves and stems are eaten by Rhesus macaques and pig-tailed macaques.
6	*G. sopsopia*	The ripe fruits are eaten raw or dried. Unripe fruits can be used to prepare pickles. Leaves are eaten along with small fish. Leaves are used to treated roundworm. The dry sliced pericarps are used as medicine against stomach trouble Wood is moderately hard used for house building and fuel wood.	Arils of the fruits are eaten by Hoolock Gibbon, giant squirrels and Slow loris**.**
7	*G. xanthochymus*	The ripe fruit which is very acidic can be eaten raw or cooked with other vegetables. Pericarps of fruit are used as acidifying agents for traditional curry.The juice prepared from the dry sliced pericarp is eaten as sherbet, which is used against dysentery. Fruit latex is used as medicine for curing wound and skin diseases. Bark of the tree and latex of unripe fruits are used to make yellow dye. Wood is hard, good for making house.	Ripe Fruits are eaten by Rhesus macaques, Pig-tailed macaques and golden langur**.**

Fig.- Natural habitat of Hollongapar Gibbon Wildlife Sanctuary

Fig.- *Garcinia* species in their natural habitat

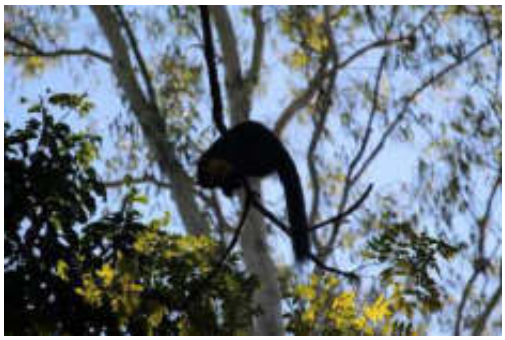

Fig.- Half eaten fruits of *G. morella*by HollockGibbon

CHAPTER 6

6 Discussion

The basic objective of the present study was to survey the population status of various species of *Garcinia* found in Hollongpara Gibbon Wildlife Sanctuary and to prepare a distributional map and also to collect information regarding ethnomedical value of it. *Garcinia* is a highly medicinal plant found in various forest of Assam. This study revealed that 8 species of *Garcinia* was found in Hollongpara Gibbon Wildlife Sanctuary and the surrounding areas. The sanctuary is fragmented into 5 compartments where 6 species were found in wild condition. Out of these recorded species, *G. lanceifolia* was found as a cultivated plant and in homesteads. In the studied area these species are used traditionally for the treatment of various stomach related disorders. The information was collected on actual use and result derived by the informants. The study revealed that local people have been using the fruits not only for the medicinal purposes but also for consumption as food items, juice etc. According to the informants the use of this plant as medicinal value is different to that of normal consumption as food items. For medicinal purposes, the fruit is sliced into small pieces, and then dried under the direct sunlight about 10-15 days for preservation. *Garcinia* spp. being rich in pharmacological properties and bioactive components. The fruit could be standardized in making refreshing drink which could be commercialized at the large scale or other food products and made easily available for the consumers.

The study revealed that population of *Garcinia* has been depleted very fast in its natural habitats due to over-exploitation and habitat fragmentation. Tea gardens are major factor for over-exploitation and habitat fragmentation. The railway track divides the sanctuary into two

halves and has caused serious threats for the entire ecosystem. Due to various activities of animals the population of *Garcinia* species are also affected. Informants said that elephants have uprooted large trees frequently. In some areas *Garcinia* species are affected by elephant activities. Apes, squirrels and birds consume fruits of *Garcinia* species and play key role in seed germination. In this study we found that the distribution of *G. sopsopia* is very rare in this forest. *G. sopsopia* is found only a few forests of Assam and Hollongpara is one of them. Therefore, improvement of conservation status of this important plant is urgently needed.

In this study we did a concise plant population survey for collecting data. Studying the density, frequency, and abundance of the plant species in its natural habitat is a crucial objective for estimating population size. Abundance is a measure of the number or frequency of individual in an area, while distribution provides insights into the geographical extent of the species' presence. Analysing the abundance and distribution patterns of populations plays a role in understanding their dynamic responses to selective pressures over time. Results of the study showed that the density, abundance and frequency of *G. sopsopia* is comparatively low than the others. It is also a rare species found in Assam. Our study showed that *G. lanceifolia* was not found in wild condition. In surrounding village areas, it was found as a cultivated plant.

Considering the importance of fruits as herbal medicine, the conservation of the various species of *Garcinia* plant is equally important. Our study revealed that due to different social and environmental adversities the plant has been subjected to endangered. As such it needs a specific strategy to increase the cultivation/plantation of these valuable species of *Garcinia* on priority basis.

CHAPTER 7

7. Conclusion

The present study was carried out to study the diversity of taxa of *Garcinia* in Hoollongapar Gibbon Sanctuary and to prepare a distributional map for the member of the genus. Through this extensive study we found 8 *Garcinia* species from this forest and near areas. Out of these 8 species of *Garcini*a, we found that 6 species are wild and distributed in various compartments. *G. lanceifolia* and *G. lanceifolia*var.*oxyphylla* were found in surrounding areas as a cultivated plant. The present investigation gives a record of *Garcinia* in Hollongapara Gibbon Wildlife Sanctuary. The study concludes that the population of *G. pedunculata* is comparatively high than that of other species, whereas *G. sopsopia*is found to be in very law in Hollongapara Gibbon Wildlife Sanctuary, Assam. The study also gives a clear picture of diversity as well as population status of *Garcinia*in our study area, which helps to immediate conserve the threatened *Garcinia* spp. in Hollongapara Gibbon Wildlife Sanctuary, Assam.

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Exploring the Antimicrobial and Antifungal Properties of Bio-enzymes for A Novel Approach to Sustainable Water Treatment

PROJECT REPORT

Submitted in partial fulfillment of the requirement for the degree of

Bachelor Degree

In

BIOTECHNOLOGY

GAUHATI UNIVERSITY

Submitted By

Santanaba Krishna Hazarika

Roll No: UA-201-225-0692

Under the guidance of

Dr. Debashree Saikia

DEPARTMENT OF BIOTECHNOLOGY

DARRANG COLLEGE, TEZPUR, ASSAM

GAUHATI UNIVERSITY

June 2023

Department of Biotechnology

FORWARDING CERTIFICATE

I hereby recommend that this project work entitled **"Exploring the Antimicrobial and Antifungal Properties of Bio-enzymes for A Novel Approach to Sustainable Water Treatment"** prepared under the supervision of Dr. Debashree Saikia be accepted in partial fulfillment of the requirements for the Under-graduate degree in Biotechnology from the Department of Biotechnology, Darrang College ,Tezpur, Assam, in the year 2023.

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CERTIFICATE

This is to certify that this Project Report entitled **"Exploring the Antimicrobial and Antifungal Properties of Bio-enzymes for A Novel Approach to Sustainable Water Treatment "** submitted by **Santanaba Krishna Hazarika, B.Sc. 6th semester, Biotechnology, Dept. of Biotechnology, Darrang College,** is hereby approved as a creditable mini Research Project work is carried out and presented in a manner satisfactory to warrant its acceptance as a prerequisite to the degree, for which it has been submitted. It is understood that by this approval, the undersigned do not necessarily endorse or approve any statement made, opinion expressed or conclusion drawn therein but approve only for the purpose for which it is submitted.

Signature of the Supervisor

Dr. Debashree Saikia

Date:

Place: Darrang College, Tezpur

DECLARATION

I, **Santanaba Krishna Hazarika** hereby declare that this project entitled **"Exploring the Antimicrobial and Antifungal Properties of Bio-enzymes for A Novel Approach to Sustainable Water Treatment"** submitted to the Department of Biotechnology, Darrang College, Tezpur, Assam, India, for acceptance in partial fulfillment of the requirements for the Bachelor degree in Biotechnology, under Gauhati University, is prepared by me and the same has not been/is not been submitted to any other institution.

Name: Santanaba Krishna Hazarika

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Date:

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Santanaba Krishna Hazarika

Date:

Place: Darrang College, Tezpur

CONTENTS

ABSTRACT

Tomato (Solanum lycopersicum) is a widely cultivated and consumed fruit known for its nutritional value and unique properties. Tomatoes are rich in essential nutrients such as vitamins (Vit A, Vit C, and Vit K), minerals (potassium and folate), and antioxidants (lycopene and beta-carotene). These compounds contribute to their vibrant color and provide numerous health benefits, including reducing the risk of chronic diseases such as heart disease and certain types of cancer. The objective of this project was to investigate the nutritional composition and potential health benefits of bananas (Musa spp.). Bananas are one of the most widely consumed fruits globally and are renowned for their delicious taste and high nutritional value. Through an analysis of scientific literature and empirical studies, the project aimed to provide an overview of the nutritional profile of bananas and highlight their potential impact on human health.

The research encompassed the examination of macronutrients, such as carbohydrates, fiber, and protein, as well as micronutrients, including vitamins (vitamin C, vitamin B6) and minerals (potassium, magnesium). The project explored the role of bananas in contributing to a balanced diet and their potential benefits for various aspects of human health, such as cardiovascular health, digestive health, and immune function.

This project investigated the bioenzyme derived from tomatoes and bananas also its antimicrobial and antifungal properties. The objective was to assess the bioenzyme's potential for reducing Total Dissolved Solids (TDS) in wastewater. The bioenzyme was extracted and characterized, and its efficacy against microbial and fungal strains was evaluated. The results revealed significant antimicrobial and antifungal activity of the tomato bioenzyme. Moreover, the application of the bioenzyme to waste water samples resulted in a notable reduction in TDS levels. These findings suggest that tomato bioenzyme hold promise as a natural and sustainable solution for water treatment and TDS reduction.

INTRODUCTION

Bio-enzymes, also known as enzymatic solutions or microbial enzymes, are innovative and eco-friendly alternatives to conventional cleaning agents. These enzymatic solutions harness the power of natural enzymes derived from various sources such as plants, fruits, and microorganisms to break down organic matter and effectively clean a wide range of surfaces.

Bio-enzymes work through a process called enzymatic catalysis, where enzymes act as biological catalysts to accelerate chemical reactions. These enzymes possess specific properties that allow them to target and degrade specific organic compounds, such as proteins, carbohydrates, and fats, into smaller, more manageable molecules. As a result, bio-enzymes have the ability to remove stains, odors, grease, and other organic residues that traditional cleaning agents may struggle to eliminate.

One of the key advantages of bio-enzymes is their biodegradability. Since they are derived from natural sources, they are non-toxic and environmentally friendly. Bioenzymes have the ability to break down complex organic substances into simpler, harmless compounds, which can be easily assimilated by natural processes. This makes them safe for use in various applications, including household cleaning, waste management, agriculture, and even industrial processes.

Furthermore, bioenzymes offer cost-effective and sustainable solutions. They can be produced from readily available and renewable resources, reducing the dependence on non-renewable raw materials. With their effectiveness in removing tough stains and residues, bio-enzymes can also help minimize the need for harsh chemicals, thereby promoting a safer and healthier environment.

Tomato (Solanum lycopersicum) is a popular and widely consumed fruit that holds a significant place in both culinary and nutritional domains. Known for its vibrant color, distinct flavor, and versatility in various dishes, tomatoes have become a staple ingredient in cuisines around the world. However, tomatoes offer more than just culinary appeal; they are also rich in essential nutrients and bioactive compounds that provide numerous health benefits.

Over time, tomatoes have been bred and developed into numerous varieties, each exhibiting unique characteristics such as size, shape, color, and taste. Today, they are cultivated in diverse regions and climates, making them readily available throughout the year.

One of the primary reasons tomatoes have gained attention is their impressive nutritional profile. They are low in calories but rich in essential vitamins, minerals, and antioxidants. Tomatoes are an excellent source of vitamin C, which plays a crucial role in immune function and collagen synthesis. They also provide significant amounts of vitamin A, essential for vision, and vitamin K, important for blood clotting and bone health. Additionally, tomatoes contain minerals like potassium, which helps regulate blood pressure, and folate, which is vital for cell growth and development.

One of the most notable compounds found in tomatoes is lycopene, a powerful antioxidant responsible for their vibrant red color. Lycopene has been extensively studied for its potential health benefits, particularly in reducing the risk of chronic diseases such as cardiovascular disease, certain cancers, and age-related macular degeneration. Research suggests that lycopene may help neutralize harmful free radicals, reduce inflammation, and protect against oxidative stress.

Beyond their nutritional content, tomatoes possess culinary properties that have made them a beloved ingredient in various cuisines worldwide. Their flavor profile can range from sweet and tangy to savory, depending on the variety and ripeness. This versatility allows tomatoes to be incorporated into an array of dishes, including salads, sauces, soups, sandwiches, and more. Additionally, the acidity of tomatoes can enhance the taste and balance of flavors in culinary creations.

Tomatoes also possess functional properties that contribute to overall well-being. Their high water content makes them hydrating and easy to incorporate into a hydrating diet. Furthermore, tomatoes are an excellent source of dietary fiber, which aids in digestion and promotes a healthy gut. The combination of water and fiber in tomatoes contributes to feelings of fullness and can assist in weight management.

Bananas, scientifically known as Musa spp., are one of the most widely consumed fruits across the globe. Native to Southeast Asia, these tropical fruits have been cultivated for thousands of years and have become an integral part of various culinary traditions and dietary habits. The distinctive yellow peel and soft, creamy flesh make bananas easily recognizable and highly sought after by people of all ages.

Bananas are not only popular for their delightful taste but also for their numerous health benefits and versatile culinary applications. They are consumed both as a standalone snack and incorporated into various recipes, such as smoothies, desserts, and baked goods. Moreover, bananas play a significant role in traditional medicine and have been attributed with numerous medicinal properties in different cultures.

This introduction aims to provide an overview of the botanical aspects, nutritional composition, and cultural significance of bananas. Furthermore, it will explore the various health benefits associated with their consumption and shed light on their environmental impact and economic significance.

As a staple food in many regions, bananas are an abundant source of essential nutrients, including carbohydrates, dietary fiber, vitamins, and minerals. They are particularly rich in potassium, vitamin C, and vitamin B6, offering a range of health benefits such as supporting heart health, promoting digestion, and boosting the immune system. The natural sugars present in bananas provide a quick energy boost, making them a popular choice among athletes and individuals seeking a natural source of fuel.

Additionally, bananas are known for their positive impact on mood and mental well-being. They contain tryptophan, a precursor to serotonin, a neurotransmitter that contributes to feelings of happiness and relaxation. Furthermore, the fiber content in bananas helps regulate blood sugar levels and promotes a feeling of satiety, making them a valuable asset for weight management and overall digestive health.

Beyond their nutritional value, bananas hold cultural and economic significance in many countries. They are not only a dietary staple but also play a role in religious rituals, festivals, and

symbolic traditions. Moreover, bananas are a major export crop for several nations, providing employment opportunities and contributing to the global economy.

In conclusion, bananas are a widely beloved fruit, cherished for their taste, versatility, and nutritional benefits. From their origins in Southeast Asia to their global popularity, these fruits have become a fundamental part of our diets and cultures. Whether enjoyed as a convenient snack or incorporated into various culinary creations, bananas offer a wealth of nutrients and contribute to overall well-being. Understanding their botanical, nutritional, and cultural significance enables us to appreciate the remarkable journey of this humble fruit and its enduring appeal.

Plant Review: *Solanum lycopersicum*

Botanical Characteristics:

Tomato plants are herbaceous perennials but are commonly grown as annuals due to their sensitivity to frost. They are typically indeterminate, meaning they have vining growth habits, but determinate varieties with more compact growth exist as well. The plants have a branching stem system with compound leaves composed of multiple leaflets. The flowers are yellow and self-fertile, allowing for easy pollination and fruit set. The fruits, which are botanically classified as berries, come in a variety of colors, including red, yellow, orange, and even green when unripe.

Cultivation:

Tomatoes thrive in warm climates and require well-drained soil with good organic matter content. They prefer full sun exposure to optimize growth and fruit production. Depending on the variety, tomatoes can be grown directly in the ground or in containers, making them suitable for both large-scale and home gardens. Regular watering is necessary to maintain optimal soil moisture levels, especially during periods of fruit development. The use of trellises or stakes is common to support the sprawling vines and facilitate fruit access and airflow.

Varieties:

Tomato plants come in numerous varieties, each with distinct characteristics. Determinate varieties, also known as bush tomatoes, are compact and tend to produce fruits over a relatively short period, making them suitable for space-constrained gardens. Indeterminate varieties, on the other hand, continue to grow and produce fruits until frost, often requiring staking or caging for support. Tomato cultivars also differ in fruit size, shape, color, and taste, offering options for various culinary preferences.

Nutritional and Health Benefits:

Tomatoes are well-regarded for their nutritional value. They are low in calories and rich in essential vitamins, minerals, and antioxidants. Tomatoes are an excellent source of vitamin C, which supports immune function and collagen synthesis. They also contain vitamin A, essential

for vision, and vitamin K, important for blood clotting. Additionally, tomatoes provide potassium, folate, and dietary fiber, contributing to overall health and well-being.

Tomatoes are particularly known for their high content of the carotenoid pigment lycopene, responsible for their red color. Lycopene is a potent antioxidant associated with various health benefits, including reducing the risk of certain cancers, cardiovascular diseases, and age-related macular degeneration. Cooking tomatoes, as in the case of tomato sauces or pastes, enhances the bioavailability of lycopene, making it easier for the body to absorb.

Culinary and Culinary Applications:

Tomatoes are a versatile ingredient in the culinary world and are used in a wide range of dishes and cuisines. They can be consumed raw in salads, sandwiches, and salsas, adding a refreshing and tangy flavor. Cooked tomatoes are a fundamental component of numerous sauces, soups, stews, and pasta dishes, imparting depth and richness to the flavors. They are also commonly dried, canned, or made into purees, pastes, and ketchups for extended use and preservation.

In addition to their direct consumption, tomatoes are a key ingredient in various processed food products, such as juices, salsas, and canned goods. The versatility and availability of tomatoes make them a staple in countless culinary creations worldwide.

The taxonomy of the plant:

Kingdom: Plantae - Plants

Division: Magnoliophyta - Flowering plants

Class: Magnoliopsida - Dicotyledons

Order: Solanales - Solanales

Family: Solanaceae - Nightshade family

Genus: Solanum - Nightshades

Species: ***Solanum lycopersicum***

Fig 1 : Fruits of ***Solanum lycopersicum***

The morphology of tomato plant *(Solanum lycopersicum*)

Roots: Tomato plants have a fibrous root system consisting of numerous branching roots. These roots anchor the plant in the soil and absorb water and nutrients for growth and development.

Stem: The stem of a tomato plant is herbaceous and typically grows erect or vining, depending on the variety. It is characterized by a cylindrical shape and has a green color when young, turning woody and brown as the plant matures. The stem branches out and bears leaves, flowers, and fruits.

Leaves: Tomato plants have compound leaves composed of multiple leaflets. The leaves are typically alternate in arrangement and vary in size and shape depending on the variety. Each leaflet is ovate or lanceolate with serrated margins. The leaves are dark green and have a slightly hairy texture.

Flowers: Tomato plants produce yellow flowers that are typically self-fertile. The flowers are radially symmetrical and have five petals fused at the base, forming a star-shaped appearance. The flowers are borne in clusters known as inflorescences.

Inflorescences: Tomato plants bear inflorescences known as cymes, which are composed of multiple flowers. The cymes arise from the leaf axils and are located at the terminal ends of the stems. Each cyme consists of a central flower known as the primary flower, surrounded by smaller secondary flowers.

Fruits: The fruit of the tomato plant is a berry and is the edible part of the plant. It varies in size, shape, and color depending on the cultivar. Tomatoes can be round, oval, or oblong, and their color ranges from red, yellow, orange, to green, depending on the ripeness and variety. The fruit has a fleshy pulp with numerous seeds embedded in gelatinous tissue.

The geographical condition of tomato plant (*Solanum lycopersicum*)

Climate: Tomato plants require a warm and temperate climate for optimal growth. The ideal temperature range for tomato cultivation is between 20 to 30 degrees Celsius (68 to 86 degrees Fahrenheit). Extreme heat or cold can negatively impact plant growth and fruit development. Additionally, tomatoes require a frost-free growing season, as they are sensitive to low temperatures.

Sunlight: Tomato plants are sun-loving and require ample sunlight for optimal growth and fruit production. They thrive in full sun exposure, which typically means receiving at least 6 to 8 hours of direct sunlight per day.

Soil: Well-drained and fertile soil is essential for tomato cultivation. The soil should have good water-holding capacity while allowing excess water to drain away. Sandy loam or loamy soil with a pH range of 6 to 7 is considered ideal for tomato plants. Additionally, the soil should be rich in organic matter to provide essential nutrients to the plants.

Water and Irrigation: Adequate water supply is crucial for tomato plants, especially during periods of fruit development. While tomato plants require consistent moisture, overwatering should be avoided to prevent waterlogging and root diseases. Irrigation methods such as drip irrigation or soaker hoses are commonly used to provide targeted watering and prevent excess moisture on the foliage.

Altitude: Tomato plants can be cultivated at various altitudes, but they generally prefer lower to mid-altitude regions. The specific altitude range may vary depending on the local climate and environmental conditions. In higher altitude areas, temperature fluctuations and shorter growing seasons may pose challenges for tomato cultivation.

Sl. No	Language	Name
1	Assamese	Bilahi
2	Hindi	Tamatar
3	English	Tomato
4	Sanskrit	Raktaphala
5	German	Tomate
6	Italian	Pomodoro
7	Chinese	Fanqie
8	Spanish	Tomate
9	Russian	Pomido

Table 1: Vernacular Names of tomato plant (*Solanum lycopersicum*)

Here is a breakdown of the nutritional value of tomatoes per 100 grams of raw, ripe tomatoes:

Nutrition	Amount
Calories	18 kcal
Carbohydrates	3.9 grams
Fiber	1.2 grams
Protein	0.9 grams
Fat	0.2 grams
Vitamin C	14 milligrams
Vitamin A	1025 IU(International Unit)
Vitamin K	7.9 micrograms
Potassium	237 milligrams
Lycopene	2573 micrograms

Table 2: Nutritional Values of tomato plant (*Solanum lycopersicum*)

Plant Review: Musa sp

Botanical Characteristics:

Bananas are herbaceous plants with large, elongated leaves that grow in a spiral pattern from a central pseudostem. The pseudostem is not a true stem but a cluster of leaf sheaths tightly wrapped around each other. It can reach heights of up to 20 feet, providing support to the inflorescence and fruit clusters. The inflorescence, known as a banana "hand," contains multiple individual fruits called "fingers." The fruit itself is a berry with a thick, peelable skin, varying in color from green to yellow or even red in some cultivars.

Cultivation:

Bananas thrive in tropical and subtropical regions with abundant sunlight and high humidity. They require well-drained soil and regular watering. The plants are propagated through suckers or offshoots, which are young shoots emerging from the base of the parent plant. These offshoots are separated and replanted to establish new banana plants. Bananas are fast-growing and typically bear fruit within 9 to 12 months after planting.

Varieties and Uses:

There are numerous banana cultivars, each with its own distinct characteristics. The most commonly consumed variety is the Cavendish banana, known for its sweet flavor and creamy texture. Other popular varieties include the plantain banana, which is starchy and used in cooking, and the red banana, which has a slightly different taste and appearance.

Bananas are predominantly consumed as a fresh fruit, eaten raw or added to smoothies, salads, and desserts. They can also be cooked, fried, or used in baking, adding a unique sweetness and moistness to various dishes. In addition to the fruit, other parts of the banana plant are utilized. The leaves can be used as natural food wrappers, while the fibers from the pseudostem can be used for making paper and textiles.

Significance and Economic Impact:

Bananas hold immense cultural and economic significance in many regions. They are a staple food for millions of people, providing a valuable source of nutrition and calories. Bananas are often associated with tropical landscapes and are part of traditional ceremonies, festivals, and rituals in various cultures. Furthermore, the cultivation and trade of bananas have a significant impact on the economies of many countries, generating employment and export revenue.

The taxonomy of the plant

Kingdom: Plantae (Plants)

Order: Zingiberales

Family: Musaceae

Genus: Musa

Fig 2: *Musa sp* (Banana)

The geographical condition of banana (*Musa sp*)

Tropical and Subtropical Regions: Bananas are predominantly cultivated in tropical and subtropical regions around the world. They require warm temperatures throughout the year, typically between 15°C (59°F) and 35°C (95°F). Extreme cold or frost can be detrimental to banana plants.

Sunlight: Banana plants require ample sunlight to thrive. They typically prefer full sun exposure for at least 6 to 8 hours a day to support photosynthesis and promote healthy growth.

Rainfall and Humidity: Adequate rainfall and high humidity are essential for banana plants. They require a consistent and well-distributed water supply. Ideal rainfall for banana cultivation ranges from 1,500 to 2,500 millimeters (59 to 98 inches) annually. However, excessive rainfall and water logging can be detrimental to the plants, as they are susceptible to root rot.

Soil: Bananas prefer well-drained, fertile soils with a pH range between 5.5 and 7.0. The soil should have good water-holding capacity and adequate organic matter content. Sandy loam or loamy soils are considered ideal for banana cultivation.

Wind Protection: Banana plants can be susceptible to damage from strong winds. Therefore, geographical areas with natural windbreaks such as hills, forests, or the presence of man-made windbreaks can provide protection to the plants.

Altitude: Bananas are generally grown at lower altitudes, typically below 1,000 meters (3,280 feet) above sea level. However, some specific banana varieties have adapted to higher altitudes, up to 2,000 meters (6,560 feet), depending on the local climate and conditions.

The morphology of banana (*Musa sp*)

Pseudostem: The banana plant has a pseudostem, which is not a true stem but a collection of tightly packed leaf sheaths that grow from an underground rhizome. The pseudostem is cylindrical, succulent, and composed of overlapping layers of leaf sheaths. It provides support for the plant and can grow quite tall, reaching heights of up to 20 meters (66 feet) in some species.

Leaves: The leaves of a banana plant are large, elongated, and spirally arranged around the pseudostem. They have a prominent midrib and numerous parallel veins. The leaves are broad and can grow up to several meters in length. They are typically green in color, but some species have reddish or purplish hues. The leaves are smooth, with a waxy surface, and may have a slightly leathery texture.

Inflorescence: The banana plant produces a large inflorescence, commonly referred to as the "banana heart" or "banana blossom." The inflorescence emerges from the center of the pseudostem and consists of a central stalk called the rachis. The rachis branches out, bearing multiple clusters of flowers called "hands." Each hand consists of a row of individual flowers called "fingers."

Flowers: The flowers of a banana plant are small and tubular, arranged in dense clusters on the rachis of the inflorescence. They are typically pale yellow or creamy white in color and have both male and female reproductive parts. The flowers are protected by large, fleshy bracts.

Fruits: The banana fruit is a berry that develops from the female flowers of the banana plant. It is elongated, curved, and varies in size depending on the cultivar. The peel of the fruit is typically yellow when ripe, but some varieties may have green, red, or even purple peels. Inside the peel, the fruit has a soft, creamy flesh that is typically pale yellow or white. The fruit contains numerous small, black seeds that are usually not developed in cultivated varieties.

Roots: The roots of a banana plant are fibrous and shallow, spreading laterally near the soil surface. They serve to anchor the plant and absorb water and nutrients from the soil

Sl. No	Language	Name
1	English	Banana
2	Hindi	Kela
3	Assamese	Kol
4	French	Banane
5	German	Banane
6	Dutch	Banaan
7	Russian	Banán
8	Portuguese	Banana
9	Spanish	Plátano

Table 3: Vernacular Names of banana (*Musa sp)*

Here is a breakdown of the nutritional value of banana per 100 grams of raw, ripe banana:

Nutrition	Amount
Calories	105 kcal
Carbohydrates	27 grams
Fiber	3 grams
Protein	1 gram
Fat	0.4 grams
Vitamin C	10.3 milligrams
Vitamin B6	0.4 milligrams
Potassium	422 milligrams
Magnesium	32 milligrams
Manganese	0.3 milligrams

Table 4: Nutritional Value of banana (*Musa sp*)

REVIEW OF LITERATURE

Consumption of harsh chemicals on daily basis and wastage of food are two huge problems in the contemporary era which needs to be addressed compulsory. Preparation of bio-enzymes can be helpful in curbing these problems efficiently as they are non-toxic, non-hazardous, non-corrosive, eco-friendly and completely natural liquids. They are easily synthesized by anaerobic fermentation of jiggery, fruit/vegetable/flower or plant waste in general and water with addition of microorganisms in a plastic container (Sethi et al., 2021). Now-a-days, bio enzymes can be used for different purposes as different works has been going on this topic worldwide.

In 2011, Tang and Tong worked on "Garbage enzyme", a fermentation product of kitchen waste, water and brown sugar, is claimed in the media as a multipurpose solution for household and agricultural uses. They assessed the effects of dilutions (5% to 75%) of garbage enzyme in reducing pollutants in domestic wastewater it seems that ammonia nitrogen and phosphorus could be removed by the addition of the garbage enzyme (Tang and Tong, 2011).

In 2019, Javalkar and his co-workers studied the effect of Eco-enzymes in Domestic waste water treatment (Javalkar et al., 2019).

Kumar et al., 2019 published the test reports of eco- enzyme which was found to be used during the event of World Culture Festival at the river bank in March 2016. The eco- enzyme is found to positively affect pH (from 6.7 to 7.2) reducing solids (from 884 to 745) suspended solids-(from 121 to 47) hardness and chlorides in a stable water body- Pond. The eco-enzyme testing in drain water showed optimum water cleaning effect on 0.5% concentration by showing the reduction of Biological Oxygen Demand from 690 to 231, Chemical oxygen demand from 537 to 384, nitrates (from 5.54 to 3.39) Coliform count by 10%. Considering

cost-effectiveness of the enzyme it is considered feasible technique to mitigate polluted water bodies (Kumar et al., 2019).

Srimathi. N et al., 2020 studied the effects of bioenzyme on dairy wastewater. Wastewater is directly discharged into the ground or other water sources; it causes soil pollution and it affects the nature of the soil. Hence it is necessary to treat the wastewater before discharging. Bio Enzyme is produced by the fermentation process of citric fruit peels, water, and jaggery.

Then from the results the efficient percentage of Bio Enzyme for treating the Diary Wastewater was found (Srimathi. N et al., 2020).

In 2021, Sethi and the coworkers published about Bioenzyme preparation at home as well as laboratory and its multi-utility in everyday life (Sethi et al., 2021).

In 2022, Naik studied the methods of preparation of bio-enzymes at home using different fruits and vegetables waste and their different applications (Naik, 2022).

MATERIALS AND METHODS

The tomato (*Solanum lycopersicum*) & banana (Musa sp) were collected from Tezpur, in the first week of April. In this study, two types of bio-enzymes were prepared for analysis. The bio-enzymes are fermented from peels of banana and Tomato. The materials used for preparation of enzymes are as follows-

- Fruit peels and vegetable peels (mentioned above)
- Water (normal drinking water)
- Jaggery (used at homes)
- Plastic container with a screw cap
- Yeast (available at local market)

Methodology- The present analysis and characterization can be divided into five main steps

1. Preparation of Bio- Enzyme
2. Filtration of Bio-enzymes
3. Characterization of Bio-Enzymes
4. Qualitative analysis for Biochemical analysis
5. Test for microbial properties

1. Preparation of Bio-Enzymes

The peels of consumed fruits and vegetables at home were collected for the analysis. The peels were further divided into smaller pieces to increase the surface area of the reaction. Jaggery (10g), peels (30g) and water (100 mL) were taken in the ratio of 1:3:10 into an airtight plastic container and mixed thoroughly (Figure 2). Then a pinch of yeast was added. The yeast used is baker's yeast or Saccharomyces cerevisiae. This procedure was repeated for both the samples. Gasses will be produced in this process of fermentation. So, we choose plastic containers because they can expand otherwise glass bottles would have exploded. Then the containers were kept undisturbed at a safer place for 1.5 month for the fermentation reaction to proceed. Gasses are required to be released at different time intervals from the containers. For the gases to be released, the lid of the plastic containers was opened once in a day for a minute and the lid was closed again. After some days the gasses will considerably decrease and after one month a

coloured liquid will be produced along with the small particles and some solid residue. The liquid part is the raw bio-enzymes and it is needed to be separated out by filtration with the help of a muslin cloth.

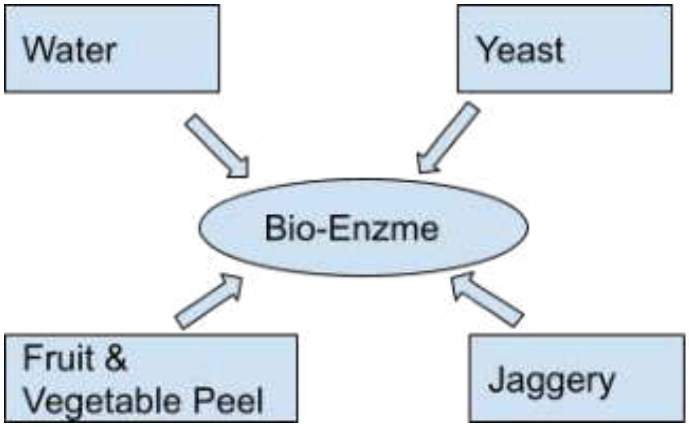

Fig 3 : Procedure of preparation of Bio-Enzymes

` **Fig 4:** Samples of different Bio-Enzymes

Fig 5: Peels used for preparation of Bio-Enzymes

2. Filtration of Bio-enzymes

Filtration of Bio-Enzymes was done after 1.5 months to obtain the raw liquid sample; filtered bio-enzyme solution was stored separately in the bottle. The characterization of the bio-enzymes was done with the liquid part collected.

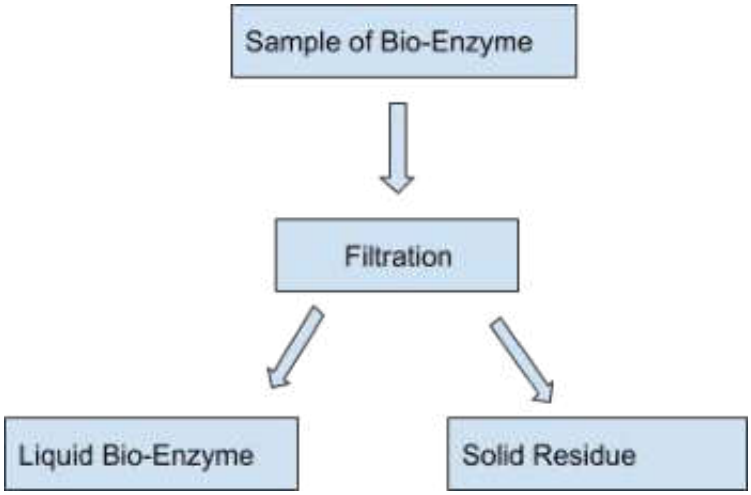

Fig 6: Procedure of filtration Bio-Enzymes

3. Characterization of Bio-Enzymes

The filtered liquid part is used for the characterization of bio-enzymes. Before finding usability of bio-enzymes it is necessary to find out the physical characteristics of bio-enzymes (1-6). The parameters like pH, and TDS (total dissolved salts) were found out. The physical characteristics of the different bio-enzymes extracted are given in the table 1 below

Sample	Source	Colour	Odour	Yield
1	Banana Peel	Light Yellow	Alcoholic	98 ml
2	Tomato	Brick Red	Alcoholic	100 ml

Table 5: Physical Characteristics of prepared Bio-enzymes

3.1 The pH of Bio-enzymes

In order to determine the pH of the bio-enzymes extracted, laboratory pH meter was used. The table 3 shows the pH of different samples of Bio-enzymes extracted from different samples.

Sample	Source	pH
1	Banana Peel	5.25
2	Tomato	5.80

Table 6: Results of pH readings

4. Biochemical Analysis of bio-enzymes

Preliminary tests for qualitative analysis of bio-enzymes were carried out in order to test the presence of different biochemical constituents. This was done because bio-enzymes are prepared by fermentation of fruit and vegetable peels, which shows that there should be presence of organic compounds. Alcohol and carboxylic groups were already present in the samples because that was a fermentation process. Both the samples were tested for carbohydrates, metabolites, lipids, proteins with chemicals and solutions available in the laboratory.

4.1 Identification of metabolites (Phytochemicals)

Tests (Test1-Test 6) were carried out to confirm the presence of flavonoids, phenols/ tannins, alkaloids, cardenolides, quinones and saponins, respectively.

Test 1 (T1)- Test For Flavonoids – Alkaline reagent test

The 2.0 ml of samples were taken in a test tube and few drops of dilute 10% NaOH solution were added to it. Then dilute HCl was added to the solution and yellow color formed and after addition of base it was changed to colorless.

Sample	Source	Result
1	Banana Peel	Present
2	Tomato	Absent

Table 7: Results of Alkaline reagent test

Fig 7: During the process of Alkaline reagent test

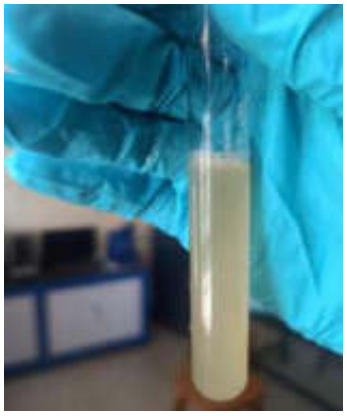

Fig 8: Result of tomato Alkaline reagent test

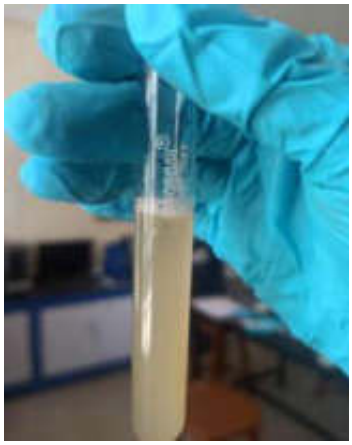

Fig 9: Result of banana Alkaline reagent test

Test 2 (T2)-For Phenols (Tannins) – Ferric chloride test

Dilute 5% ferric chloride (FeCl3) was added to the 2.0 ml of the sample and the result was noted.

Sample	Source	Result
1	Banana Peel	Dark Green Colour
2	Tomato	Light Green Colour

Table 8: Results of Ferric chloride test

Fig 10: During the process of Ferric chloride test

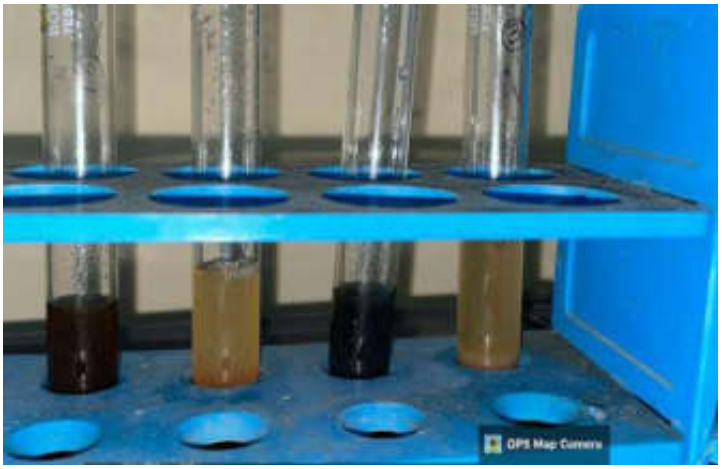

Fig 11: Result of Ferric chloride test

Test-3 (T3)-For Saponins – Foam test

2.0 ml of sample was added to 6.0 ml of water and was shaken vigorously. Formation of foam was seen after addition of dilute HCl, if foam persisted then saponin present.

Sample	Source	Result
1	Banana Peel	Present
2	Tomato	Absent

Table 9: Results of Saponins- Foam test

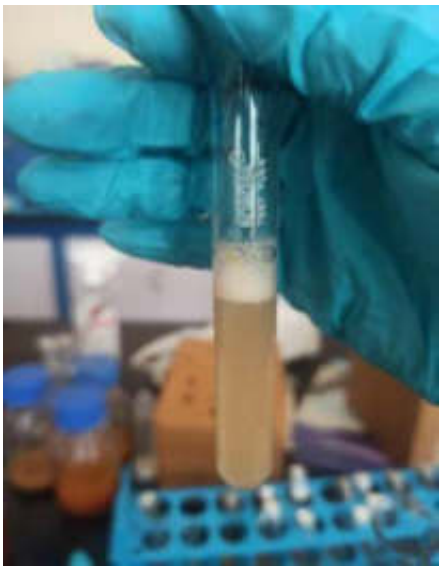

Fig 12: Result of Saponins test of banana

Fig 13: Result of Saponins test of tomato

Test-4 (T4) - For Quinones- Acid test

Concentrated HCl was added to 2.0 ml of sample till yellow precipitate was seen

Sample	Source	Result
1	Banana Peel	Absent
2	Tomato	Present

Table 10 : Results of Quinones- Acid test

Fig 14: Result of Quinones- Acid test of Banana

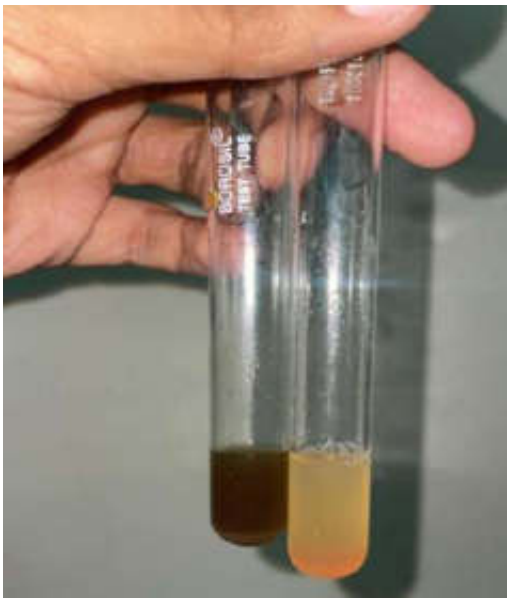

Fig 15: Result of Quinones- Acid test of Tomato

Test -5 (T5)- For Alkaloids- Mayer's test

3-5 drops of Mayer's test was added to the 1.0 ml sample formation of reddish or brown precipitate to confirm its presence.

Sample	Source	Result
1	Banana Peel	Present
2	Tomato	Present

Table 11: Results of Alkaloids-Mayer's Test

Test- 6 (T6)- For Cardenolides- Keller test

Few drops of acetic acid were added to a 2.0 ml of sample in a test tube and few drops of dilute 5% FeCl3 solution was added to it. Then conc. H_2SO_4 was added carefully to the walls of the test tube and formation of brown rings was done.

Sample	Source	Result
1	Banana Peel	Present
2	Tomato	Present

Table 12: Results of Cardenolides- Keller test

Fig 16 : Results of Cardenolides- Keller test of banana

Fig 17 : Results of Cardenolides- Keller test of tomato

4.2 Identification of Proteins

Yeast is used for making the solution of bio-enzymes, it produces enzymes to complete metabolic activities for growth and later on, it dies because of lack of nutrients but enzymes are left behind in the solution. As enzymes are complex proteins so the solution of bio- enzymes also contains proteins. Two tests were performed to confirm the presence of proteins and the reference was taken as Amul Full fat milk from the market.

Ninhydrin test-

1.0 ml of Ninhydrin solution was added to 1.0 ml of sample and was shaken and was kept in the water bath for 5-10 minutes till boiling. Then the dark purple to light purple color was observed in all the samples taken.

Sample	Source	Result
1	Banana Peel	Present
2	Tomato	Present

Table 13: Results of Ninhydrin test

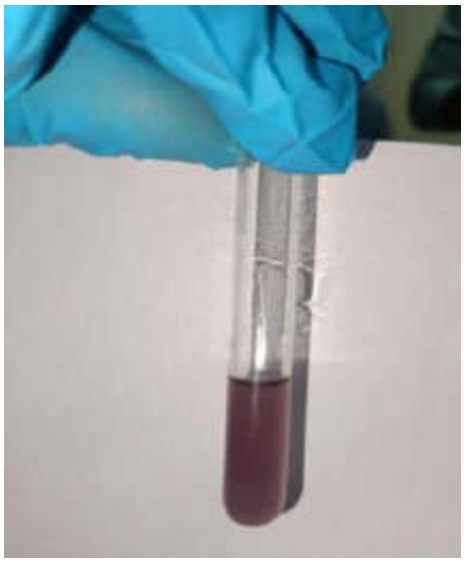

Fig 18: Result of Ninhydrin test of banana

Fig 19: Result of Ninhydrin test of tomato

4.3 Identification of Lipids

2.0 ml of both banana sample and tomato sample was taken in two different test tubes and 2.0 ml ethanol and water was added to both the samples. Formation of cloudy solution was seen.

5. Test for Anti-microbial properties

5.1. Anti-fungal properties: To check the antifungal properties of bio-enzymes, the extracted bio-enzymes from banana and tomato were applied to different bread pieces and tap water was used as a reference solution. Water was applied to the bread to do the differentiation and analyze the better anti- fungal agent between the two samples. All the bread samples were packed in the plastic bag to intact the moisture content in the bread pieces and kept the samples aside for 7 days. And on the eighth day the bread pieces were taken out of the plastic bags and checked for fungal growth.

5.2. Antibacterial properties:

To check the antibacterial properties of both the bio-enzymes, agar disc diffusion method was performed for gram-negative bacteria *Escherichia coli*.

Disc Diffusion Test-

Petri plates of Nutrient Agar were prepared. They were inoculated two days prior in an incubator at 37°C in broth. Then the bacteria were spread on the agar plates using the spread plate method. The wells were made on every plate using pipette tips. Then 20 microlitres of bio-enzymes were added in one of the wells in the plate, antibacterial disc was added in another well and the last well was filled with tap water and kept as control. All the petri plates were sealed and were incubated for 24 hours. The results were recorded after an incoming zone of inhibition around the discs.

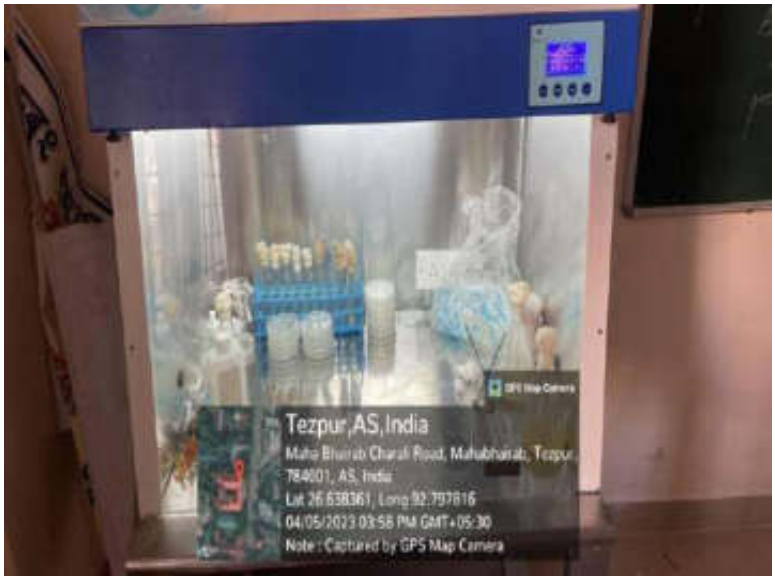

Fig 20: During the process of preparation of plats

Fig 21: During the process of preparation of media

RESULTS AND DISCUSSION

pH – The different bio-enzymes (Banana and Tomato) extracted were found to have weakly acidic character. Both of them have the pH in the range of 5-6.

TDS – The Total Dissolved solids of all the samples were recorded and found to be in the particular order- Banana >Tomato.

Anti-microbial properties-

Following tests showed the antimicrobial properties of bio-enzymes-

1)Test for Anti-Fungal properties- Samples with banana bio-enzyme showed antimicrobial properties as seen a week after its application. It resists the growth of fungus in moderate to high degree where it was applied.But Tomato bio-enzymes couldn't show any antifungal Properties.

Fig 22: Result of Anti-Fungal properties using banana bio-enzyme

Fig 23 : Result of Anti-Fungal properties using distilled water

Fig 24: Result of Anti-Fungal properties using tomato bio-enzyme

2) Test for Antibacterial properties -

All the samples showed antibacterial properties till 10^{-2} dilution of samples in water and showed resistance towards both Gram positive and Gram negative bacteria. All samples have shown formation of a ring around the disc clearly showing the zone of inhibition. The diameter of the circle around the disc provided information about the degree of inhibition of growth by the bio-enzymes

Fig 25: Antibacterial properties of banana bio-enzyme

Fig 26: Antibacterial properties of tomato bio-enzyme

Biochemical Tests:

These following tests indicated the presence of different groups within the samples of bio-enzymes which are-

Metabolites (Phytochemicals)- All the tests T1-T6 for different metabolites confirmed the presence of flavonoids, alkaloids, quinones, cardenolides, phenols and saponins.

Identification of Proteins- Ninhydrin test,gave positive results and confirmed the presence of proteins in the bio-enzymes.

Application of Bio-enzymes:

(1) Soil stabilization-

For soil stabilization bio-enzymes proved to be an effective method of application as bio-enzymes were capable of lowering the pH of the soil solution within 10 minutes that was taken. Different bio-enzymes samples were used for testing of stabilization of soil

(2) Treatment of contaminated water-

After the treatment of contaminated water with 1% Bio-enzymes,variation was observed in the TDS of the solution which was observed for 5 days and recorded.The change in TDS of contaminated water showed that the acidic pH and presence of protein and metabolites in the bio-enzymes were able to reduce the dissolved solid in contaminated water. During the 5 days of duration, TDS of the solution gradually decreases by 20%-25% in addition to 1% bio-enzymes to the solution.

Sl. No	Sample	TDS of sample before using bioenzyme	Bioenzyme used	TDS Immediately after addition of bioenzyme	TDS After Day 1	TDS After Day 2	TDS After Day 5
1	Fish Market Waste Water	298.8	Banana	399.75	365.7	303.2	185.4
2	Fish Market Waste Water	284.5	Tomato	401.6	395.4	322.2	201.5
3	City Waste Water	466.5	Banana	556.8	512.6	475.5	322.5
4	City waste water	465.2	Tomato	576.7	524.8	482.4	345.5

Table 14 : Results of TDS Test

(3) Usage of Bio-enzymes for household use-

Using bio-enzymes at different places at our homes gave satisfactory results. The amount used is different for particular applications so dilution should be done. As the bio-enzymes show acidic properties it has to be diluted before usage because the acidic character may spoil the texture of the things on which they will be applied. For cleaning of dark stains, it can be used directly but while using on the human body or pets or for sanitizing purposes it needs to be diluted first.

CONCLUSIONS

It is concluded that the bio-enzymes are biological catalysts and are made up of proteins; they also contain metabolites, lipids and carbohydrates. In the present study, all the samples of bio-enzymes found to be cost effective, anti- microbial and eco-friendly. All the bio-enzymes showed acidic character and high TDS values due to the presence of high amounts of organic content. They can be used in household purposes due to their acidic character and has the potential of replacing harsh chemical cleaning agents used in our households. Bio-enzymes can act as good soil stabilizers. The results showed that only 1% bio-enzymes was sufficient to change the pH of soil solution There are various applications of bio-enzymes such as to improve the consistency and binding property of soil. They can treat wastewater very easily as the results showed that only 1 ml of bio-enzymes was sufficient to increase the pH and decrease the TDS of the 20 ml contaminated water sample. Anyone can follow simple methodology for the preparation of the bio-enzymes and can very easily make it at their homes.

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A Case Study on Fertilizer Usage and Zinc Deficiency in Indian Soils

A Dissertation Submitted to the Department of Chemistry, Darrang College

(For Partial Fulfilment of the Bachelor's Degree in Science, under Gauhati University)

Submitted By

Anurag Parashar Sarmah

B.Sc. 6th Semester

Roll No.: US-191-225-0017

Session: 2019-2022

Under Supervision

Of

Dr. Manash Protim Hazarika

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DECLARATION

I, Anurag Parashar Sarmah, hereby declare that the dissertation project work entitled “A case study on fertilizer usage and zinc deficiency in Indian soils” submitted towards partial fulfilment of requirements for the award of Bachelor of Science, is my original work and the dissertation has not formed the basis for an award of any degree, fellowship, or any similar title to the best of my knowledge.

Signature: **Date:**

CERTIFICATE

This is to certify that this dissertation titled "A case study on fertilizer usage and zinc deficiency in Indian soils" submitted by Anurag Parashar Sarmah, B.Sc. 6th semester, Roll No: US-191-225-0017, Registration No: 19075913 to the Department of Chemistry, Darrang College, Tezpur for the partial fulfilment of the Bachelor Degree in Science (Chemistry Honours) under Gauhati University was carried out under my guidance and supervision during the academic year 2022.

I wish him success in life.

Date:

(Dr. Manash Protim Hazarika)
Assistant Professor
Department of Chemistry
Darrang College

CONTENTS

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The completion of this project was primarily influenced by the encouragement and guidance of many well-wishers. As such, I would like to express my gratitude to all those who helped carry out this project.

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Abstract

Micronutrient malnutrition is a rising problem in developing countries, resulting in various health and social issues such as mental retardation, immune system impairments, and generally poor health. Zinc (Zn) deficiency has gotten much attention in recent years, and it appears to be the most dangerous micronutrient shortfall, along with vitamin A inadequacy. Zinc insufficiency is prevalent in children and is a leading cause of death in children worldwide. Cereal-based meals are the most common daily calories and protein source in nations where zinc insufficiency is a severe public health issue. It is, therefore, not surprising that high Zn deficiency in humans occurs predominantly in areas where soils are deficient in Zn, as shown in many Southeast Asian countries. India has some of the most Zn-deficient soils in the world. Nearly half of India's cultivated soils are poor in plant-available Zn; these soils are under extensive wheat and rice production with minimal Zn fertilizer treatment. These facts indicate an urgent need for an improved Zn concentration of cereal grains in India.

Introduction

Agricultural dependency in India stems from the notion that agricultural growth is a prerequisite for the prosperity of any economy. Also, it should be noted that the country has experienced and maintained a historically unparalleled rise in agricultural output over the last 50 years. However, in the past few years, the expansion of cultivated land has nearly ceased. As a result, yields per hectare of agricultural land have gotten highly essential, and they are currently the primary factor of growth. Furthermore, increasing abolition of food grain imports can also be considered a success [1].

India has made impressive gains in agricultural production in the last decade. However, a new agricultural approach is required to meet the growing demand for agricultural productivity, including modern agricultural treatments that have synergistic effects on yields. As a result, chemical fertilisers have become particularly crucial. The adoption of modern agricultural technology helps farmers keep track of their resources while allowing them to harvest more effectively [2].

Fertilisers are compounds or mixtures that provide vital nutrients to crops. They are supplied as soluble forms of solids, liquids, or gases and are generally safe to handle. Fertilisers can be administered either to the soil or to the leaves directly. Except for Nitrogen (N), all nutrients are made by concentrating and refining ores taken from mines. On the other hand, N fertilisers are manufactured from ammonia, which is synthesised by Haber–Bosch process. Improved materials and methods contribute to higher fertiliser usage, increasing fertiliser efficiency, nutrient profitability, and lowering detrimental effects on the environment. Fertilisers can be both inorganic and organic; however, since inorganic or synthetic fertilisers contain most of the nutrients provided to soil and crops, they focus on this contribution. Maintaining soil fertility has always been a problem for farmers. Prior to the invention of fertilisers, farmers kept their agricultural land fertile by fallowing the field or transferring animal manure from grazing livestock or enclosing them in the field a night before cropping. The residues of previous legume crops, pastures, and green manures continue to be an additional source of N for farmers. However, farmlands are often temporarily removed from crop production due to these natural nutrient sources. On the other hand, chemical fertilisers make it possible to use the land for continuous production [3].

Fertilisers can have two general modes of action. The first is traditional additives that provide nutrients. The second mode of action by which some fertilisers act is by modifying water retention and aeration of soil to enhance its effectiveness. Fertilisers are typically provided in varying proportions:

- three main macronutrients: nitrogen (N), phosphorus (P), potassium (K);
- three secondary macronutrients: calcium (Ca), magnesium (Mg), and sulfur (S);
- common micronutrients: copper (Cu), iron (Fe), manganese (Mn), molybdenum (Mo), zinc (Zn) and nickel (Ni), and sometimes boron (B), silicon (Si), cobalt (Co), vanadium (V). [4]

The vital nutrients essential for healthy plant growth are generally categorised as elements. However, fertilisers are not administered in elemental form. Instead, fertilisers are administered as compounds of these elements. The macronutrients are taken by plants in more significant amounts and are found in plant tissues in concentrations ranging from 0.15 per cent to 6.0 per cent dry matter (DM) (0 per cent moisture). Plants are made up of four main elements: hydrogen, oxygen, carbon, and nitrogen. Water and carbon dioxide are abundant carbon, hydrogen, and oxygen sources.

Moreover, although nitrogen makes up most of the atmosphere, it is in an inaccessible state for plants. Nitrogen is the most crucial additive since nitrogen is present in proteins, DNA and other components like chlorophyll. However, nitrogen must be made available in a "fixed" form to be of any use to plants. Only a few bacteria and their host plants (particularly legumes) can produce nitrogen (N_2) in the atmosphere by converting it to ammonia [5].

Nitrogen was the first chemical fertiliser to gain popularity, followed by phosphorus and potassium. However, the use of phosphorus and potassium has been limited thus far. Due to the increased productivity of the crops, the native soils began depleting their nutrient reserves, and the crops started responding to micronutrient fertilisers. Various studies have found that crop factor productivity has decreased despite adequate fertilisation (nitrogen, phosphorus, potassium).

The decrease in crop productivity can be subjected due to deficiency of certain micronutrients like Zinc (Zn), Iron (Fe), Magnesium (Mg) etc. In 1967, the Indian Council of Agricultural Research launched an All India Coordinated Project to investigate changes in

soil micronutrient status in various agro-climatic zones. Nene first noted a zinc deficiency in the Tarai rice harvest in the micronutrients in 1965 [6]. In 1970, zinc shortage was also discovered in wheat crops grown on the sandy soils in Punjab and after that in much of India's heavily cultivated districts.

Table 1. Available (DTPA extractable) zinc content and extent of deficiency in different Indian soils

State/Union Territory	Number of samples[a]	Available Zn (mg kg^{-1})		PSD[b]
		Range	Mean	
Andhra Pradesh	6498	0.59–2.04	0.97	52
Assam	12,165	0.36–5.00	2.69	34
Bihar	13,260	0.11–11.30	0.70	46
Delhi	75	0.27–18.60	—	33
Gujarat	26,646	0.76–1.43	1.06	24
Haryana	21,598	0.36–1.01	0.68	61
Karnataka	2318	0.49–2.31	1.48	25
Kerala	650	1.37–20.5	5.07	34
Madhya Pradesh	13,223	0.10–3.00	0.53	62
Maharashtra	2665	0.28–9.80	—	44
Meghalaya	95	0.66–4.23	1.70	51
Nagaland	12	0.55–2.65	1.48	17
Orissa	17,042	0.20–10.30	1.45	57
Punjab	15,647	0.53–1.07	0.80	46
Pondicherry	4100	0.40–17.00	2.90	8
Rajasthan	183	0.60–0.87	0.77	21
Tamil Nadu	29,908	0.14–2.51	1.22	36
Uttar Pradesh	25,191	0.08–9.76	0.70	46
West Bengal	2732	0.10–18.50	1.20	49

SOURCE: Micronutrient status and fertilizer use scenario in India, Anand P. Gupta (2005)

The soils of Madhya Pradesh have the highest zinc insufficiency, followed by Haryana. In contrast, the Union Territory of Pondicherry has the lowest. As a result, Zinc-containing fertiliser is required to realise the potential of any particular crop fully. It has also been observed that the extractable zinc content of the soils increases with the application of zinc sulphate (the area of zinc deficiency was reduced with the application of zinc sulphate in the highly cultivated areas of Haryana and Punjab states). It is thus imperative to work out the proper quantity and frequency of zinc sulphate application dependent on the soil's characteristics and the cropping system.

Fertilizer Usage in India

According to the National Academy of Agricultural Sciences (NAAS), India's foodgrain demand will reach over 300 million tonnes per year by 2020, requiring an increase of 82 million tonnes from the 2009-10 output estimates of 218 million tonnes. Increased productivity per unit area must account for a large portion of the intended improvement. Rice productivity must rise from 2202 kg/ha in 2008-09 to 2895 kg/ha by 2020, while wheat productivity must improve from 2802 kg/ha to 3918 kg/ha. Similarly, pulse productivity must improve from 762 kg/ha to 1282 kg/ha in ten years. In contrast, rice production has remained stable at around 2100 kg/ha, wheat at around 2700 kg/ha, and pulses at around 600 kg/ha over the last five years. It is about time to look at the causes of this exhaustion. In this scenario of shrinking land and water resources, the bulk of the increase in crop production will have to come from the scientific use of fertilisers [7].

All India Report on Input Survey 2016-17

TABLE 2A: USAGE OF INPUTS-FERTILIZERS BY MAJOR SIZE GROUPS

ALL CROPS

Area in '000 Hect.
Quantity in Metric Ton

Sl. No.	Size Group (ha)	Gross cropped area	Area treated with fertilizers	Quantity Applied										Area treated with		Quantity of FYM applied
				DAP	Urea	Super Phosphate	Ammo-nium Sulphate	Others			Total			Farm Yard Manure	Pesticides	
								N	P	K	N	P	K			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	MARGINAL (BELOW 1.0)															
	I	23173	20465	2399231	5420897	435947	15402	164273	266106	609774	1092550	1439505	609774	5232	9378	23975568
	UI	23507	14991	964018	2335685	246737	5120	85691	157777	219615	1334687	640700	219613	5725	9089	23722036
	T	46681	35456	3363249	7755782	682663	20527	249964	423883	829386	4427238	2080207	829386	10957	18467	46807604
	SMALL (1.0-1.99)															
	I	22215	20569	1945991	4252710	381871	9113	112362	179086	184744	2427434	1122539	386744	1870	6644	20213799
	UI	22209	15214	992695	1658774	189974	7863	59787	115434	153336	1059360	601833	153336	4949	9304	10900856
2	T	44424	35803	2938691	6111503	588849	16948	172150	294522	340081	3514997	1724152	540081	8820	17529	39114455
	SEMI-MEDIUM (2.0-3.99)															
	I	22726	21358	1708572	4594508	251889	6887	118139	195713	380423	2548604	1021957	380423	3603	8978	18752460
	UI	23244	15745	986612	1953348	282569	5427	57133	112382	135144	1128106	562753	135144	4355	8825	14579986
3	T	46000	37094	2617176	6547856	434460	11314	175261	308099	515571	3668738	1584734	515571	7958	17795	33332446
	MEDIUM (4.0-9.99)															
	I	19175	17851	2075122	3254747	217430	5266	108977	126304	98913	1408770	1113649	98913	2531	7439	12159974
	UI	19042	11452	584128	1221054	123406	3868	28223	54345	62488	695697	342751	62488	2665	5971	8706340
4	T	38217	29303	2659250	4475796	340840	9136	137200	180648	161401	2676453	1456436	161401	5196	13410	20866314
	LARGE (10 AND ABOVE)															
	I	6534	6275	495211	1026334	83864	182	7128	12021	34656	568421	253240	36656	626	2914	2208629
	UI	8105	3316	120955	209187	28554	468	6455	11066	13250	161650	72300	13250	889	1942	1478820
5	T	13118	9625	616266	1314522	112439	650	13583	23087	47910	729868	325539	49910	1515	4856	3688450
	ALL GROUPS															
	I	96253	86512	8628139	18548027	1291029	36825	511373	779231	1612516	13005528	4952898	1632516	13862	37344	78418430
	UI	96187	60772	3568305	7657048	880222	21151	236798	451001	583835	4488719	2220551	583835	18794	34712	67408834
	T	192440	147284	12202614	26205473	2091250	57977	748161	1230216	2196353	17588301	7173449	2196353	34656	72057	145811268

Note: (1) I – Irrigated, UI – Unirrigated, T = Total of I & UI. (2) Total may not tally due to rounding off.

For local reference, data was also collected on the most common fertilisers used by small farmers in Tezpur, Assam, from a local wholesale fertiliser vendor (Sonitpur Nursery, Tezpur) [25]. As expected, almost no attention was being put on the deficient micronutrients like Zinc (Zn) by the farmers. The commonly used fertilisers, along with their compositions are:

Ammonium sulphate [$(NH_4)_2\ S0_4$]: This is a nitrogenous fertiliser used to raise the production level of crops like paddy, potato, etc. In this fertiliser, there is nearly 25% ammonia transformed into the nitrate by the denitrifying bacteria present in the alkaline soil. Thus, these nitrates are easily absorbed by the crops and plants. This fertiliser is produced in India on a large scale at Sindri in Jharkhand.

Calcium Ammonium Nitrate [Ca $(N0_3)_2\ NH_4NO$): This is also a nitrogenous fertiliser in which the amount of nitrogen is about 20, which the plants directly absorb. On mixing it in the soil, no side effect appears in the soil, and due to the extreme solubility in water, it is easily intermixed in the soil.

Super Phosphate of lime [Ca $H_2\ (P0_4)_2$ + $Ca_50_4.2H_2O$]: This is a homogeneous mixture of calcium dehydrogenate phosphate [$CaH_2(P0_4)_2$] and Gypsum [$CaS0_4.2H_20$] in which 16-20% P_20S exists. The reactive component of this fertiliser is calcium dehydrogenate phosphate, which is soluble in water. Another phosphatic fertiliser is triple superphosphate of lime which is also used on behalf of superphosphate of lime, and the micro powder of bones prepares it.

Urea (H_2NCONH_2): This is obtained by heating the mixture of carbon dioxide at 125-150°C and about 8.5 atmospheric pressure. There is nearly 46% nitrogen in urea, and this fertiliser is used while introducing the seed into the soil. After spreading urea on the soil, water is supplied 3-4 days later.

Calcium Cyanamid [Ca $(CN)_2$]: This is also called Nitrolim, and it is a nitrogenous fertiliser which is supplied in the market as a mixture of [Ca (CN)2] and carbon. This fertiliser is used before introducing seed into the soil.

Calcium nitrate [Ca $(N0_3)_2$]: This is the nitrogenous fertiliser, and on the market or commercially, it is called Narvegian saltpeter.

Zinc Deficiency in Indian Soils

Zn insufficiency is the most common micronutrient deficiency concern in soils in India, particularly in rice-wheat cropping systems. High soil pH, high CaCO3, poor organic matter, and low soil moisture contribute to Zn deficiency in Indian soils. Other micronutrient deficiencies have also been observed, but their rate is significantly lower than Zn deficiency. According to an analysis of over 250,000 soil samples and 25,000 plant samples obtained from various Indian states, 48 per cent of the soil samples and 44 per cent of the plant samples had insufficient levels of Zn [17,18]. Fe, Cu, and Mn deficiency were found in 11 per cent, 7 per cent, and 5 per cent of the soil samples, respectively (Table 3) [19].

Table 3. Micronutrient deficiency in soils of different regions of India

Area	Number of samples	Percentage of soils deficient			
		Zn	Cu	Fe	Mn
East	54,061	47.3	1.4	0.4	4.9
North	64,906	51.2	1.3	12.8	3.1
South	68,863	59.9	5.1	21.6	9.6
West	63,717	34.7	19.4	7.6	2.4
All India	251,547	48.6	7.0	11.2	5.1

These results suggest that soil Zn insufficiency is a substantial constraint to crop productivity and a significant cause of Zn deficiency in the diet. Interestingly, in 5800 fields, Zn fertiliser trials were carried out where it was discovered that crops responded to Zn fertilisation with production improvements in 63 per cent of the trial crops [18]. This percentage is higher than the percentage of Zn-deficient soils in India (48%) and could imply that India has a significant concealed Zn deficiency problem. In order to maintain an appropriate Zn nutritional status of plants and contribute to required food production for India's projected population increase, 325,000 tonnes of Zn should be applied annually till 2025.

Effects of Zinc Deficiency: 'Situation in India'

Zinc (Zn) deficiency in humans has gained significant attention in recent years, not only from nutritional and medical experts but also from economists. Zinc deficiency and vitamin A deficiency have been designated as one of the world's most pressing concerns. The Copenhagen Consensus, a group of eight economists (including five Nobel Laureates) formed in 2008, came to this conclusion. According to reports, removing the Zn deficiency problem will have immediate benefits and returns for people in poorer countries. The World Health Organization has also acknowledged the global significance of the problem of zinc deficiency in human populations. Zn insufficiency was the fifth most important risk factor for illness and mortality in the poor world, according to a WHO report published in 2002. Zn deficiency is thought to impact approximately half of the world's population, similar to Fe deficiency. [8,9].

Zinc has several essential roles in biological systems, including maintaining gene expression and protein synthesis, protecting the structural and functional integrity of biological membranes, and detoxifying extremely hazardous oxygen-free radicals [10-12]. Zn is required by the most significant number of proteins in biological systems, with Zn-binding proteins accounting for roughly 10% of the proteome of eukaryotic species [13,14]. Many proteins and transcription factors require Zn to maintain structural stability and function. In addition, zinc is required for better protection against infectious diseases since it is required for gene regulation and expression.

Zn deficiency is widespread in South Asia, resulting in a high occurrence of childhood infectious illnesses and mortality. Several data indicate that Zn supplementation reduces the prevalence and severity of childhood infectious illnesses, as proven by Zn supplementation trials in Nepal, India, and Bangladesh [15]. Zinc deficiency is a major public health problem in India, and it's mostly caused by a lack of zinc in the diet. It is estimated that approximately 25% of the Indian population is in danger of Zn deficiency [8]. The level of zinc deficiency and its implications in India were calculated using the disability-adjusted life years (DALYs) approach,

which calculates the number of years of healthy life lost in a population due to death, disease, or disability. Using this approach, it was discovered that Zn deficiency is a severe health problem in India, resulting in the loss of 2.8 million DALYs, primarily due to an increase in human infectious illnesses [16].

How to Tackle Zinc Deficiency?

Because of its high solubility and inexpensiveness, zinc insufficiency is most commonly treated using $ZnSO_4$. Farmers also employ ZnO (and, to a lesser extent, ZnEDTA) in addition to $ZnSO_4$. The Central Anatolia region in Turkey is also well-known for severely Zn-deficient soils. In Central Anatolia, applying 23 kg Zn ha^{-1} to the soil in the form of $ZnSO_4.7H_2O$ resulted in a nearly 2-fold rise in grain Zn content and considerably enhanced grain yield [20]. When paired with foliar Zn application, soil application can enhance grain Zn concentration by up to 3- or 4-fold in wheat. Zn fertilisation in the form of a foliar treatment is an effective technique to increase grain Zn concentration. Compared to ZnO and ZnEDTA, $ZnSO_4$ improved grain Zn content the best among the forms studied for foliar application (unpublished results). Before or after heading, two successive foliar treatments of 0.5 per cent (w/v) $ZnSO_4.7H_2O$ help double grain Zn content. The results of field trials conducted in three locations revealed that applying foliar Zn fertilisers during late growth stages increased grain Zn concentrations more than applications during early growth stages.

Researchers at the Indian Agriculture Research Institute have published great research articles showcasing the fantastic benefits of Zn-enriched urea fertilisers on grain yield and grain Zn content in rice and wheat [21-23]. Adding up to 3% Zn to urea fertilisers boosted grain production and grain Zn content in aromatic rice. Increased application of Zn enriched urea fertiliser resulted in a roughly 60% increase in grain Zn concentration. In addition, an identical increase in Zn concentration was discovered in straw, which could be critical for animal Zn nutrition. The yield benefit and 'benefit : cost' ratio obtained from Zn-enriched urea application are outstanding. Both ZnO and $ZnSO_4$ can enrich urea with Zn, and these two Zn sources are equally effective in increasing rice and wheat grain yields. However, when it came to raising grain Zn concentration, $ZnSO_4$ performed better than ZnO.

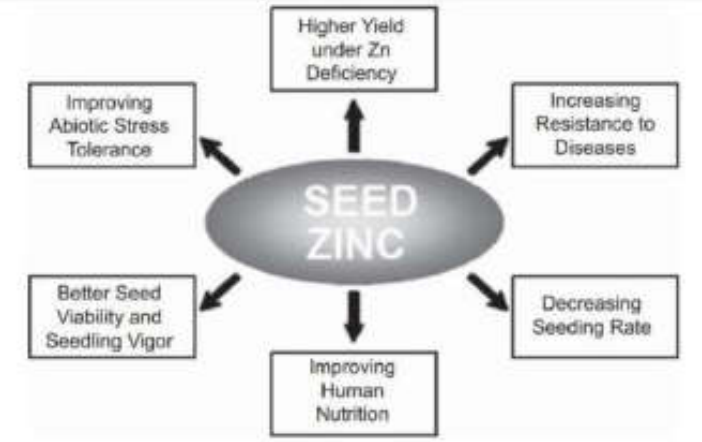

Fig. 1 Agronomic and human nutritional benefits resulting from use of Zn-enriched seeds [21].

Conclusion

Application of Zn-containing fertilisers is a simple and effective way to bio fortify cereal grains with Zn that may be done everywhere in the country. A new fertiliser strategy is urgently needed in India to stimulate and promote the development and application of Zn-enriched fertilisers to improve public health while also contributing to crop output. Long-term success in Turkey with Zn-supplemented NPK fertilisers suggests that enriching fertilisers with Zn and applying them across the country would be a fantastic investment for humanity and agricultural output in India. Because of losses in dietary intake and grain concentrations of Zn and other micronutrients in the last 40–50 years [24] and significant increases in food prices in recent years, this demand is becoming increasingly essential. Dr Howarth Bouis (www.harvestplus.org) calculated that a 50 per cent increase in food prices would result in a 30 per cent decrease in daily Fe consumption, potentially increasing Fe insufficiency prevalence by 25% among children and women. Furthermore, increased food prices will have an unfavourable effect on daily Zn intake, particularly among resource-poor families, exacerbating the problem of Zn shortage in India.

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"EXTRACTION OF FAT FROM COMMERCIALLY MANUFACTURED PACKET POTATO CHIPS AND THEIR POTENTIAL HEALTH IMPACTS"

A PROJECT SUBMITTED TO THE DEPARTMENT OF CHEMISTRY, DARRANG COLLEGE

[For Partial Fulfilment of the Bachelor's Degree in Science (Chemistry Honours) Under Gauhati University]

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CERTIFICATE

This is to certify that the dissertation titled "EXTRACTION OF FAT FROM COMMERICALLY MANUFACTURED POTATO CHIPS AND THEIR POTENTIAL HEALTH EFFECTS" submitted by Priyadarshini Hazarika, B.Sc 6th semester, Roll: US-201-225 No: 0125, Regd. No.: 20045645 of 2020-2021 to the Department of Chemistry, Darrang College, Tezpur for the partial fulfilment of the Bachelor's Degree in Science (Chemistry Honours) under Gauhati University was carried out under my guidance and supervision during the academic year 2020-2023.

I wish her success in life.

DATE :-

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Date :-

Priyadarshini Hazarika

ABSTRACT

Global trends moved towards fast food consumption due to the busy lifestyle of humans. Hence, the intake of fat-related food has exceeded the daily dietary reference intake (DRI) of fat, which caused multiple diseases. The consumption of fried foods and specifically potatoes is associated with the development of cardiovascular and cancer diseases in the population due to these foods containing a high fat level and some toxic compounds such as acrylamide. Potatoes (*Solanum tuberosum*) are an important global crop that can be transformed into many products impacting several health dimensions ranging from undernutrition, food security and disease prevention to issues of overnutrition including obesity, diabetes, heart disease. But processed potato products are typically categorized as high fat and sodium foods, as well as being classified as a significant source of carbohydrate, in the form of starch. Conversely, potato products are less known for their contribution 50 of key micronutrients (vitamin C, potassium, magnesium), fibres and phytochemicals (phenolics and carotenoids).

The aim of the present work was to evaluate the fat content in commercially available packet potato chips This work summarizes total fat content present in potato chips and describes the state of commercial processing on nutritional quality and its potential impacts on human health.

Keywords: Daily Dietary Intake, Acrylamide, Undernutrition, Potato Chips

CONTENTS

1. INTRODUCTION

1. INTRODUCTION

According to nutrition facts, fats are an essential part of the diet and play an important role in maintaining a healthy life[1].

Fats and cholesterol tend to be the most focused terms of the public and health enthusiasts. As fats happens to be the most concentrated source of energy in the diet that providing about 8 to 9 calories per gram, while on the other hand, carbohydrates and proteins have only four calories per gram. Fat is known to have three elements which include carbon, hydrogen, and oxygen. But it has more carbon and hydrogen than oxygen, leading to nine calories per gram. Fats are the source of energy in food, belong to a group of elements called lipids, and they are all combinations of saturated and unsaturated fats.

The human body is well designed, which makes up two types of fats, essential for the proper functioning of the body and are obtained from the food consumed. These fats play a major role in controlling inflammation, blood coagulation, and brain development. It also serves as a storage unit for storing the body's extra calories in fat cells or adipose tissue that helps to insulate the body. They tend to be an important source of energy. Fats also help the body absorb and transport the vitamins A, D, E, and K through the bloodstream.

1.1 Types of Fats

There are three different types of fats:

- **Saturated Fat**

It is responsible for bad cholesterol. They are found in most animal products like cheese, milk, meat and so on and hence one must limit the quantity of intake. Consuming saturated fat in large quantities is the most popular reason for heart disease as it causes cholesterol to block the arteries.

- **UNSATURATED FATS**:

Unsaturated fats are found in plant foods and oils. They are healthy fats, but should be eaten in moderation.

There are two types of unsaturated fats:

- mono-unsaturated fats
- poly-unsaturated fats

- **Monounsaturated fats**

Monounsaturated fats are healthy fats found in Avocados, Macadamia nuts, Peanuts, Olives and Olive oil. It plays a vital role in protecting the heart and is also involved in supporting insulin sensitivity, fat storage, weight loss, and healthy energy levels.

- **Polyunsaturated Fats**

Polyunsaturated fats are healthy fats, which are abundantly found in both plant and animal foods, such as vegetable oils, Walnuts, Flax seeds, salmon, etc. These fats include both Omega 3 and Omega 6 fats. Omega 3 helps reduce inflammation and supports healthy hormone levels and cell membranes. Omega 6 fatty acids play an important role in supporting healthy brain and muscle functioning.

- **Trans Fats**

Trans fats are also called unsaturated fatty acids or trans fatty acids. These fats are naturally obtained in several foods such as beef, lamb, whole milk, cheese, cream, and butter from cattle. Conjugated linoleic acid is a natural trans fatty acid which is beneficial in strengthening the immune system and inhibiting the development of cancer. However, most trans fatty acids are made when manufacturers convert liquid oils into solid fats. In the application of hydrogenation, vegetable oils are hydrogenated to produce vegetable shortening, margarine, peanut butter, and other products used for salad dressing. Trans fats are present in many processed foods such as baked food items, cookies, crackers, snack foods, deep-fried foods and other food made or fried in partially hydrogenated oils.

1.1.1 SOME OTHER TYPES OF FATS

Essential Fatty Acids

Our body is capable of synthesizing most fatty acids, apart from these three essential fatty acids: Linoleic acid, Linolenic acid, and Arachidonic Acid. These designated essential fatty acids must be supplied through the diet. The deficiency symptoms of these fatty acids include poor growth, and skin irritation and have been seen in infants fed with the formula lacking these essential nutrients.

Cholesterol

Cholesterol is a type of fat found in food, but also in our blood. Cholesterol has many important functions in the body but having high levels of the wrong type of cholesterol in the blood increases heart disease risk.

There are two types of cholesterol:

1. **Low-density lipoprotein (LDL) cholesterol is the "lousy" cholesterol.** LDL cholesterol picks up cholesterol in the blood and deposits it in the endothelium (inner wall) of the artery. This leads to plaque build-up in the artery.

2. **High-density lipoprotein (HDL) cholesterol is the "healthy" cholesterol.** HDL cholesterol carries LDL cholesterol away from the blood and carries it to the liver to be recycled. By doing this, HDL cholesterol keeps the endothelium (inner wall) of the arteries healthy.

Our bodies need cholesterol:

- to make vitamin D, which helps our body absorb calcium and promote bone growth
- to make hormones like testosterone, estrogen for normal growth and reproduction

Eating foods high in saturated and trans fats leads to more LDL (lousy) cholesterol in the body. LDL cholesterol slowly builds up along the walls of the arteries. Over time, this can lead to plaque build-up that can make our arteries narrower. It is possible for the arteries to become so narrow that blood cannot flow through them. When blood is not able to flow to the heart or the brain, the result is a heart attack or stroke.

1.1.2 Cholesterol in Food

Our bodies produce cholesterol, and we also get cholesterol from the foods we eat. Although foods high in saturated fat contain cholesterol, foods high in cholesterol are not always high in saturated fat. People with a heart condition or diabetes should get 200mg or less of cholesterol from food each day[2].

Fig: SOME FOOD ITIEMS HIGH IN FAT CONTENT

1.2 How Much Fat Do You Need?

The Heart and Stroke Foundation[2] and the American Heart Association[2] recommend that less than 30% of our energy (calorie intake) comes from any kind of fat.

Saturated fat (the less healthy type of fat) should not be more than 7% of total calories. Saturated fats raise LDL (lousy) cholesterol in the body.

1.2.1 Relation Between Calories and Fats

The fat present in different food varies and so does the calories present in them. Here the food consumption recommendations depend on age, gender, and activity level. Some recommended amounts are given below.

Calorie and fat intake recommendations for men

DAILY CALORIES	RECCOMENDED DAILY (TOTAL FAT INTAKE)	RECOMMENDED MAX. (DAILY SATURATED FAT INTAKE)
1800-2000	60-65g*	14-15.5g**

Calorie and fat intake recommendations for women

DAILY CALORIES	RECOMMENDED DAILY (TOTAL FAT INTAKE)	RECOMMENDED MAX. (DAILY SATURATEDFAT INTAKE)
1500-1700	50-56g*	11.5-13g**

But so far there is no golden rule[8] guiding daily fat intake. Generally, some fat intake, particularly intake of unsaturated fats, can have beneficial effects on the human body. Children especially need some fat in their diets to be healthy. However, any type of fat, including these healthier dietary fats, can have negative effects when consumed in excess. Some of the beneficial guidelines regarding the amount and types of a fat a person should consume are stated below.

- Consume less than 10% of daily caloric needs in the form of saturated fats. Limiting consumption to less than 7% has been shown to reduce the risk of heart disease.
- Replace saturated fats with unsaturated fats if possible
- Minimize consumption of trans fats.
- Consume less than 300g of dietary cholesterol each day.

Age	Suggested Fat Intake Limit
2 - 3	30% to 40% of Total Calories
4 - 18	25% to 35% of Total Calories
19+	20% to 35% of Total Calories

FIG: Fat Intake by Age

1.3 CONSUMPTION OF CHIPS ALL OVER THE WORLD

According to a research outline[3] prepared in 2020, with the main goal to locate the per capita consumption of potato chips for the following countries: Denmark, Norway, Sweden, UK, Germany, France, United States.

- In the UK, 93% of the population regularly consume potato chips, and 63% admit to eating them daily.
- Statista reports that in 2019, 35.22 million Americans ate an average of 16 or more bags of chips.
- Another report cites that 86% of the people in both the United States and France eat potato chips/crisps. This figure makes them the two largest consumers. Great Britain is close on their heels at 84%. China isn't the biggest fan of potato chips, with just 28% of the country eating the snack.
- A 2016 report cited America as the largest chip purchaser and broke down the sales in dollars per world region.
- 2012 Data
  - Potato crisps/potato chips consumption by the population per country:

USA	FRANCE	GREAT BRITAN	EGPYT	BRAZIL	SOUTH AFRICA	CHINA
86%	86%	84%	72%	51%	43%	28%

Market In Eastern Europe is Growing

- The following numbers are from 2018 and based on

RUSSIA	UKRAINE	ROMANIA	POLAND	BELARUS	CZESH REPUBLIC	MOLDOVA	OTHERS
33%	16%	16%	8%	8%	4%	4%	11%

consumption in kg

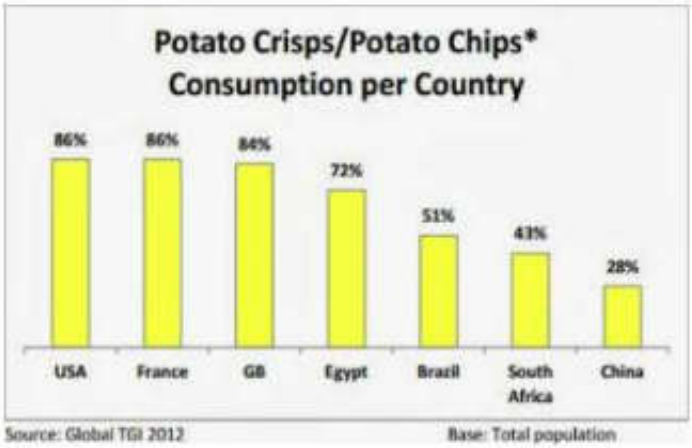

FIG:- ACCORDING TO OCTOBER 2013 (FOR POTATO CHIPS/CRIPS)

1.4 GROWTH OF THE POTATO CHIPS MARKET

Global potato chips market is growing on account of increasing popularity among the consumers, especially the adolescents. Apart from this, the introduction of new flavours of potato chips has also helped in widening the market for potato chips around the globe. The report by IMARC[7]Group titled, "**Potato Chips Market – Global Industry Trends, Share, Size, Growth, Opportunity and Forecast 2017-2022**" finds that the global potato chips market has grown at a CAGR of 4% during 2009-2016, reaching a value of US$ 26 Billion in 2016. According to the report, the market is further expected to reach a value of around US$ 127 Billion by 2022, growing at a CAGR of 5% during 2016-2022. The report evaluates the consumption trends of potato chips around the globe. Currently, the United States dominates the global potato chips market followed by Western Europe, Asia-Pacific and Other Europe. The report further makes an analysis of the competitive landscape of the market. The major player in the market is PepsiCo, accounting for the majority of the global shares. Latest report titled "**Potato Chips Market: Global Industry Trends, Share, Size, Growth, Opportunity and Forecast 2022-2027"**, The global potato chips market size reached US$ 32.2 Billion in 2021. Looking forward, the publisher expects the market to reach US$ 39 Billion by 2027, exhibiting a CAGR of 3.24% during 2021-2027.

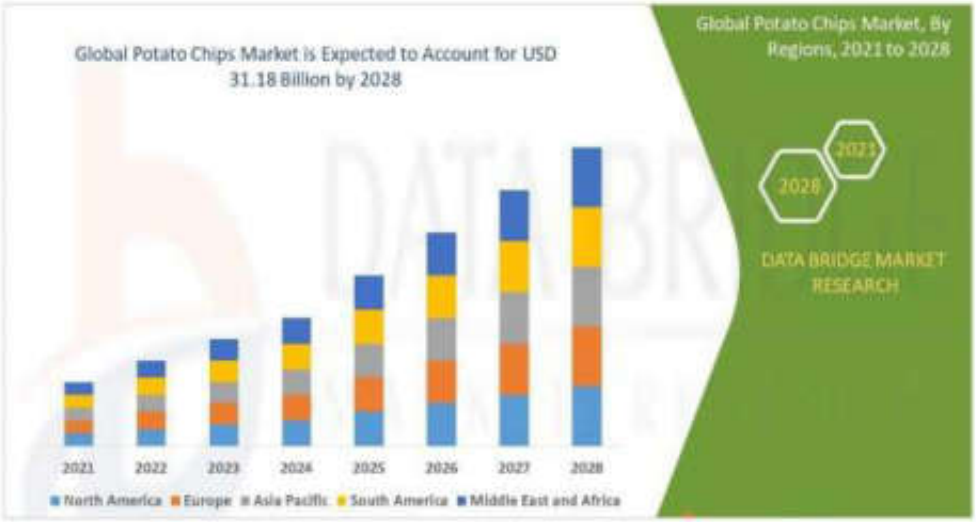

FIG :- [RAPID INCREASE IN THE POTATO CHIPS MARKET -2021 TO 2028]

1.5 HAZARDOUS EFFECT ON HEALTH

Potato chips generally have between 120 and 180 milligrams of sodium per ounce. In the long term, this can cause high blood pressure. Unfortunately, most people with high blood pressure do not have symptoms associated with it, and this can be dangerous as it may not be properly diagnosed and treated. As if left untreated, high blood pressure can lead to stroke, heart failure, coronary heart disease, and kidney disease. Other long-term side effects of eating a lot of chips are weight gain, trouble sleeping, dry skin, kidney disease, headaches, and inflammation. Potato chips are made with refined oils and processed carbohydrates, which are highly inflammatory. This leads to inflammation and pain throughout the body along with brain fog, fatigue, and weight gain. Also, has negative impacts on the cardiovascular system as refined oils are a class of omega-6 oils[7], which are inflammatory, especially when there is an imbalance of omega-3 anti-inflammatory fats.

1.6 MARKET OCCUPIED BY SOME BRANDS IN INDIA

PepsiCo, owner of the Lay's brand had 50 percent of the potato chips market[5] in India in 2016. Balaji Wafers followed at 16 percent while ITC ranked third. The country's potato chip market was valued at nearly 2.6 billion U.S. dollars in 2017, growing at 18.7 percent to reach 5.5 billion dollars by 2022.

The salty snack market in Indian processed food market, snacks make up a share of almost 20 percent. The per capita consumption of snacks differs by region and was the highest in the southern region of the country. The salty snack market, to which potato chips belonged, was estimated to witness a high value growth.

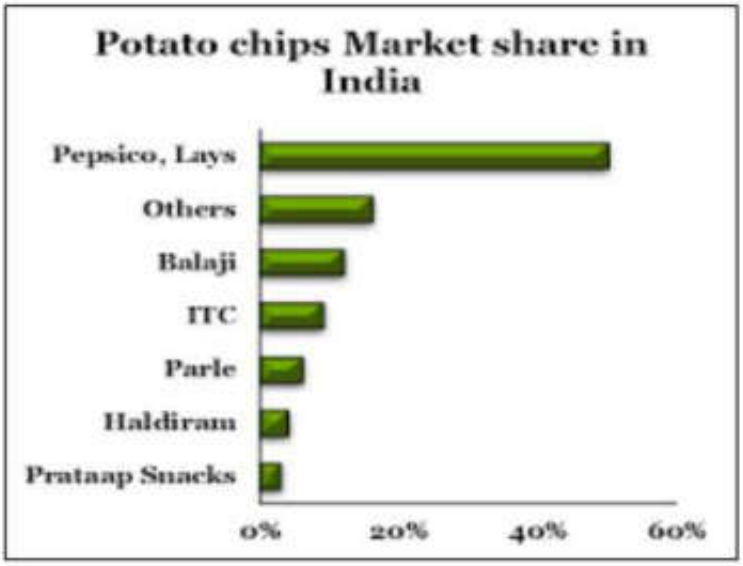

FIG : SOME MAJOR BRANDS OCCUPYING THE POTATO CHIPS MARKET IN INDIA

FIG: Lays brand owned by Pepsi Co.

1.7 SOME INDIAN BRANDS AND THEIR FAT CONTENT

Below are listed 10 brands of potato chips/wafers and two brands of potato crisps[10].

- Saturated Fat

Saturated fat is a 'bad' fat found in relatively high amounts in many meat and dairy products, including cream milk, cheese, butter and cream.

- Highest amount of saturated fat was found in Kakaji (15.96 gm/100 gm). It was lowest in Lay's (12.52 gm/100 gm) – this is good for consumers.

- Polyunsaturated Fat

  Polyunsaturated fats can help reduce bad cholesterol levels in our blood and this, in turn, can lower your risk of heart disease and stroke.

- Highest amount of polyunsaturated fat was found in Pringles (10.26 gm/100 gm) – this is good for consumers. It was lowest in Haldiram's (8.41 gm/100 gm).

- Monounsaturated Fat

Monounsaturated fat is one of the healthy fats, along with polyunsaturated fat. Eating moderate amounts of monounsaturated (and polyunsaturated) fats in place of saturated and trans fats can benefit your health.

- Highest amount of monounsaturated fat was found in Kakaji (10.55 gm/100 gm). It was lowest in Lay's (9.11 gm/100 gm).

		Potato Chips/Wafers				
Parameter ↓	% Weightage	Uncle Chipps	Haldiram's	Balaji	Lay's	
Protein	12	9.29	9.67	9.32	9.22	
Fat (on dry basis)	8	6.42	6.73	5.99	6.85	
Energy value	6	4.20	4.08	4.29	4.08	
Moisture	5	3.98	4.10	3.94	3.88	
Acid-insoluble ash (on dry basis)	5	5.0	4.85	4.10	4.70	
Acid value of extracted fat	5	4.8	4.9	4.50	4.60	
Peroxide value	5	4.97	4.76	4.75	4.77	
Salt	5	4.97	4.12	4.61	4.07	
Dietary fibre	5	4.25	4.40	4.42	4.20	
Rancidity	4	4	4	4	4	
Trans fat	3	3	3	3	3	
Saturated fat	3	2.55	2.49	2.52	2.69	
Polyunsaturated fat	3	2.61	2.46	2.62	2.72	

							Potato Crisps	
	Parle's	Diamond	Bingo	Kettle Studio	Kaleva	Kakaji	Pringles	Opera
	9.59	9.40	9.43	9.61	9.25	9.21	9.27	9.39
	6.66	6.77	6.07	6.25	4.40	4.17	6.66	4.93
	4.11	4.0	4.35	4.25	3.76	3.52	4.02	3.88
	4.42	3.12	3.26	3.24	1.25	1.0	3.34	2.20
	4.40	3.95	4.25	4.40	4.55	4.85	4.55	4.10
	4.7	4.60	4.50	4.60	4.65	4.75	4.7	4.55
	4.73	4.83	4.82	4.85	1.5	1.5	4.76	3.55
	4.23	4.48	4.02	4.11	4.06	3.99	4.16	3.49
	4.09	4.3	4.31	4.04	4.37	4.11	4.31	4.33
	4	4	4	4	4	4	4	4
	3	3	3	3	3	3	3	3
	2.58	2.59	2.44	2.45	2.40	2.28	2.68	2.34
	2.58	2.57	2.50	2.49	2.73	2.62	2.73	2.57

2. MATERIALS AND METHODOLOGY

2. MATERIALS AND METHODOLOGY:

Some of the most commonly used fat abstraction solvents are Ethyl ether and petroleum ether. But pentane and hexane are also used in the extraction of fat in some food products (Dasari and Goud, 2013, Min and Ellefson, 2010, Thiex et al., 2003)

There are various methods for fat abstraction. some of them are have been listed below

Extraction methods

- Soxhlet method
- Folch method
- Bligh and Dyer method
- Microwave-assisted extraction
- Supercritical fluid extraction
- Ultrasonic-assisted extraction

The methodology includes to understand various hazard, health effects (especially in children) and to create social awareness. The fat content was mainly determined according to AOAC (Association of Official Analytical Chemists).

2.1 EXTRACTION OF FAT FROM POTATO CHIPS

2.1.1 MATERIALS AND CHEMICALS USED(EXPERIMENTAL):

The materials used during performing the experiment are test tubes, mortar, pestle, spatula, beaker, pipet, stopper round bottom flask and potato chips and the chemical used is petroleum ether (acts as abstracting solvent).

2.1.2 EXPERIMENTAL PROCEDURE[11]:

Part A – Prepare the Potato Chips

1. Pre-weigh a 100ml beaker and 250 ml round bottom flask and record the weights.
2. Collect a decent amount of potato chips and crush them to dust using a mortar and pestle. Transfer the crushed potato chips to a watch glass.
3. Using a spatula add about 10g of crushed potato chips to your pre weight round bottom flask.
4. Set the round bottom flask in cork ring on a stable platform (so that it will not fall over). Record the combined weight.

PART B - Extract Fat from the Potato Chips

1.

1. Collect about 60 ml of petroleum ether.
2. Transfer about 30 ml of the petroleum ether to the round bottom flask containing the crushed potato chips.
3. Stopper the round bottom flask and shake it for several seconds.
   CAUTION-PRESSURE WILL BUILD UP IN THE ROUND BOTTOM FLASK AS WE PERFORM THE EXPERIMENT.
4. After a few seconds stop. Slowly remove the stopper to release pressure in the stopper round bottom flask.
5. Re-stopper, shake and release the pressure from the round bottom flask two more times.
6. Let the round bottom flask stand for 1-2 min so the solid chips can settle on the bottom of the test tube.
7. Using a pipet, transfer the ether solution from the round bottom flask to the 100ml pre weighted beaker. Be careful not transfer any solid.

2. Transfer another 30 ml of ether to the round bottom flask. Repeat the process to extract more fat.

PART C- Separate the Fat and Petroleum Ether Solution

CAUTION- PETROLEUM ETHER IS VOLATILE AND FLAMMABLE.

1. The transferred ether solution in the 100 ml beaker and covered with a filter paper.
2. Some holes are created on the filter paper (so that the petroleum ether solution can escape).
3. Place the beaker in an open space for 1-2days.
4. The ether will evaporate leaving the fat behind.
5. Weight and record the weight of the beaker with fat. By difference, determine the weight of the fat extracted.

2.2 PHOTOGRAPHS

Fig: Crushed chips

Fig: Measuring the chips

Fig: Measuring petroleum ether

Fig: Extracting the ether solution

Fig: Storing in a safe place

Fig: Fat abstracted

3. RESULTS AND DISCUSSIONS

3. Result and Discussion:

We have taken a decent amount of potato chips (one of the below mentioned brand) and crushed it to dust. Then we measured about 10g of crushed chips and transferred it to a round bottom flask(pre-weighted). Then we carefully measure about 60ml of petroleum ether in a measuring cylinder. First, we transferred about 30ml to the round bottom flask. Then we stoppered it and shaked it well for few seconds. Then we slowly remove the stopper and released the pressure build. Again, we re-stoppered it and shaked it well for two more times. We let the round bottom stay still for a few minutes so the solid chips can settle down. Using a pipet, we transferred the ether solution into a pre-weighted cylinder(100ml). Be careful to not transfer any solid. Again, we added 30ml of petroleum ether and repeated the process for2-3 times for complete fat extraction. After the ether solution is collected in the beaker cover it with filter paper and made some holes in the paper. We left the beaker in an open space for 2-3days. The ether evaporated leaving the fat behind. Record the combined weight (beaker plus fat), then from the difference calculate the weight of the fat.

Weight of round bottom flask(250ml) = 105.850g

Weight of beaker(100ml) = 50.440g (Borosil), 51.615g(Riveria)

TABLE 1: TOTAL WEIGHT OF BEAKER(B/R) AND FAT, DIFFERENCE BETWEEN TOTAL WEIGHT AND BEAKER

BRANDS	TOTAL WEIGHT [BEAKER(B/R) + FAT]	DIFFERENCE (TOTAL WEIGHT-WEIGHT OF BEAKER)
UNCLE CHIPS	53.750g **(B)**	3.31g
LAYS	53.700g **(B)**	3,26g
TEDHE MEDHE	54.890g **(R)**	3.275g
TOO YUMM	51.790g **(B)**	1.35g
POTATO CRAKERS(PRAN)	53.425g **(B)**	2.985g
KURKURE	53.900g **(B)**	3.46g

TABLE 2. FAT CONTENT IN BELOW MENTIONED POTATO CHIPS (EXPERIMENTAL)

POTATO CHIPS	FAT CONTENT (in)	
BRANDS	**100g (labelled data, already mentioned)**	**10g(experimental)**
UNCLE CHIPS (plain salted)	**35.0g**	**3.31g**
LAYS (American style cream & onion)	**33.1g**	**3.26g**
TEDHE MEDHE(Bingo) (Masala tadka)	**32.8g**	**3.275g**
TOO YUMM (Karare)	**17g**	**1.35g**
POTATO CRAKERS(Pran)	**30.25g**	**2.925g**
KUKURE (Masala Munch)	**35.70g**	**3.46g**

Now, from the difference we are able to determine the fat content in the above, mentioned brands.

RESULT : **From the experimental data we are able to state that the Uncle Chips have the highest amount of fat contents while Too Yumm seems to have less fat content in comparison to other brands.**

DICUSSION

This research focused on evaluating the fat content present in the packet potato chips and discuss their potential health impacts. The first aim was to evaluate the fat content in commercially manufactured potato chips of some brands (mainly in India). As discussed in the introduction, the fat present in the any food items may be healthy or unhealthy, but over-consumption of any kind of fat (maybe healthy) may cause adverse impacts on the health such as stroke, heart failure, coronary heart disease, and kidney disease. Other long-term side effects of eating a lot of chips are weight gain, trouble sleeping, dry skin, kidney disease, headaches, and inflammation. Potato chips are made with refined oils and processed carbohydrates, which are highly inflammatory. This leads to inflammation and pain throughout the body along with brain fog, fatigue, and weight gain. Also, has negative impacts on the cardiovascular system as refined oils are a class of omega-6 oils, which are inflammatory, especially when there is an imbalance of omega-3 anti-inflammatory fats. In the above discussed brands of potato chips brands, we able to determine their fat contents, which helped us to understand the negative health impacts and helped us make a healthy choice by selecting a healthy snack over the heavy fat containing food items.

4. CONCLUSION

4.CONCLUSION

This study shows that individuals are consuming increasing quantities of fried potato chips (FPCs), most commonly consumed snack, especially by children. However, through various scientific research and data collected from our experiment we are able to determine the high percentage of fat content which immensely effects the human health and also a major risk factor for the onset of a variety of diseases.

Also, research in the field of nutrition[6] demonstrated that FPCs encompass significant quantities of acrylamide, a known carcinogen and neurotoxin. Thus, frequent intake of FPC, especially at younger age, might generate cumulative amounts of acrylamide in the body, thereby silently increasing the risk for various diseases. Although intake of a balanced diet can prevent this scenario, further measures should be set to overcome the oxidative damage.

The present study outlines existing scientific evidence and experimental data suggesting an urgent need for systematic study regarding the health effects of consumption of FPC in the general population (especially children).

In conclusion, I would suggest that we should switch to healthy alternative with low fat content and better nutritional values or try to minimise or better to avoid the consumption of these high fat containing fast food items.

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A STUDY

ON

"AWARENESS OF NEGATIVE IMPACTS OF ALCOHOL AMONG THE STUDENTS OF DARRANG COLLEGE, TEZPUR OF SONITPUR DISTRICT OF ASSAM"

Project Work

Submitted to Department of Education,Darrang College in partial fulfillment of the requirement for the Degree of Bachelor of Arts with Education Major from Gauhati University.

Paper :- EDU-HC-6026

Under the Guidance of:

Ringprangdi Thaosen

Assistant Professor

Department Of Education

Darrang College,Tezpur

Submitted By:

Priya Daimari

B.A 6th Semester

Roll No: UA-201-225-0440

Reg No: 20045026

UID: 20AD0460

CERTIFICATE

This is to certify that Priya Daimari Student of B.A. 6th semester, Department of Education, Darrang college, Tezpur, bearing Roll UA 201225 No. 0440 and Registration No. 2004502 6 of 2020-2023 has submitted a project report on "A study on awareness of negative impacts of alcohol among the students of Darrang college, Tezpur" under my guidance and supervision.

This project report has been prepared for the partial fulfillment of Bachelor degree in education under Gauhati University. This project is his/her original work and has not been submitted to any other institution.

Thaosen
23/5/23
Singature of supervisor

Name Rinzgprangdi Thaosen

Designation Assf. Professor

Department of Education

Darrang college

Place-Tezpur, Assam.

Date 23/05/23

DECLARATION

I, Priya Daimari bearing G.U roll no. UA-201-225-0440 and College UID. 20AD0468 of academic year 2020 to 2023 declare that the project work entitled "A Study on awareness of negative impacts of alcohol among the students of Darrang College Tezpur, Assam" is the result of genuine project work carried out by me under the supervision of Ringpragdi Thaosen, Department of Education, Darrang College, Tezpur for partial fulfillment of Degree of Bachelor of Arts. This project report has not been submitted to any other institute for any other academic degree or award.

Priya Daimari
Signature

Place : Darrang College, Tezpur

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It is a matter of great pleasure that the University of Gauhati, Assam has introduced Project Work as a part of the Syllabus of 6th Semester (CBCS), Education. This is an opportunity to acquire experience of educational knowledge.

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Last but not the least, I want to thank my family members and friends for their kind co-operation and encouragement.

Place : Darrang College, Tezpur

Date : 23/05/23

Priya Daimari
Signature

CONTENTS

TOPIC

A STUDY

ON

AWARENESS OF NEGATIVE IMPACTS OF ALCOHOL AMONG THE STUDENTS OF DARRANG COLLEGE TEZPUR, ASSAM

ABSTRACT

Alcohol is one of the most widely used and abused drugs. When use irresponsibly alcohol has the potential to cause numerous and severe consequences. This study examined whether the Students of Darrang, Tezpur under Sonitpur district of Assam were aware about the negative impacts of alcohol. Two groups were stratified on the bases of gender i.e. male and female. The study used a case study method. Self-structured questionnaire developed by the investigator was administered to representative sample (100 cases) of undergraduate and higher Secondary level students of Darrang College, Tezpur. Simple percentage method was used as a statistical technique. The result showed that maximum students of Darrang College, Tezpur were aware on the negative impacts of alcohol. Apart from these, female students were more aware than the male students. There is a need to intensify efforts to increase awareness of the negative impacts of alcohol among the Students of Darrang College Tezpur, Assam.

Keywords : Awareness, alcohol, Students, negative impacts

INTRODUCTION

Alcohol is one of the world's most abused drugs and it is a powerful chemical that can have a wide range of adverse effects on almost every part of our body, including our brain bones and heart. Alcohol is regarded as the part of life by many but also problematic beverage by a lot of people. Alcohol's impacts on the body starts from the moment when a person takes their first sip.

Alcohol can have an impact on our mood, health, level of energy and motivation. Alcohol can also lead to the development of increase in domestic violence, road traffic injuries and neglect. Significantly social and economic losses to individual and society can be cause through alcohol. Alcohol misuse results in increased criminal justice and law enforcement expenses, decreased work productivity and increased health care cost. Development of chronic diseases and other serious problems including high blood pressure, heart disease, stroke, liver disease and digestive problems occur due to alcohol.

Alcohol can also have negative impacts among the students. The short and long term

effects, alcohol can impair students physically and mentally impacting their education and health. Therefore, students must be aware about the negative impacts of alcohol because alongwith studies it can create lack of interaction between family and friends. Students must also have the ability to make their parents aware of alcohol if their parents use alcohol, because it may create a violence in the family and may disturb in their studies. Students can also play an imperiant role in informing young family members about the harmful impacts of alcohol can have on their lives.

Educational institutions should bring expert to develop and disseminate information and awareness communication designed to educate students about the alcohol and the dangers and negative consequences of alcohol. Therefore, awareness programme should be conducted amongst school, colleges and communities to extent the knowledge to which students were aware of the negative impacts of alcohol.

The present study was undertaken whether the students of Darrang College, Tezpur Assam were

aware of the negative impacts of alcohol.

OBJECTIVES OF THE STUDY

(i) To study whether the students of Darrang College Tezpur are aware about the negative impacts of alcohol.

(ii) To study gender wise differences in respect to awareness about the negative impacts of alcohol.

OPERATIONAL DEFINITIONS

(i) Awareness :- Awareness is the ability to perceive, to feel or to be conscious of events, objects, thoughts or sensory patterns.

(ii) Alcohol :- Alcohol is a chemical substance found in drinks such as beer, wine and liquour.

(iii) Students :- A person formally engaged in learning, especially one enrolled in a School or college. For the study, the students of Darrang College Tezpur, Assam.

(iv) Negative impacts :- The impacts that something is on a situation, process and powerful effect.

SIGNIFICANCE OF THE STUDY

Alcohol is one of the most used substance in the world and is the third-leading preventable cause of death. Alcohol has devastated many lives and significantly harmed many patients, families and students.

Therefore, a study on awareness of negative impacts of alcohol is as important as treatment. It can play an important role in informing young family members and students about the harmful impacts of alcohol can have on their lives.

Keping in view the objective of the study, an attempt has been made to analyse on the awareness of different dimension of negative impacts of alcohol. In this study the researcher aims to determine whether the students of Darrang College, Tezpur were aware about the negative impacts of alcohol, because it may cause several problems in their academic performance as well as in the community. Thus, the study is considered to be of immense significance.

DELIMITATIONS OF THE STUDY

(i) The present study was delimited to Darrang College, Tezpur of Sonitpur district, Assam.

(ii) Only the students of Higher Secondary and under-graduate were taken for the study.

AREA OF THE STUDY

Darrang College, Tezpur of Sonitpur district, Assam was chosen as the study area for the present work.

Darrang College, Tezpur was established in the year 1945. It is affiliated to Gauhati University, Guwahati Assam. With the motto of 'Be a Jewel Among Men," it has been uninterruptedly working for fruitful dissemination of knowledge to its pupils with the solemn aim of making them worthy citizens of the country.

REVIEW OF RELATED LITERATURE

(i) S. Patrick, S. Victor (1987) conducted a study on "Factors affecting alcohol use by college students". From the study it was found that the most consistent and potent predicter of the frequency and consumption of alcohol was peer pressure. The most significant predictor of negative behavioural consequences associated with drinking was the presence of responsible attitudes toward alcohol, followed by peer pressure and alcohol knowledge.

(ii) M. William G (1990), conducted a study on "An Evaluation of the effects of College Alcohol Education on the prevention of Negative Consequences". From the study it was found that the current study were mainly in agreement that alcohol education significantly improves knowledge, but demonstrates little effect on responsibility and negative consequences. The correlation co-efficients for knowledge acquisition, responsible attitudes and negative consequences indicated a lack of relationships that would influence prevention of negative consequences.

(iii) S. Jean T, C. Laurel A, M. Ruth, T.E Dielman (1996) conducted a study on "Effectiveness of a High School Alcohol Misuse Prevention Program. From the study it was found that an alcohol misuse prevention curriculum for tenth-grade students was developed. implemented and evaluated through twelfth grade with 1041 students from four school districts. The curriculum emphasized social pressure resistance training, immediate effects of alcohol, risks of alcohol misuse and social pressures to misuse alcohol. There were desirable program effects on alcohol misuse prevention knowledge, alcohol misuse and refused skills.

(iv) H. Daniel W (2003) conducted a study on "Male and female sensitivity to alcohol induced brain damage." From the study it was found that women are more vulnerable than men to many of the medical consequences of alcohol use. Although research has shown that male alcoholics generally have smaller brain volumes than non-alcoholic males, the have compared brain structure in alcoholic men and women had mixed results. The majority of studies suggest that women are more vulnerable to alcohol-induced brain damage age than men, the evidence remains inconclusive.

(v) P. Crystal L (2004) conducted a study on "Positive and negative consequences of alcohol consumption in College Students". From the study it was found that college student drinking does indeed involve many negative consequences, some of which are quite serious but that students also experience many positive consequences. Infact, they report their encounters with positive consequences as being more extreme and more frequent than their encounters with negative consequences. Finally, participants reported that their positive and negative consequences would influence their future drinking decisions in a number of different ways. Further research directions and implications for interventions are discussed.

METHODOLOGY

METHOD USED

Methodology is a technique to solve research problem significantly. A case study method was used by the investigator for the present study. Here a case study method was used because this method describes what exists at present.

DATA

(i) Primary Data :- Primary data is a data that has been collected from the students by using self-structured questionnaire.

(ii) Secondary Data :- Secondary data for the study includes journals, articles, e-resources, websites etc.

POPULATION

Population of the study comprises Higher Secondary and undergraduate level students of Darrang College, Tezpur under Sonitpur district of Assam.

SAMPLE

Out of the total population, the number of Sample taken was 100 (hundred) i.e 50 (fifty) male and 50 (fifty) female students of Darrang College Tezpur, Assam.

SAMPLING TECHNIQUE

Simple Random Technique was used by the investigator. Two groups were stratified on the basis of gender (50 males and 50 females).

TOOLS USED

Self-structured questionnaire was used as a tool by the investigator to collect the required data from each strata 50 males and 50 females from each group leading to a total of 100 cases.

STATISTICAL TECHNIQUE USED

Simple percentage method was used as a statistical technique.

ANALYSIS AND INTERPRETATION OF DATA

The analysis and interpretation of data collected has been carefully analysed with the help of tables and figure shown below.

Objective 1 : To study whether the students of Darrang College Tezpur, Assam were aware about the negative impacts of alcohol.

Table NO. 1

Sl.No.	Variables	Yes	Percentage %	NO	Percentage %
1.	Are you aware that consumption of alcohol can break the concentration power on studies ?	90	90%	10	10%
2.	Are you aware that alcohol can create problems you and your friends ?	86	86%	14	14%
3.	Are you aware about the various health issues like high blood pressure Stroke like cancer, mouth cancer, etc because of alcohol ?	95	95%	5	5%
4.	Are you aware that alcohol can damage the brain cells which may lead to problems with thinking and memory ?	93	93%	7	7%
5.	Are you aware that alcohol can lead to Social problems for people such as unemployment, divorce, domestic abuse and homelessness ?	90	90%	10	10%
6.	Are you aware that alcohol can lower the level of growth and Sex hormones in both adolescent boys and girls ?	75	75%	25	25%
7.	Do you know that Significant social and economic losses to individuals and society can be cause through alcohol ?	88	88%	12	12%
8.	Do your parents advise you to be aware of alcohol as it can cause physical and mental health issues ?	94	94%	6	6%
9.	Are you aware that alcohol can make life Span Shorter ?	86	86%	14	14%
10.	Have you ever attended awareness program conducted on the negative impacts of alcohol ?	35	35%	65	65%

From table no. 1, it can be seen that;

90% students were aware that consumption of alcohol can break the concentration power on studies whereas 10% students were not aware.

86% students were aware that alcohol can create problems between them and their friends, whereas 14% students were not aware.

95% students were aware about various health issues like high blood pressure stroke like cancer, mouth cancer, etc because of alcohol. whereas 5% students were not aware.

93% students were aware that alcohol can damage the brain cells which may lead to problems like thinking and memory. whereas 7% students were not aware.

90% students were aware that alcohol can lead to social problems for people such as unemployment, divorce, domestic abuse and homelessness. Whereas 10% students were not aware.

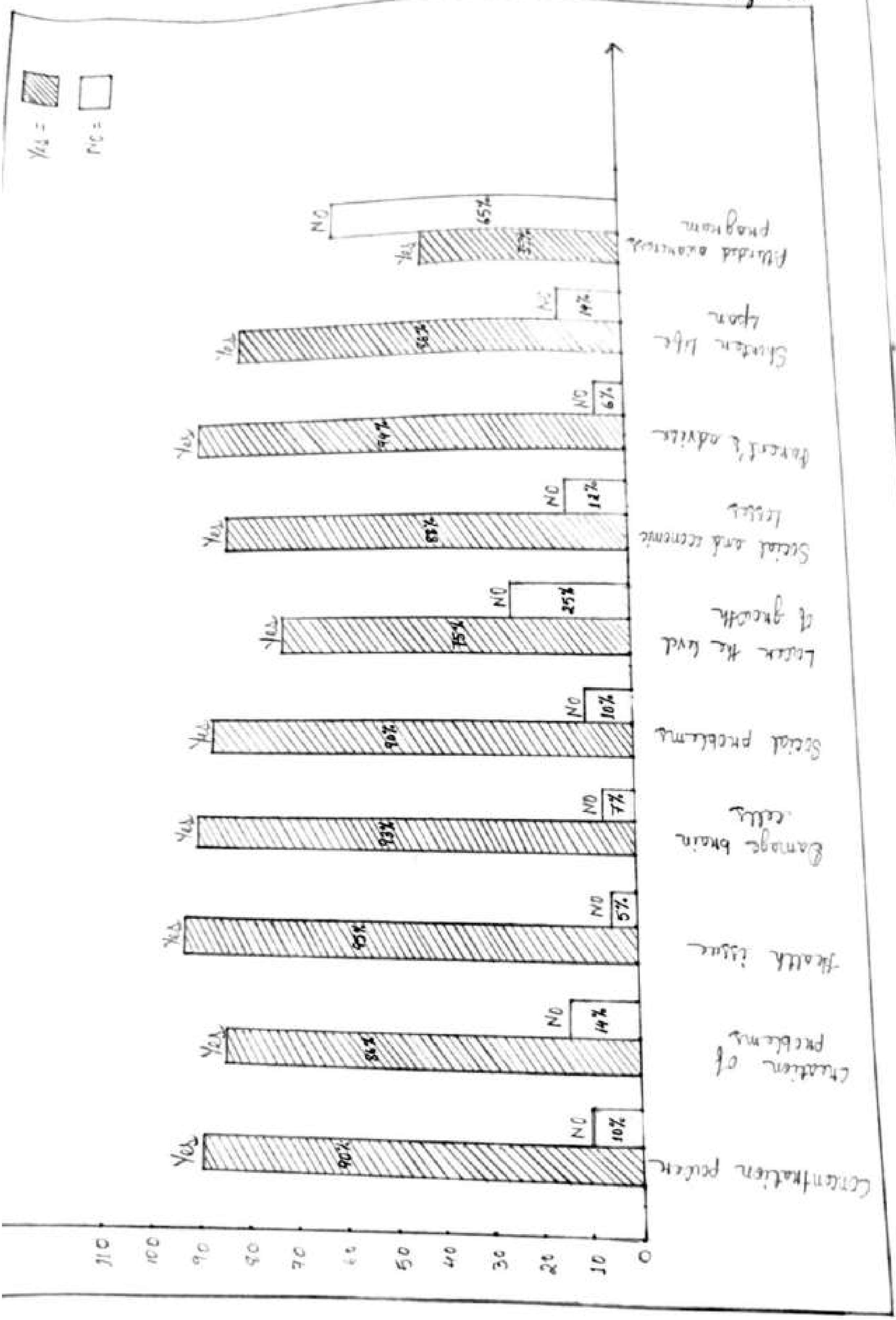
75% students were aware that alcohol can lower the level of growth and sex hormones in both adolescent boys and girls. whereas 25% students were not aware.

88 % Students were aware that significant social and economic losses to individuals and society can be cause through alcohol. Whereas 12 % Students were not aware.

94 % Students of their parents advise them to be aware of alcohol as it can cause physical and mental health issues. Whereas 6 % Students of their parents do not advise them to be aware of alcohol.

86 % Students were aware that alcohol can make life span shorter. Whereas 14 % Students were not aware.

35 % Students have attended awareness program conducted on the negative impacts of alcohol. Whereas 65 % Students have not attended awareness program conducted on the negative impacts of alcohol.


Yes =
No =
Concentration power
Creation of problems
Health issue
Damage brain cells
Social problems
Lessen the level of growth
Social and economic issues
Parent's advice
Shorten life span
Attended awareness program
Yes
No
90%
10%
86%
14%
95%
5%
93%
7%
90%
10%
75%
25%
88%
12%
94%
6%
86%
14%
35%
65%
0
10
20
30
40
50
60
70
80
90
100
110

Objective 2 : To study gender wise differences in respect awareness about the negative impacts of alcohol.

Table NO. 2

S.L. NO.	Variables	Male				Female			
		Yes	%	NO	%	Yes	%	NO	%
1.	Are you aware that consumption of alcohol can break the concentration power on studies ?	41	41%	9	9%	49	49%	1	1%
2.	Are you aware that alcohol can create problems between you and your friends ?	39	39%	11	11%	47	47%	3	3%
3.	Are you aware about the various health issues like high blood pressure stroke like cancer, mouth cancer, etc. because of alcohol ?	46	46%	4	4%	49	49%	1	1%
4.	Are you aware that alcohol can damage the brain cells which may lead to problems with thinking and memory ?	44	44%	6	6%	49	49%	1	1%
5.	Are you aware that alcohol can lead to social problems for people such as unemployment, divorce, domestic abuse and homelessness ?	43	43%	7	7%	47	47%	3	3%
6.	Are you aware that alcohol can lower the level of growth and sex hormones in both adolescents boys and girls ?	35	35%	15	15%	40	40%	10	10%
7.	Do you know that significant social and economic losses to individuals and society can be cause through alcohol ?	43	43%	7	7%	45	45%	5	5%
8.	Do your parents advise you to be aware of alcohol as it can cause physical and mental health issues ?	45	45%	5	5%	49	49%	1	1%
9.	Are you aware that alcohol can make life span shorter ?	38	38%	12	12%	48	48%	2	2%
10.	Have you ever attended awareness program conducted on the negative impacts of alcohol ?	19	19%	31	31%	16	16%	34	34%

From table no. 2 it can be seen that ;

41% male and 49% female students were aware that consumption of alcohol can break the concentration power on studies. whereas 9% male and 1% female students were not aware.

39% male and 47% female students were aware that alcohal can create problems between them and their friends. Whereas 11% male and 3% female students were not aware.

46% male and 49% female students were aware about various health issues like high blood pressure stroke like cancer, mouth cancer, etc because of alcohal. Whereas 4% and 1% female students were not aware.

44% male and 49% female students were aware that alcohal can damage the brain cells which may lead to problems with drinking and memory. whereas 6% male and 1% female students were not aware.

43% male and 47% female students are aware that alcohal can lead to social problems for people such as unemployment, divorce, domestic abuse and homelessness. whereas 7% male and 3% female students were not aware.

35% male and 40% female students were aware that alcohal can lower the level of growth and sex

hormones in both adolescents boys and girls. Whereas 15% male and 10% female students were not aware.

43% male and 45% female students were aware that significant social and economic losses to individuals and society can be cause through alcohol. Whereas 7% male and 5% female students were not aware.

45% male and 49% female students of their parents advise them to be aware of alcohol as it can cause physical and mental health issues. Whereas 5% male and 1% female students of their parents do not advise them to be aware of alcohol.

38% male and 48% female students were aware that alcohol can make their life span shorter. Whereas 12% male and 2% female students were not aware.

19% male and 16% female students have attended awareness program conducted on the negative impacts of alcohol. Whereas 31% male and 34% female students have not attended awareness program conducted on the negative impacts of alcohol.

FINDINGS OF THE STUDY

The findings of the study were -

1. From the study it was found that most of the Students i.e 90% of Students were aware, regarding that consumption of alcohal can break their concentration power on Studies and may create problems between them and their friends.

2. Maximum percentage of female Students i.e. 49% were more aware than male Students i.e 46% in case of various health issues like high blood pressure stroke, cancer, etc.

3. Most of the Students of Darrang College, Tezpur i.e 93% of Students were aware on the negative impacts of alcohal which may damage brain cells and may lead to problems with thinking and memory.

4. Maximum Students of Darrang College, Tezpur i.e 90% of Students were aware that negative impacts of alcohal can lead to social problems such as ; unemployment, divorce, domestic abuse and homelessness.

5. Maximum female students i.e 48% were more aware than male students i.e 38% regarding that alcohol can make life span shorter.

6. Only few students i.e 35% of the students of Darrang College, Tezpur have attended awareness program conducted on the negative impacts of alcohol.

CONCLUSION

The present study on awareness of negative impacts of alcohol were conducted among the Higher Secondary and undergraduate level Students of Darrang College Tezpur, Assam. The objectives of the study were to examine whether the Students of Darrang College, Tezpur were aware about the negative impacts of alcohol. It was also examined between 50 male and 50 female Students. Overall maximum Students were aware about the negative impacts of alcohol. Furthermore, the present study showed that female Students were more aware than male Students. And also it was showed that only few students have attended awareness programme conducted on the negative impacts of alcohol. Creating awareness about the adverse effect of alcohol and academic counselling for Higher Secondary and undergraduate level Students were recommended

SUGGESTIONS

1. Health education teachers, college health counsellor and college administrators should combine their professional experience to promote health education interventions and health counselling programme to make students aware on the negative impacts of alcohol.

2. Parents should be friendly and must properly monitor and counsel their adolescent students to be aware on the harmful effects of alcohol for better future and career.

3. Educational Institution should organize seminars regarding the programme on the negative impacts of alcohol among the students.

4. Students should try to create awareness if their parents, relatives and neighbours use alcohol, because it may create violence in family and may disturb in their Studies.

5. Educational Institution should try to provide awareness programme among the students for several problems in the society like unemployment, economic losses, violence may occur through the negative impacts of alcohol.

6. Parents should take initiative to make their children aware about the negative impacts of alcohol, so that their children may not create any violence between family, friends and in the community.

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QUESTIONNAIRE

AWARENESS OF NEGATIVE IMPACT OF ALCOGOL

Name:.....

Age:.....Educational qualification:.....Gender:.....

Name of School/College:.....

1. Are you aware that consumption of alcohol can break the concentration power on studies ?

(a) Yes (b) NO

2. Are you aware that alcohol can create problems between you and your friends ?

(a) yes (b) No

3.Are you aware about the various health issues like high blood pressure stroke, like cancer, mouth Cancer , etc because of alcohol ?

(a) Yes (b) No

4. Are you aware that alcohol can damage the brain cells which may lead to problems with thinking And memory ?

(a) Yes (b) No

5. Are you aware that alcohol can lead to social problems for people such as unemployment divorce, domestic abuse and homelessness ?

(a) yes (b) No

6. Are you aware that alcohol can lower the level of growth and sex hormones in both adolescent boys and girls ?

(a) Yes (b) No

7. Do you know that significant social and economic losses to individuals and society can be cause through alcohol ?

(a) Yes (b) No

8. Do your parents advise you to be aware of alcohol as it can cause physical and mental health issues ?

(a) Yes (b) No

9. Are you aware that alcohol can make life span shorter ?

(a) Yes (b) No

10. Have you ever attended awareness program conducted on the negative impacts of alcohol ?

(a) Yes (b) No

A STUDY ON PSYCHOLOGICAL STRESS OF UNDERGRADUATE STUDENTS LEAVING HOME FOR HIGHER STUDIES

Project Report Submitted to Gauhati University for the fulfilment of the Honours Course in 'Education' Paper No:- EDU-HC-6026 B.A 6TH Semester Examination of Gauhati University

Under Guidance of:-

Dr. Mukul Saikia

HOD

Department of Education

Darrang College, Tezpur

Submitted by:-

Supriti Daimari

6th Semester, B.A

Roll No.- UA-201-225-0612

Registration No.- 20045197 of 2020-23

Darrang College, Tezpur

CERTIFICATE

This is to certify that Supriti Daimari student of B.A.6th Semester, Department of Education, Darrang College, Tezpur, bearing Roll UA201-225 No 0612 and Registration No 20045197 of 2020-23 submitted a project report on "A study on psychological stress of undergraduate students leaving home for higher studies" under my guidance and supervision.

This project report has been prepared for the partial fulfillment of Bachelor degree in education under Gauhati University. This project is his/her original work and has not has been submitted to any other institution.

Mukul Saikia

Signature of Supervision

Name- MUKUL SAIKIA

Designation- Associate Professor

Darrang College

Department of Education

Place-Tezpur, Assam

Dated - 23/5/23

DECLARATION

I, **Supriti Daimari** bearing G.U roll no .**UA-201-225-0612** and college **UID. 20AD0383** of academic year 2020 to 2023 declare that the project work entitled "**A study on psychological stress of undergraduate students**" is the result of genuine project work carried out by me under the supervision of **Dr. Mukul Saikia**, Department of Education, Darrang college, Tezpur for partial fulfillment of degree of Bachelor of Arts. This project report has not been submitted to any other institute for any other academic degree of award.

Place: Darrang College, Tezpur

Supriti Daimari

ACKNOWLEDGEMENT

It is matter of great pleasure that the **UNIVERSITY OF GUWAHATI, ASSAM** has introduced Project work as a part of the syllabus of 6th semester (CBCS), Education. This is an opportunity to acquire experiences of educational knowledge.

I am sincerely thankful to Dr. Mukul Saikia, Head of the department for helping me and providing with all the facilities to carry out my project work.

It gives me immense pleasure to express my gratitude to my supervisor Dr. Mukul Saikia Sir, Department of education, Darrang College, Tezpur for her valuable guidance and suggestions throughout the process of carrying out of my project work.

I also express my sincere thanks to all the other faculty members of the department of Education, Darrang College, and Tezpur for their valuable guidance and inspiration during my project work.

Last but not the least; I want to thank my family members and friends for their kind co-operation and encouragement.

Supriti Daimari
signature

Place: Darrang College, Tezpur

Date: 23/5/23

A STUDY ON PSYCHOLOGICAL STRESS OF STUDENTS LEAVING HOME FOR HIGHER STUDIES

ABSTRACT

Moving away from home and living and studying independently can be a big step for young people and their parents which cause psychological stress among many students. This work investigates the psychological stress of the undergraduate students of Darrang College, Tezpur. A total of 100 undergraduate students of Darrang College, Tezpur. Tezpur were surveyed in the study. The findings suggest that most of the students are not under stress and are happy with their current environment.

CONTENT

INTRODUCTION

In our life time everyone suffers from stress. Stress is basically a feeling of emotional strain and pressure. It usually happens when we are in a situation that we don't feel we can manage or control. Stress can affect both our mental and physical health. But of all people adolescents suffer from stress the most because of their career, family issues and personal issues and as such students leaving for higher studies suffer from stress as well.

Moving away from home and living and studying independently can be a big step for young people and their parents. For many years, parents and teachers have been concerned with the psychological challenges that students face during their higher education. Factors such as homesickness, loneliness, hopelessness, isolation etc. are face by the students. Due to this most students suffers from anxiety which leads to depression and various health issues. When people come in contact with new environment some people able to adjust and cope up with the environment, while others suffers from it. So, my research is about a study on psychological stress of students leaving home for higher studies. Here, we try to find out about what percentages of students are able to cope up with their environment. Along with this we will find out among boys and

girls who suffer from more stress and who among them able to cope up with the environment faster.

OBJECTIVES

Darrang College

- To study stress of the undergraduate students of Tezpur leaving home for higher studies.
- To compare the difference of stress between the boys and girls.

IMPORTANCE/SIGNIFICANCE

My research is based on psychological stress of the students leaving home for higher studies. Studying psychological stress is important because stress has a powerful impact on various aspects of our life not only it can affect our mood, energy level, relationships and work performance, Stress can also cause and exacerbate a wide variety of health conditions. Stress can lead to serious health problems including: cardiovascular disease, digestive disorder, decreased immune functioning etc.

Moving away from home to live on campus or an apartment near college has always been both an exciting and anxious time for students. Taking this major step in life is accompanied by different stressors including a rigorous class

schedule, making new friends and adjusting to new responsibilities. However, also face additional stressors such as severe fear and anxiety of getting infected and potential to be isolated from loved ones and friends, creating a higher risk for a mental health crisis. Due to this student suffers from different mental health crisis such as sleep issues, hopeless outlook, fatigue, feelings of panic or trouble focusing or focusing too much on something worrisome, changes in appetite and weight, irritability, trouble getting along with others, hearing voices, mood swings(high and low) suicidal thoughts and self-harm all require attention. In most cases students who suffers from stress end up being in depression, so if we know about a student suffering from stress right from start we can take initiative before it turn to worst. It is important to conduct mental health programs such as counseling/ psychotherapy for the students. So, the students can remain mentally healthy. It will prevent the students from doing any self-harm to them and it will also help them to keep their mind and body adapt. Practicing stress management is very important because it can help the students to prevent mental problems. Stress management offers a range of strategies to better deal with stress and difficulty in our life. Managing stress can help us lead a more balanced healthier life. Students should learn stress management skills such as practicing relaxation techniques

such as deep breathing, yoga, meditation, exercise, improving personal relationships, problem solving skills etc.

College should be one of the best times in a young person's life but transitioning away from home isn't always easy. With the right planning and understanding of available resources to protect their mental health, it can still be the time of their lives.

DELIMITATIONS OF THE STUDY

The present study is limited to Tezpur town of Assam. It covered only the undergraduate students living in hostel, paying guests in Tezpur.

AREA OF THE STUDY

The study will be conducted for the undergraduate students of Darrang College, Tezpur.

Tezpur is a city and urban agglomeration in Sonitpur District, Assam state, India. Tezpur is located on the banks of the river Brahmaputra, 175 kilometers northeast of Guwahati, and is the largest of the north bank cities with a population of 1,40000 as per Metropolitan Census 2023.

REVIEW OF RELATED LITERATURE

Various researches on psychological stress of students leaving home for higher studies have been conducted. Some of this as follows:

1. Bernier. A, Larose. S, Whipple. N(2005) found that there is a difference between students who were to leave home and those who were to stay at home in terms of their perceptions of the parent-adolescent relationship prior to the transition to college.(TI)
2. Lester. J (2009) found that there is a positive correlation for female students between adjustment to university and prior discussion with parents about university life than men.
3. Nghiem. H.S, Le. T.T.K, Ly. T.N.A, Tang. Y.V and Phan. T.T.M (2021) study found that women and younger college freshman have higher sickness intensity than men and first year college students. They also found that learning away from home help us improve our social communication skills, increase our independence and save money.

METHODLOGY

Methodology is a technique to solve the various research problems scientifically. Here descriptive survey method is used because this method describes and interprets what exists at present.

An effective and success of any research work depends on the methods and procedure followed and step wise execution of the study.

Population: A population is the complete set or group of individuals, whether that group comprises a nation or a group of people or objects with a common characteristic. Since our present study relates to the stress level of students of Darrang College, hence our population for this study comprises of all the students studying in Darrang College.

Sampling: A sample is simply a subset of population. Here, samples were collected from Darrang College, Tezpur. Random sampling technique was adopted for this study.

Tools: The major tools used for this study is – A questionnaire prepared by the investigator to collect relevant data.

Sources of Data: The data were collected from two sources, primary data and secondary data sources.

The primary data has been collected from the college students by using self-construct questionnaire. Websites have been used at the secondary sources of data.

DATA ANALYSIS AND INTERPRETATION

The analysis and interpretation of data collected had been carefully analyzed with the table shown below.

Table 1: Table showing stress of the under graduate students of Darrang College living in Tezpur leaving home for higher studies.

SL. NO.	VARIABLES	YES	PERCENTAGE %	NO	PERCENTAGE%
1	Do you live away from home?	100	100%	0	0%
2	Do you feel empty inside regularly?	32	32%	68	68%
3	Are you mentally disturbed for the past few months?	30	30%	70	70%
4	Do you feel nervous and stressed?	61	61%	39	39%
5	Do you feel that things are not going your way?	54	54%	46	46%
6	Do you feel that you are able to adjust with your current environment?	82	82%	18	18%
7	Do you often feel lonely?	42	42%	58	58%
8	Do you think you are getting along with your new friends?	83	83%	17	17%
9	Do you feel that you can't start a new conversation with new people around?	34	34%	66	66%
10	Are you having difficulty facing a staying asleep?	37	37%	63	63%
11	Are you happy with your current educational institute?	75	75%	25	25%
12	Are your regular with your classes?	71	71%	29	29%
13	Dou often keep yourself locked inside your room?	32	32%	68	68%

14	Do attend social gathering/ programme in your institute?	71	71%	29	29%
15	Are you satisfied with your food in your hostel/ PG?	39	38%	62	62%
16	Are you facing any health issue in the past few months?	37	37%	63	63%
17	Are you able to cope up with your studies?	71	71%	29	29%

Table 2: Comparison of boys and girls with regards to stress:

Sl. No	Variables	Boys				Girls			
		Yes	%	No	%	Yes	%	No	%
1	Do you live away from home?	50	50%	0	0%	50	50%	0	0%
2	Do you feel empty inside regularly?	15	15%	35	35%	17	17%	33	33%
3	Are you mentally disturbed for the past few months?	14	14%	36	36%	16	16%	34	34%
4	Do you feel nervous and stressed?	33	33%	17	17%	28	28%	22	22%
5	Do you feel that things are not going your way?	24	24%	26	26%	30	30%	20	20%
6	Do you think you are able to adjust with your current environment?	42%	42%	8	8%	40	40%	10	10%
7	Do you often feel lonely?	15	15%	35	35%	27	27%	23	23%
8	Do you think that you are getting along with your new friends?	40	40%	10	10%	43	43%	7	7%
9	Do you feel that you can't start a new conversation with new people around you?	14	14%	36	36%	20	20%	30	30%
10	Are you having difficulty falling or staying asleep?	14	14%	36	36%	23	23%	27	27%
11	Are you happy with your current educational institute?	38	38%	12	12%	37	37%	13	13%
12	Are you regular with your classes?	31	31%	19	19%	40	40%	10	10%
13	Do you often keep yourself locked inside your room?	13	13%	37	37%	19	19%	31	31%

14	Do you attend social gathering / programs in your institute?	41	41%	9	9%	30	30%	20	20%
15	Are you satisfied with you food in our hostel / PG?	28	28%	22	22%	10	10%	40	40%
16	Are you facing any health issue in the past few months?	21	21%	29	29%	16	16%	34	16%
17	Are you able to cope up with your studies?	34	34%	16	16%	37	37%	13	13%

Table 3: Comparison of Boys and Girls with regard to home visit:

Sl. No.	Variables	GIRLS					
		Weekly		Fortnightly		Monthly	
		No.	%	No.	%	No.	%
1	Do you live away from home?	5	5%	4	4%	41	41%
		BOYS					
		Weekly		Fortnightly		Monthly	
		No	%	No	%	No.	%
		1	1%	37	37%	12	12%

Table showing the frequency of home visit:

BOTH					
Weekly		Fortnightly		Monthly	
No.	%	No.	%	No.	%
6	6	78	78%	16	16%

From Table No 1, it can be seen that,

1. 100% of students live away from home.
2. 32% of students feel empty inside regularly.
3. 30% of students are mentally disturbed for the past few months.
4. 61% of students feel nervous and stressed.
5. 54% of students feel that things are not going their way.
6. 82% of students are able to adjust with their current environment.
7. 42% of students often feel lonely.
8. 83% of students are getting along with their new friends.
9. 34% of students feel that they can't start a new conversation with new people around them.
10. 37% of students are having difficulty in falling or staying asleep.
11. 75% of students are happy with their current educational institute.
12. 71% of students are regular with their classes.
13. 32% of students keep themselves locked inside their room.

14.71% of students attend social gatherings/ programs their institute

15.38% of students are satisfied with the food provided in In their hostel/paying guest.

16. 37% of students are facing health issues from the past few months.

17. 71% of students are able to cope up with their studies.

From Table 3, we can say that,

6% of students visit their home weekly.

78% of students visit their home monthly

16% of students visit their home fortnightly.

CONCLUSION

Psychological stress is prevalent in the lives of students especially when it comes to academics and succeeding in that respect. The individual's ability to handle stress is still murky. After doing all the research in conclusion we found that most of the students are happy with their current environment and also the students are getting along with their new friends and they are also happy with their current educational institute. It shows that when students leave their home for higher studies they face stress at starting which makes them hard to adjust with their new environment but with time they are able to adjust with their new environment. In conclusion, good mental health is a state of well-being that allows individuals to cope with the normal stresses of life and functions productively.

SUGGESTIONS

The following are suggested for managing the stress of the students. They are as follows:

1. **Get enough sleep:** Getting both quality sleep and enough sleep offers a variety of health benefits, including reducing stress and improving your mood.
2. **Eat well:** Make an effort to eat nutritious meals and avoid eating in the run so you can avoid indigestion.
3. **Exercise regularly:** In addition to keeping your body healthy, regular exercise releases endorphins and improves your overall cognitive abilities. Exercise can help you fall asleep, thereby reducing stress.
4. **Don't Rely on Stimulants:** Drinking coffee and energy drinks to fuel your late night study sessions will inevitably had to a crash later on .These stimulants boost cortisol levels in the body increasing the physical affect of stress.
5. **Set realistic expectations:** Consistently having too much on your plate can lead to a lot of stress. Try to manage your workload by getting realistic expectations and picking a class schedule that gives you plenty of time to study and relax.
6. **Avoid procrastinating:** Procrastination might feel good in the moment, but it often leads to stress. By managing your

time wisely, you can avoid spending all night catching up course work. Additionally, habitual procrastination may be a sign of ADHD or anxiety.

7. **Identity a stress outlet:** Stress can never be completely avoided, however, finding healthy ways to reduce stress can go a long way toward keeping it from overwhelming you. Common stress outlets include exercise, spending time with friends and family and getting massages.

Sometimes, stress can rise to dangerous levels; threaten student's physical emotional and mental health. But nobody has to face stress alone. Here are some organizations and resources the students can conduct to receive treatment and support for managing stress in college. They are as follows:

- On campus mental health services: Most colleges offer on campus (and sometimes virtual) mental health services to students.
- Off campus centers and hotlines: Colleges that can't provide appropriate stress management resources will direct the students to use on outside service, such as a local counseling or therapy center.

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A Study on psychological stress of UG students leaving home for higher studies in Tezpur

1. Do you live away from home? Yes/No
2. How often you visit your home? Weekly/Monthly/Fortnightly
3. Do you feel empty inside regularly? Yes/No
4. Are you mentally disturbed for the past few months? Yes/No
5. Do you feel nervous and stressed? Yes/No
6. Do you feel that things are not going your way? Yes/No
7. Do you think that you are able to adjust with your current Environment? Yes/No
8. Do you often feel lonely? Yes/No
9. Do you think that you are able to adjust with your new friends? Yes/No
10. Do you feel that you can't start a new conversation with new people around you? Yes/No
11. Are you having difficulty falling or staying asleep? Yes/No
12. Are you happy with your current education institute? Yes/No
13. Are you regular with you classes? Yes/No
14. Do you often keep yourself lock inside your room? Yes/No
15. Do you attend social gatherings/programs in your institute? Yes/No
16. Are you satisfied with your food in your hostel / PG? Yes/No
17. Are you facing any health issue in the past few month? Yes/No
18. Are you able to cope up with your studies? Yes/No

A DISSERTATION ON

VARIOUS INCOME GENERATING ACTIVITIES OF KANYAKA AGRO-FARM AND ITS IMPLEMENTATION

THE DISSERTATION SUBMITTED TO GAUHATI UNIVERSITY IN PARTIAL FULLFILMENT OF REQUIRMENT FOR THE MASTER DEGREE IN ARTS 4TH SEMESTER IN GEOGRAPHY

UNDER THE GUIDANCE OF:

MR. GULAP SONOWAL

ASSISTANT PROFESSOR

DEPARTMENT OF GEOGRAPHY

DARRANG COLLEGE, TEZPUR

SUBMITTED BY:

RASHIDUL HAQ

P.G 4TH SEMESTER

ROLL NO: - PA- 211-225- 0025

REGISTRATION NO: -18028469

DEPARTMENT OF GEOGRAPHY

DARRANG COLLEGE, TEZPUR

CERTIFICATE

This is to certify that Mr. RASHIDUL HAQ of 4th semester M.A in Geography bearing Roll No: - PA – 211 -225 – 0025 has prepared this Dissertation entitled *"**Various Income Generating Activities of Kanyaka Agro-Farm and its Implementation***" of Sonitpur District Assam, under my direct guidance and supervisor, as partial fulfillment to the syllabus of M.A 4th semester as prescribed by Gauhati University.

This projects report is the result of his original work and personal investigation. Neither a part of this report has ever been submitted to any college or universities for master degree.

The assistance and help during the course of this investigation has been duly acknowledged.

Signature of HOD

Signature of Supervisor

Dr. Hemanta Jyoti Nath
Associated Professor & HOD
P.G.Department Of Geography
Darrang College, Tezpur

Mr. Gulap Sonowal
Assistant Professor
P.G. Department Of Geography
Darrang College, Tezpur

DECLARATION

I, **Rashidul Haq**, do hereby make firm and solemn declaration that the research work present in this topic entitle *"**various income generating activities of kanyaka agro-farm and its implementation***" is my own reseach work. This reseach work has been carried out under the guidance and supervision of **Mr. Gulap Sonowal**, Assistant Professor, Department of Geoghraphy, Darrang College, Tezpur, Assam.

RASHIDUL HAQ
M.A. 4th Semester
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GU Roll No: PA-211-225-0025

ACKNOWLEDGEMENT

The success of this projects undertaken was largely influenced by the encouragement and guidance of many well-wishers. I take this opportunity to express my gratitude to people who had been instrumental in the completion of this project.

I would like to express my special thanks of gratitude to our respected and research guide Mr. Gulap Sonowal sir, and also our Head of the Department, Dr. Hemanta Jyoti Nath sir who gave us the golden opportunity to perfume this report.

I would like to offer my thanks of companions, my friends and to the people of the farm who have help me and co-operated me to give a final shape of this field study.

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CHAPTER 1

Introduction:

The society "Bharalipara Kanyaka Bohumukhi Paam" (Konyoka) was incorporated September 2016 with an objective of starting multi – cropping projects in 2000 acres of barren land on the flood plains of Jia Bharali River. It is located at Sheelabandha Gaon Panchayat in Sonitpur District of Assam. The coordinates are **26°44'16"N** to **26°46'30"N** latitude and **92°52'30"E** to **92°53'45"E** longitude. The kanyaka is developed with the objectives of inegrated farming practices.

Income generation can help to overcome food insecurity when economic factors are a fundamental cause of food insecurity and when food is available in local markets but lack of money is the main difficulty faced by the vulnerable population. The food security programs aim to help the population survive today, but also to live better tomorrow, and in this sense the income generating activities serve as important alternatives. Income generation simply means gaining or increasing income or money that an individual or business receives in exchange for providing a good or service after investing capital. It can also be defined as small scale projects that create an income source to individual beneficiaries or beneficiary group whilst promoting; the principal right of self-determination and the objectives of integration, reputation and re – integration [FAO-2011].

The purpose of this study was to identification of various Income-Generating Activities of kanyaka agro-farm and its implementation. It specially looked at how the community of kanyaka established by creating job opportunities and what are the different types of income generating activity supported by kanyaka.

1.1 Statement of the problem

The study area Bharaliparia Kanyaka Bohumukhi Paam"[konyoka] is located at the bank of the river called "**JIA BHARALI".** The society "Bharaliparaia kanyaka Bohumukhi paam" [konyoka] established with the objectives of integrated farming practices, but due to the low quality of soil, area has facing various problems in the agricultural sector as well as in the other sector. Due to which a large amount of impact has

shown in terms of its inputs and outputs. The study area is facing other environmental problems like flood, sand deposition, erosion in rainy season.

During the study, it has also founded that the poverty of the surrounding area is one of the noticeable problems of kanyaka. But they have taken various steps to poverty alleviation in the study area. Most of those steps have, however, had little to no impact and have shown no signs of sustainability in the community. According to Edwards and Hulme (1992:130), despite the growing reputation that Non-Governmental Organisations (NGOs) have won for themselves and their work for a few years, their contributions to development remains limited. As a result, there are various evaluations for determining the success of income-generating projects as they fall under the category of NGOs.

In an attempt to eradicate poverty, the kanyaka Bohumukhi paam has funded many income-generating activities to improve their economic activities within communities. These income-generating activities were introduced as one of the poverty-alleviation strategies. Thus, income-generating activities are supported by the kanyaka with the intention to contribute towards poverty alleviation. However, despite such activities, poverty remains high in the surrounding region of kanyaka and it is not clear whether these activities are actually doing what they originally set out to do. Thus, identifying the income-generating activities supported by kanyaka by checking whether or not they are effective in the alleviation of poverty in the communities is a positive check or negative check. Hence, this study attempted to identify these income-generating activities and their inputs and output results.

1.2 Objectives

1. Identification of various income generating activities supported by Kanyaka agro-farm.
2. To find the income generating activities in terms of its inputs and outputs.
3. To find the market accessibility of kanyaka farm to its nearby area with special reference to Tezpur town.

1.3 Research question

1. What are the income generating activities supported by “Bharaliparia Kanyaka Bohumukhi Paam” [konyoka]?
2. Is kanyaka market is benefitted by its nearby areas

1.4 Database & Methodology

According to kothari (2004), research methodology is systematic way used by researcher to solve a research problem. The author further defines research methodology as the science of establishing how the research has done (kothari 2004). This research methodology is the philosophy or general principle which guides the research.

The Database & Methodology are the techniques that were used to collect data from the authorities and institution for this study. Questionnaires and the personal interviews were the instrument that used to collect data for the research purpose. The study was based on both primary and secondary sources.

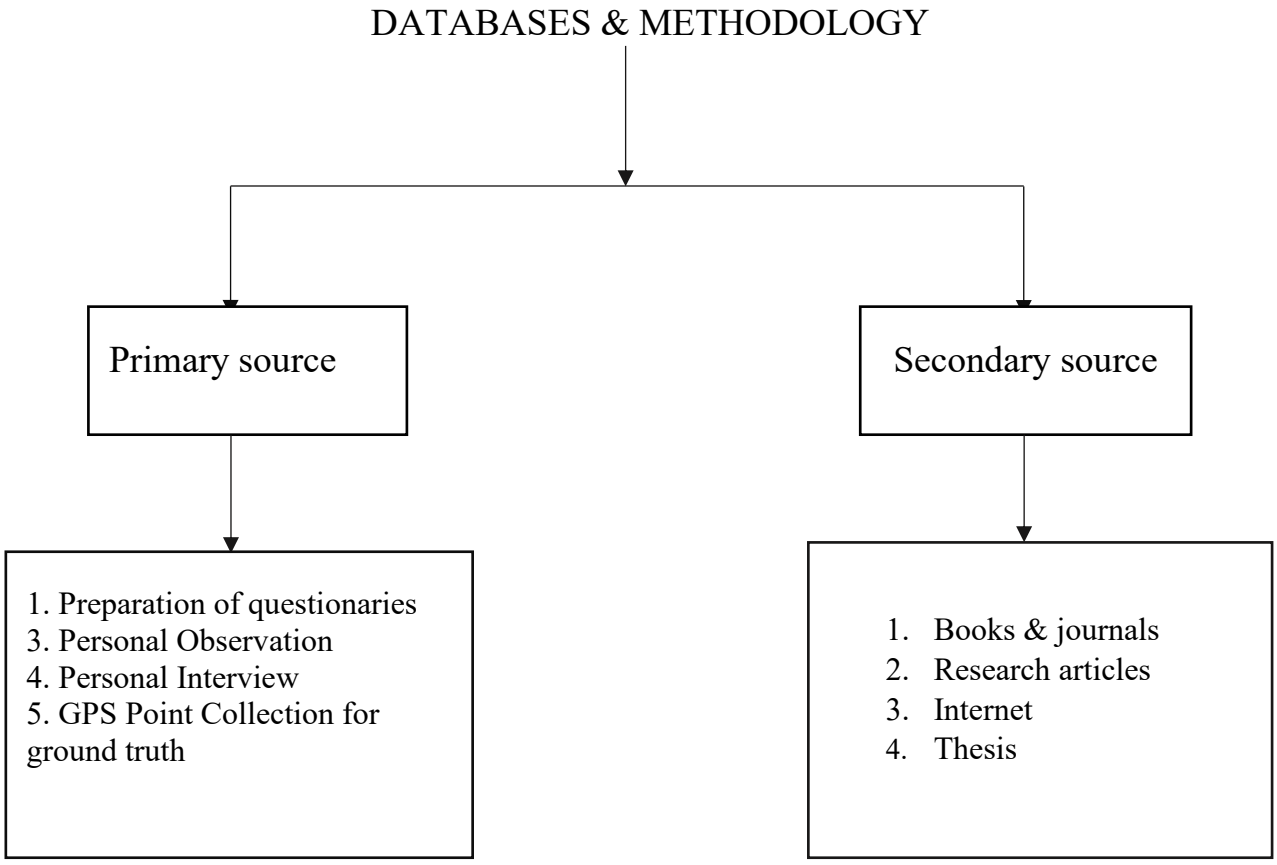


Figure 1.1: Database & Methodology

Primary source of data:

As the present study was based on both primary and secondary data source. The Primary data were collected by interview on 26th of February and 17th of march, 2023 at "Bharaliparia Kanyaka Bohumukhi Paam" [konyoka]. The data were collected through personal interviews

with the authorities and official members of the institute as well as hotel managers and the distributor of the goods.

Methodology:-

The methodology used in dissertation, the data were collected with the help of questionaries after the collection of different types of information about the income generating activities such as agriculture, pisciculture, dairy farming and etc. and then these information were tabulated in different categories. After the tabulation of those information in different income generating activities, I have prepare different simple graph, pie charts using mx excel.

1.5 Review of literature

In any research projects it is essential to understand what has already been done in the specific topic that researcher choose and what has been done in the wider subject area of that topic. A Literature review is a text written by someone to consider the critical point of current knowledge including substantive findings as well as theoretical and methodology contributions to a particular topic. Literature reviews are secondary sources, and as such, so no report any new or original experimental work. According to Kothari (2004), a literature review helps the researcher to discover important variables relevant to the topic and identifies relationships between ideals and practice.

Therefore, the researcher of this study conducted a literature review related to income generating activities in order to learn new ideas and sharing findings of others; and the impact of income generating projects, specifically in respect to agriculture, dairy farming, poultry farming, and how such projects have managed to improve the livelihood of a community. This study also focuses on the issues of poverty and the concept of income generation.

Assessing the impact of the income generating projects funded by the department of social development in Uitenhage, eastern cape" by Phatheka Patience Charles (2019), the author showed the result from this study that there are different income-generating activities and that all have need for regular monitoring and evaluation visits from officials from the Department. Project members also need training in financial management so that they do not mismanage their project finances. The research findings further indicated, clearly, that strategies currently

used by the Department are not effective enough to achieve the desired goals of poverty alleviation.

The Establishment of an Income Generating Project for Ujirani Mwema Women Group. A Case Study of Migera – Bukoba Municipal – Kagera" by Beatrice Valence (2016), in this research paper the author focused on to find out the resources and opportunities for establishment of income generation activities for Ujirani Mwema Women group. In this research paper he also focused in the source of women income in the community and the challenges facing by women to participate in the income activities.

Assessing the Impact of income generating activities toward development of coastal communities in Tanzania: A case of Pangani District Council", Tanzania by Rose Peter Kasikazi (2015), Basing on the studied area, the researcher opined that, entrepreneurship is the engine of economic growth and development of people. Entrepreneurship has a greater potential to reduce poverty among coastal communities of Tanzania through their own initiatives; joint efforts; time and resources in order to improve standard of living of uneducated and poor people who are characterized by low income and expenditure; poor nutritional status; low education attainment; lack of representation; and inequitable share of power in household decision-making. The main activities found to be carried out at Pangani district council were; agricultural activities; animal husbandry; whole sale distribution; fishing activities; retail business; and service businesses. *R.P Kasikazi (2015).*

Perfomance of income generating-projects supported by Botswana National Literacy Programme"(BNLP), by Antoinette Tsheboeng Motiki (2006), The aim of this study was to investigate the performance of income generating projects supported by BNLP in relation to projects meeting member' objectives, group dynamics, economic growth, members' health status, commitment to the projects etc. In this paper the author showed the results of this study supported this hypothesis to a great extent in that causes of failure of the projects were because the personal objectives of project members were not met, there was a problem of group disputes among members, ill health of some members was affecting their production, literacy skills learnt in literacy and income generating skills provided by BNLP were not adequate to be used in the running ofthe project and business skills are taught separately from the basic literacy skills of reading and writing and numerac; *A.T. Motiki (2006)*

"Income generation schemes for sustainable development of tribal women" by "Pacha Malyadri" (2020), In this study the author found that incomes are improved phenomenally after availing welfare schemes targeted at tribal women. However, the tribal women are needed to facilitate awareness of various schemes on circulation by the Government. The known income generation schemes were impacted positively among few tribal women and they have expressed satisfaction as there was significant empowerment in their livelihoods; *Pacha Malyadari (2020).*

"River as a source of income generation: a case study of the river Kapili in Marigaon, Assam, India" by "Monoj Kumar Jaiswal, Panchi Devi and Bharati Dutta"(2013), In this study the author's found that the not only beneficial for water supply and aquatic economic activity but also it provides necessary materials like suitable mud for making potteries and bricks. The river is one of the economic lifelines of the district; *Monoj Kumar Jaiswal, Panchi Devi and Bharati Dutta (2013).*

1.6 Study area

The society "Bharalipara Kanyaka Bohumukhi Paam" (Konyoka) was incorporated September 2016 with an objective of starting multi-cropping projects in 2000 acres of barren land on the flood plains of Jia Bharali river. It is located at Sheelabandha Gaon Panchayat in Sonitpur District of Assam. Kanyak Multipurpose Farm is located between **26°44'16"N** to **26°46'30"N** latitude and **92°52'30"E** to **92°53'45"E** longitude in the Eastern Himalayas. Kanyaka Multipurpose Farm is bordered by Dholaibil Kendra to the north, Jamugurihat and Goal villages to the south, Chaki Ghat and Gataimra to the south and Bharali River, one of the tributaries of the mighty Brahmaputa River, to the west. The kanyaka bahumukhi paam was transformed over approx. 7.454 km of arid land into lush field by starting a multi-cropping initiative.

The study area "Kanyaka Bahumukhi paam" was built by local MLA Padma Hazarika, and he also constructed a substantial guard dam to prevent flooding from the Bharali river during the rainy season.

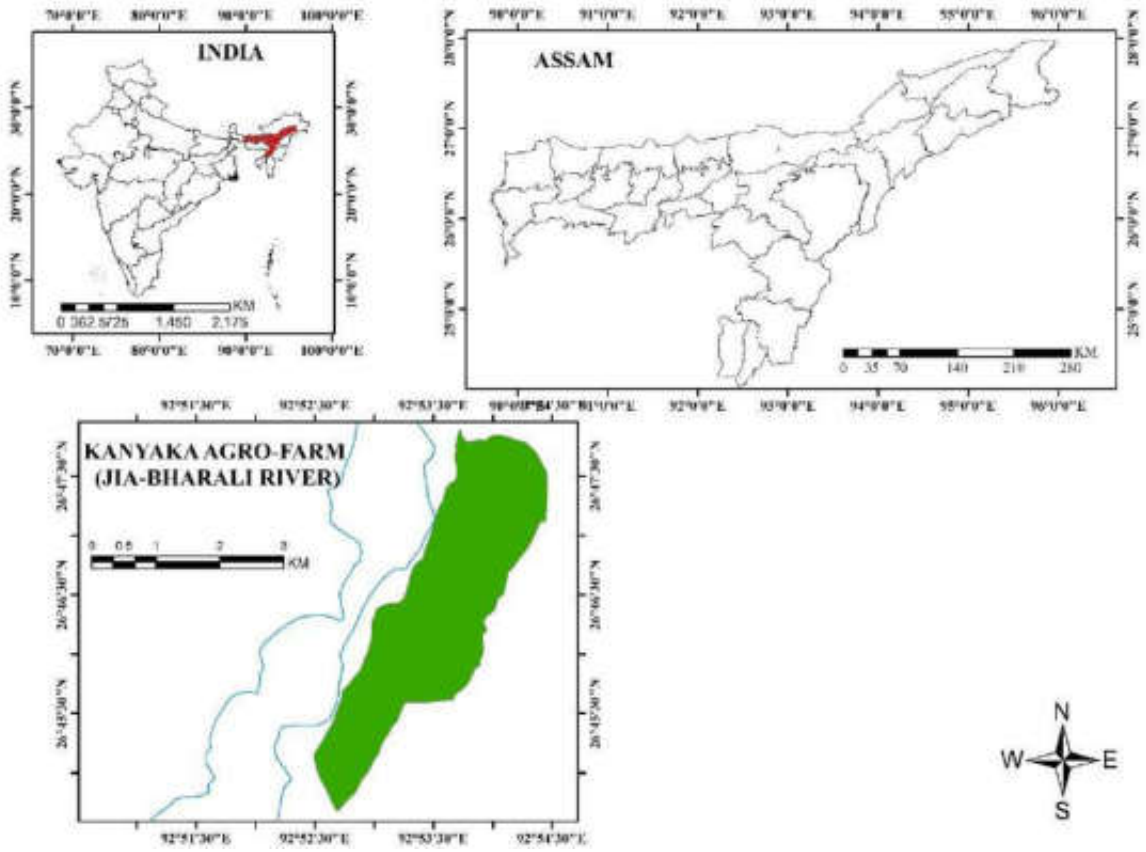


Figure 1.2: Location map of the Study area

1.7Significance of the study

Field study is the observing and collection of data about socio-economic, cultural and the natural environment and this allow us to collect the data about the dynamic place of the "Bharalipara Kanyaka Bohumukhi Paam" in Sonitpur, District of Assam. The significance of the study depicts the reasons for the researcher to undertake a particular study. Some significance of the study are as follows-

- The information obtained from the study area is useful to planners who are responsible in policy formulation as they are informed of the need of developing appropriate policies for the purpose of income generation.
- The study can be provide a valid information about the job opportunities for the people of surrounding area.

- The Local people mainly survives from the agricultural sector, while the study area provide agriculture as the important income generation activity.
- The study has strategized the approaches that the government can use to bring about sustainable development to the local community of Sonitpur District Council.

1.8 Organization of the study area:

In this dissertation it consists of four different chapter-

The first chapter incudes the introduction of the study which includes the statement of the problem, objectives, research questions, review of literature, study area, significance of the study, etc.

The second chapter includes the geographical background of the study area which consist of physical setting, location of the study area, and economic characteristics of the study area.

The third chapter includes the analysis of the study which indicates of over view of the study.

The fourth chapter includes synthesis of the study area consisting findings. Suggestion, summary and conclusion.

CHAPTER 2:

GEOGRAPHICAL BACKGROUND OF THE STUDY AREA

2.1: Location of the study

Kanyak Multipurpose Farm is located between 26°44'16" to 26°46'30"N latitude and 92°52'30" to 92°53'45"E longitude in the Eastern Himalayas. Jamugurihat is a large cultivated area in Sonitpur, Assam, about 6 km from Jammugurihat. The area extends about 4.5 km from north to south and 2 km from east to west. The elevation at Kanyaka farm is between 300 feet and 320 feet.

Kanyaka Multipurpose Farm is bordered by Dholaibil Kendra to the north, Jamugurihat and Goal villages to the south, Chaki Ghat and Gataimra to the south and Bharali River, one of the tributaries of the mighty Brahmaputa River, to the west.

2.1 Physical settings

2.1.1 Physiography

On the eastern bank of the Bharali River, there is a large area known as Kanyaka Bahumukhi Pam that spans about 2000 bighas of land. Additionally, it is located in the Jammugurihat subdivision of Assam's Sonitpur district. Rolling hills, lush plains, and a large number of water bodies make up the region's physiography.

Located in the foothills of the Himalayas, this vast area is surrounded by small hills and flood plains. The area is covered with a variety of vegetation and is home to a variety of plants and animals. The plains, on the other hand, are used for agriculture and mainly for the cultivation of multiple crops.

The area also has several water bodies including rivers, streams and ponds. The longest pond can be found in this area with a length of about 4 km. The region is a well-loved tourist destination and a significant supplier of local multi-crops and other products.

Overall, the anatomy of Kanyaka Multipurpose Farm in Jamugurihat is characterized by its diverse topography, fertile plains, and abundant water resources, which make it an ideal location for agriculture and tourism.

2.2.2 Drainage

The kanyaka Bahumukhi Pam is located on the easter side of Bharali River. The Bharali or Jia Bharali (also known as Kameng) is a tributary of the Brahmaputra River in the Indian state of Assam. The Bharali River originates in the hills of Arunachal Pradesh and flows through the city of Tezpur before joining the Brahmaputra River. This pam covers 1,100 bigha of water, the most of which are ponds and beaches. A little more than 4 kms long, it also has the longest pond.

That's interesting! It seems like there have been some significant changes in the area due to the Kanyaka Pam Project and the efforts of local farmers. Let's break down the sequence of events:

1. Initially, there was a stream of the Bharali River flowing through the area.

2. The Kanyaka Pam Project was initiated, which involved damming the mouth of the stream to separate it from the Bharali River.

3. The purpose of this damming was to prevent any disruption to the ongoing Kanyaka Pam Project.

4. As a result of the damming, the stream was separated from the Bharali River and likely lost its natural water flow.

5. Over time, without a consistent water supply, the stream dried up.

Additionally, you mentioned the efforts of local farmers in improving the soil in the area. It's commendable that their hard work has made the soil suitable for various crops. They may have employed various techniques such as soil conservation practices, organic farming methods, or irrigation systems to enhance the soil quality.

Overall, it seems like the Kanyaka Pam Project had an impact on the stream and its flow, but the efforts of local farmers have helped transform the sandy soil into fertile ground for growing different crops.

2.2.3 Climate

In Assam's Jamugurihat Sonitpur district lies a place called Kanyaka Bahumukhi Pam. The Kanyaka region has a humid subtropical climate, which is distinguished by hot, muggy summers and moderate winters.

The average temperature in Kanyaka or Jamugurihat ranges from 20°C to 30°C throughout the year Summers lasting from March to June are hot and humid. Temperatures range from 25°C to 35°C. The monsoon season from June to September is characterized by heavy rains and high humidity. Lasting from November to February, the winters in the Cognac region are mild and pleasant, with temperatures ranging from 10°C to 20°C. In winter, the region receives moderate rainfall.

Overall, Kanyaka Multipurpose Farm experiences a warm and humid climate throughout the year, with the heaviest rainfall during the rainy season.

• **RAINFALL**: Jamugurihat, located in a tropical monsoon climate, experiences heavy rainfall throughout the year. The average annual rainfall in Jamugurihat is approximately 2,500-3,000 millimeters, with the monsoon season lasting from June to September. The town receives the highest amount of rainfall during this period, with July and August being the months with the heaviest rainfall, averaging around 400-500 millimeters of rainfall each month.

After the monsoon season, Jamugurihat experiences a brief spell of post-monsoon showers in October and November. The winter months, from December to February, are relatively dry with occasional light showers.

The rains in Jamuguruthat are important for the agricultural and horticultural industries in the region. Heavy rainfall helps the growth of crops like tea, jute, and rice, which are important agricultural commodities in the region. However, excessive rainfall can also cause floods and landslides, which can cause loss of life and property.

Overall, rainfall in Jamugurihat is an important aspect of the city's climate, and plays an important role in shaping the natural and social environment of the region. This is an increase from the previous figure of 2.500 mm for March 20, 2023. From June 2018 to March 21, 2023, 1715 observations have been made, and the normalized data average is 3.400 mm. On April 13, 2021, the data reached an all-time high of 90.200 mm and on January 22, 2023, a record of 0.000 mm.

• **TEMPERATURE:** The year-round average temperature in Kanyaka or Jamugurihat is between 20°C and 30°C. The warm and muggy summer season, which lasts from March to June, has temperatures between 25°C to 35°C. From June to September, the monsoon season is characterized by a lot of rain and a lot of humidity. With temperatures ranging from 10°C to

20°C, the winter season in the Kanyaka region, which lasts from November to February, is moderate and pleasant. During the winter, there is moderate rainfall in the area.

2.2.4 SOIL

Kanyaka is a multi-purpose farm and land in the surrounding area predominantly.

Alluvial soils, which are formed from the deposition of sediments by rivers and streams. Alluvial soils are generally fertile and well suited for agriculture, as they have a good balance of nutrients and are able to retain moisture well. However, soil fertility and characteristics can vary depending on the location and type of sediment deposited.

The alluvial soils in Kanyaka Multipurpose Farm and its surrounding areas are generally suitable for the cultivation of a variety of crops including rice, sugarcane and vegetables. The soil is generally loamy with a medium to high fertility level. Initially, the soil in the area was sandy and later, due to the hard work of local farmers, the soil became suitable for various crops.

But like other agricultural areas, Kanyaka multipurpose farm soils can be affected by factors such as erosion, soil degradation, and overuse of fertilizers and pesticides Proper soil management practices, such as crop rotation, conservation tillage, and organic farming, soil fertility and can help maintain health.

2.2.5 GEOLOGY

The geology of the region is characterized by the presence of Tertiary and Quaternary rocks and sediments. The Tertiary rocks, which are about 50 million years old, mainly consist of sandstones, shales and claystones of mud formation. These rocks were deposited in a fluvial environment during the Eocene.

Overlying the Bokabil Formation is the Sylhet Limestone, which consists mainly of calcareous rocks. The Sylhet Limestone is likely to have been formed later than the Bokabil Formation, although its precise age is not indicated.

The Quaternary sediments in this area consist of alluvial deposits originating from the Bharali River located to the west of Kanyak Palm. These deposits consist of sand, silt, and clay. Aquatic deposits occurred during the relatively young Pleistocene, which occurred about 2.6 million to 11,700 years ago.

In summary, Kanyak farm is located in an area characterized by tertiary and quaternary rocks and sediments, with the presence of alluvial deposits from the Bharali river.

2.2.6 Natural vegetation

One place with a variety of plant types is Kanyaka Multipurpose Farm near Jammugurihat. The vegetation in this area is cultivated by a variety of local or scientific methods, including semi-evergreens, deciduous plants, grasslands, barren lands, and marshes, as well as semi-evergreen vegetation is characterized by a mixture of evergreen and deciduous tree species . Some of the common tree species found in this area are the hollow tree (Terminalia myriocarpa). Sal tree (Shorea robusta), Aquarius (Careya arborea). Tita tree (Mallotus philippensis) Amari tree (Chukrasia tabularis). The golden tree (Cassia fistula). Poma tree (Ficus hispida), Simolu tree (Bombax ceiba). Gomari tree (Gmelina arborea) etc. Deciduous plants are characterized by a mixture of deciduous trees and shrubs. Some of the common tree species found in the area include sal tree, Indian rosewood, Indian gooseberry, Indian coral tree, semal tree, Indian fig tree, ban tree, teak tree, etc. The grasslands are found in open areas and are dominated by 300 hyas grass species such as Imperata cylindrical, and Saccharum spp. Wetlands, marshes, and bogs are also found in the Kanyaka Multipurpose Farm area. These areas support a variety of aquatic plants, such as Nelumbe nucifera. Eichhornia crassipes, and Hydrilla verticillata.

Overall, the Kanyaka Multipurpose Farm area near Jamugurihat is an area of diverse and unique vegetation types, reflecting the diverse topography and climate of the region.

2.4 Economic resources:

2.4.1. Agriculture resources

The agricultural resources along the Bharali River have been flourishing for the past year, with nearly 2000 bighas of land supporting the growth of various crops such as bananas, lemons, watermelons, and vegetables. The region is witnessing the blooming of numerous crops, including cabbage, potatoes, black gram, mustard seeds, sesame (til), brinjal peas, wheat, cauliflower, pumpkin, bottle gourd, and other green vegetables. This diversity of crops has given the land a fresh and vibrant appearance.

To support the agricultural activities, more than 300 agricultural employees are engaged in fieldwork throughout the day. The farm has been successful in the agricultural sector due to the cultivation of a variety of crops. Additionally, the farm places emphasis on vermicompost initiatives, highlighting the organic aspect of the region's agricultural industry. Farmers have

also been providing guidance on healthy farming practices, along with the sale of organic inputs.

By focusing on diverse crop cultivation, organic initiatives, and providing knowledge on sustainable farming practices, the agricultural resources along the Bharali River have been able to thrive and contribute to the region's agricultural sector.

2.4.2. Water resources

It is located on the Bharali River's bank, which is a branch of the river Brahmaputra.

The Bharali River is a significant water source for the local populace. Because it is a perennial river, it is in continuous flow. The river travels through Arunachal Pradesh before entering Assam and has its source in the Himalayas. It is renowned for its crystal-clear water, which is used for a variety of residential and agricultural uses as well as for fishing.

In addition to the Bharali River, there are several small streams and springs in the area that provide water for various purposes. The people of the area also practice rainwater harvesting to conserve monsoon water, which is the main source of water for the area.

CHAPTER 3:

ANALYSIS

3.1: Concept of income generating activities

Income generation can help to overcome food insecurity when economic factors are a fundamental cause of food insecurity and when food is available in local markets but lack of money is the main difficulty faced by the vulnerable population. The food security programs aim to help the population survive today, but also to live better tomorrow, and in this sense the income generating activities serve as important alternatives. Income generation simply means gaining or increasing income or money that an individual or business receives in exchange for providing a good or service after investing capital. It can also be defined as small scale projects that create an income source to individual beneficiaries or beneficiary group whilst promoting; the principal right of self-determination and the objectives of integration, reputation and re – integration [FAO-2011].

It should be noted that income-generating activities can take many forms. Originally, the term was used only by economists to explain the intricacies of a nation's economy. However, it is now quite widely used to cover a range of productive activities by people in any given community. Thus, in the current context, income-generating activities simply means those activities affecting the gaining or increasing of income by an individual person or community.

According to Niekerk (2009), income generating activities are the activities focused on creating opportunities for communities to productively use locally available resources to develop less state dependent, more self-reliant households and communities able to care for themselves. Income generating activities focuses on using locally available resources to the benefit of the entire community. In addition, income generating activities provide additional benefits that reduce poverty; improve the wellbeing of the communities as well as empowerment, self-reliance and community development (Mehra, 1997).

According to Revolving Loan Fund report (2002), income generating activities are „small-scale projects that create an income source to individual beneficiaries or beneficiary groups whilst

promoting the principal right to self-determination and the objectives of integration, repatriation and re-integration. Danish Refugee Council (2002) uses the notion of income generation relatively broadly and as a cover term for a wide variety of activities such as micro-credit; grants; skills- and vocational training; business training; cash or food for work (asset creation) schemes; local economic development initiatives; and even small- and medium enterprise development.

In the strict sense of the term, income generation activities are aimed at creating a financial income. Income generating activities however, may also aim at positive effects in terms of empowerment, self-reliance and community development (Ison, 1996).

According to ACF International (2009), there are three ways income can be generated:
Firstly, income-generating activities do not always mean immediate monetary gain, although, in the end, money is used to place a measurable value on the goods and services people produce. An example of an income-generating activity which does not lead to initial monetary gain would be a situation where a productive person produces enough food to feed him- or herself as well as his or her family. In such a case, skills have been used to meet immediate needs and, thus, monetary savings have been achieved. Furthermore, a monetary value can be placed on the food produced and, in this way, the food can be viewed as an income (ACF International, 2009).
Secondly, a person can generate income by the astute investment of existing resources. An example of such income generation would be the development of a piece of land through planting a crop for sale. The money gained from selling the crop would be considered income. Another example would be an indirect form of investment through bank savings or the purchase of part of ownership (i.e. shares) in a productive enterprise such as a business. Money generated from such investments is then deemed income (ACF International, 2009).
Thirdly, people can generate income by using their skills to serve others person, who then pay them for the use of those skills. That is, individuals can utilise their skills to earn wages. Such 'skills-for-wages' income can be generated in various ways, for example: through self-employment, working for others, or by adding to personal resources through investment (ACF International, 2009).

Finally, according to the United Nations Development Program Report (1997), the limits of a welfare-oriented response to the growing poverty crisis are well-recognized. Therefore, many development agencies and governments are increasing their emphasis on assisting people

to secure income through their own efforts, rather than relying on state welfare and subsidies. Such approaches are often categorised as income-generating activities and cover initiatives as diverse as small business promotion; cooperative undertakings; job creation schemes; sewing circles; credit and savings groups; and youth training programmes. It is sometimes argued that, education and health provision; legal and political changes; and global economics also all affect the abilities of people to secure an income.

'Income-generating activities' refers to activities focussed on creating opportunities for communities to productively use locally-available resources in order to develop less state dependent and more self-reliant households and communities that are able to take care of themselves. Thus, income-generating activities focus on productively using locally-available resources as a means of benefitting the entire community (Richard, 2012:14).

3.2 Types of Income Generating Activities (I.G.A)

For most people around the world, generating income is a necessity, and it is done in order for them to survive. In study area they were started generating income activity for the commercial purpose. But unfortunately, these activities become major source of income for the neighbouring area which become most important for the local people to survive. In my study area, I have identified various source of income generating activities, among them 5 income generating activities is taken for the analysis purpose.

3.2.1 Agriculture
3.2.2 Dairy farming
3.2.3 Poultry farming
3.2.4 Swine husbandry
3.2.5 Pisciculture

Table 3.1: Showing average annual income from different sources

Types	Income in lakh	Percentage
Agriculture	38.5	13.53
Dairy farming	193.9	68.15
Poultry	9	3.16
Swine husbandry	2.8	0.98
Pisciculture	40	14.05
Total	**284.5**	**100%**

Source: Primary survey, 2023

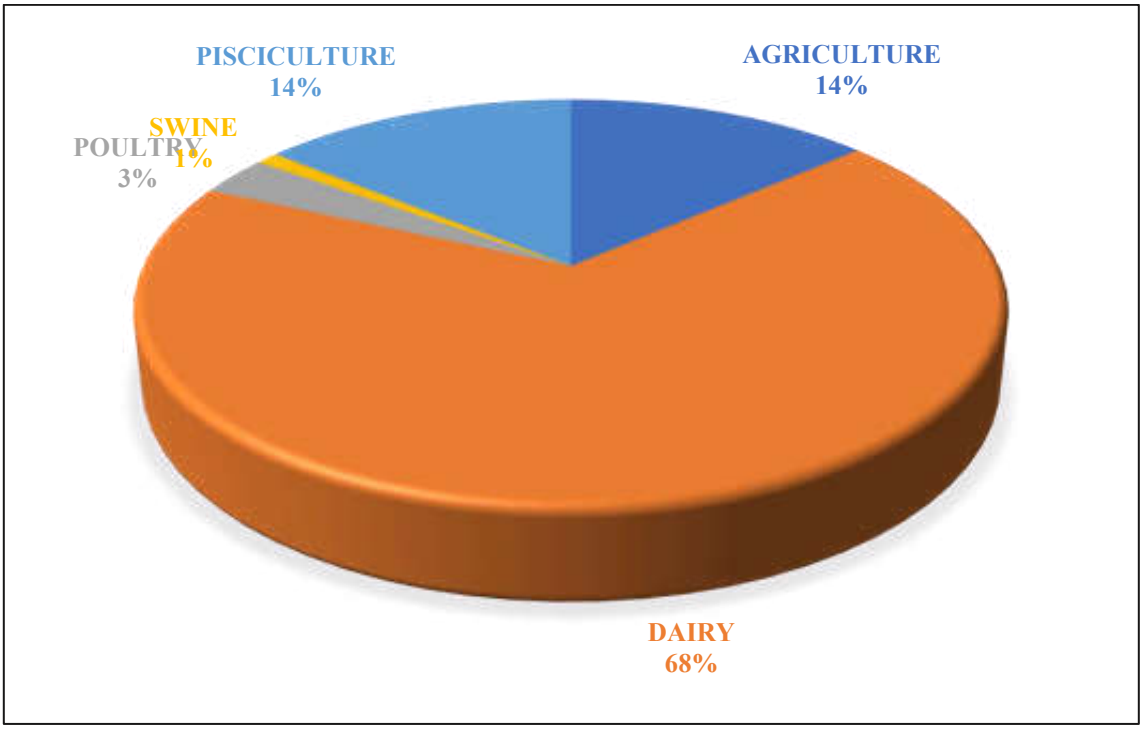


Figure 3.1: Showing percentage wise distribution of income.

The above figure 3.1: showing the percentagewise distribution of income from different sector where 68 percent of income is from dairy farming, and the contributors of the other sources go like this-agriculture 14 percent, pisciculture 14 percent, poultry farming 3 percent, and swine 1 percent.

Table 3.2: Showing permanent employment of different sector in person.

Types	Agriculture	Dairy	Poultry	Swine	Pisciculture	**Total**
Employment	100	24	4	4	5	**137**

Source: Primary survey,

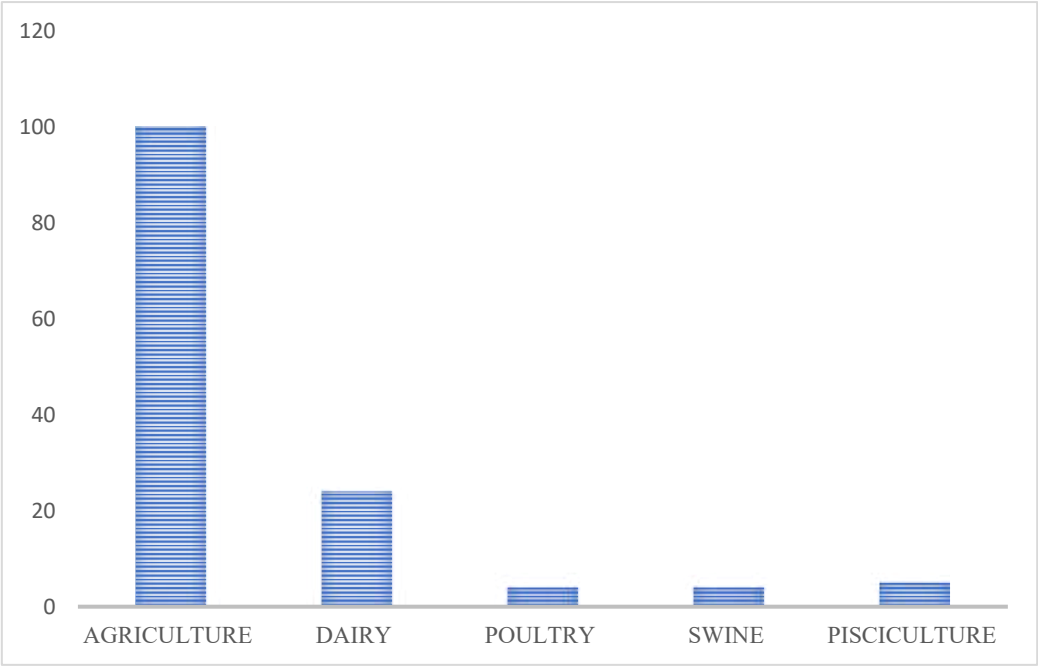


Figure 3.2: Permanent employment of different sector.

The above **figure 3.2:** showing the permanent employment generation of different sector in person where 100 persons is from agriculture and the contribution of other sector go like this- dairy 24-person, poultry 4, swine 4 and pisciculture 5 person.

3.2.1 Agriculture as a type of income generating activity

Agriculture is also considered to be the best vehicle to reduce rural poverty. This is because, in most developing countries, agriculture and agriculture-related activities provide most of the employment in rural areas. Agriculture contributes to poverty alleviation at rural, urban and national levels in the following ways:

- provision of food;
- employment creation;
- increase of real wages; and
- improvement of farm income

As we know India is an agro-based country and most of the countries GDP has came from agriculture sector. In study area agriculture plays a vital role for creating job opportunities for the people of surrounding area through the whole year. The study focuses on some major cultivation of the area which plays an important role for agriculture sector. Such as: -

- banana, rice and mustard cultivation.

➢ **Table 3.3**: Details of major crop cultivation.

Types	Area (Bigha)	Production	Income in lakhs
Mustard	500	2000 mun	20
Rice	700	12 mun	3.5
Banana	40	-	15
Total	**1240**	**-**	**38.5**

Source: Primary survey,

Table 3.4: Details showing income of major crops

Crops	Income in lakhs	Percentage
Mustard	20	52
Rice	3.5	9.09
Banana	15	38.94
Total	**38.5**	**100**

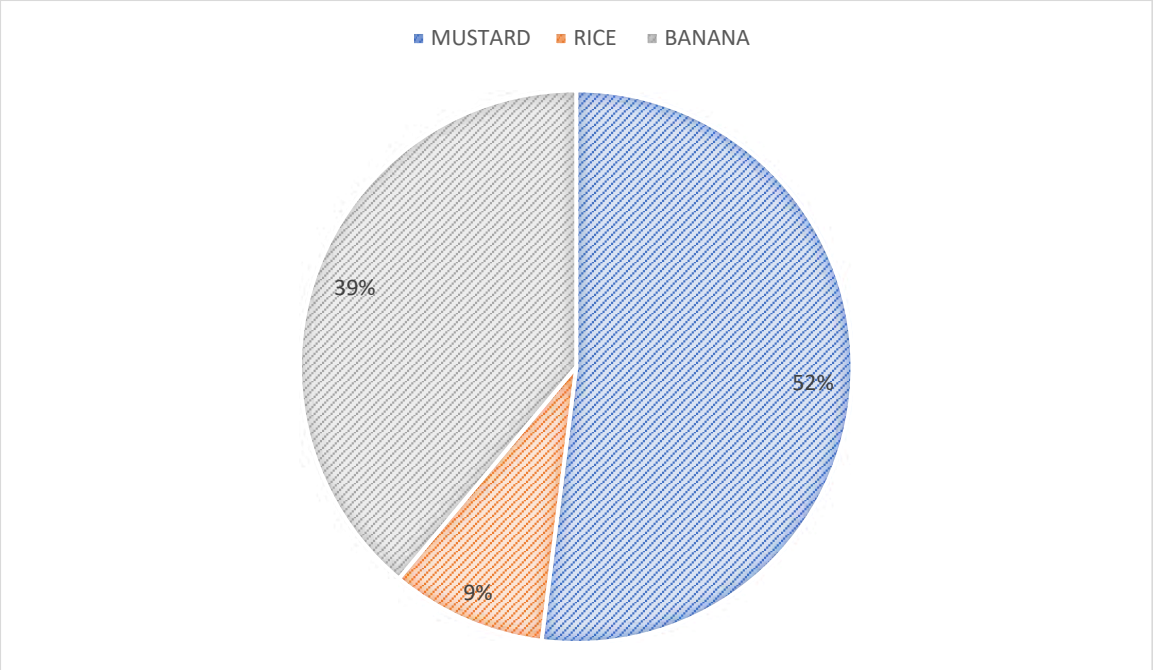


Figure 3.3: Showing income level of 3 major crops

Findings showed that agriculture is one of the main income generating activity of kanyaka. The researcher took 3 major crops cultivation of kanyaka for the study such as Mustard, Rice and Banana. The above figure 1, shows the seasonal income level where a large percentage of income generate from mustard cultivation about 52%, (2 Lakhs), and followed by Banana about 39% (12 lakhs), and Rice about 9% (3.5).

3.2.2 Dairy farming

Dairy farming is the branch of agriculture that encompasses the breeding, raising, and utilization of dairy animals, primarily cows for the product of milk and the various dairy products processed from it.

In study area researcher found two types of dairy farm, such as cow farm and buffalo farm as buffalo's milk is also produced in commercial quantities in India. In cow farm I have identified three breeds of dairy cows such as- Australian, local and Gir for the purpose of dairy products. As pasture is the natural feed for the dairy animals and abundance of good pasture provides most of the requirements of a good dairy ration kanyaka provide a vast area of grassland where cows and buffalo's are on pasture through all the year. Besides the pasture kanyaka also provide some nutrient food to keep the balance of milk production. Disses is one of the greatest problem of the dairy farm, in kanyaka management system includes cleanliness, sanitization, isolation of sick, to keeping premises free of hazards that might couse of injury and infection.

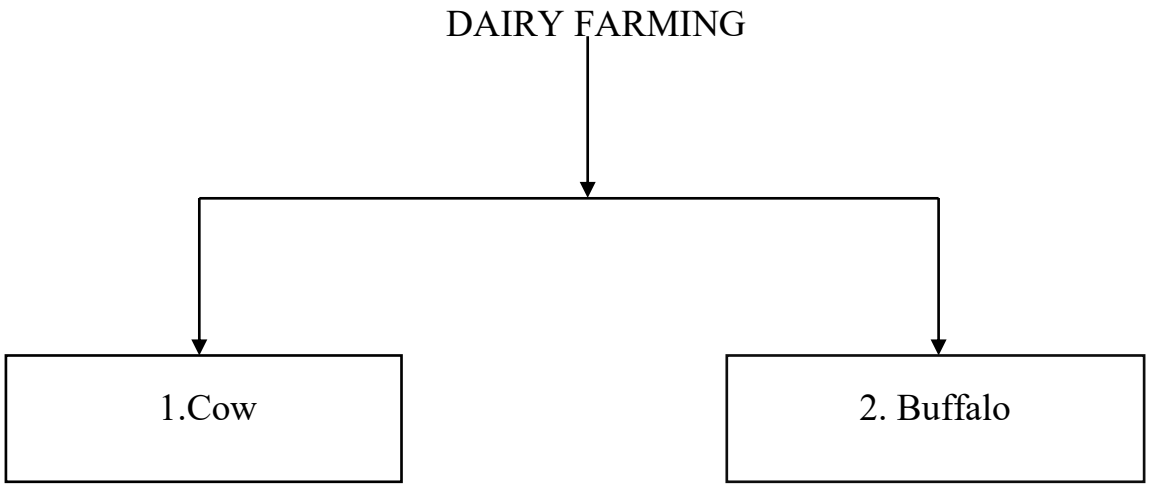


Figure 3.4: flow chart showing the dairy farm of kanyaka.

- **1.Cow farm:**

Table 3.5: Details of cow farm

Species of cow	No. of cow	Annual Milk Production (in litre)	Annual Income	Total income
Local	300	81000	4050000	16,200,000
Australian	280	145800	7290000	
Giri	220	97200	4860000	
Total	800	324000		

Table 3.6: Annual Milk Production

Variety of cow	Annual Milk Production (In liter)	Percentage
Local	81000	25
Australian	145800	45
Gir	97200	30
Total	**324000**	**100%**

Source: Primary survey

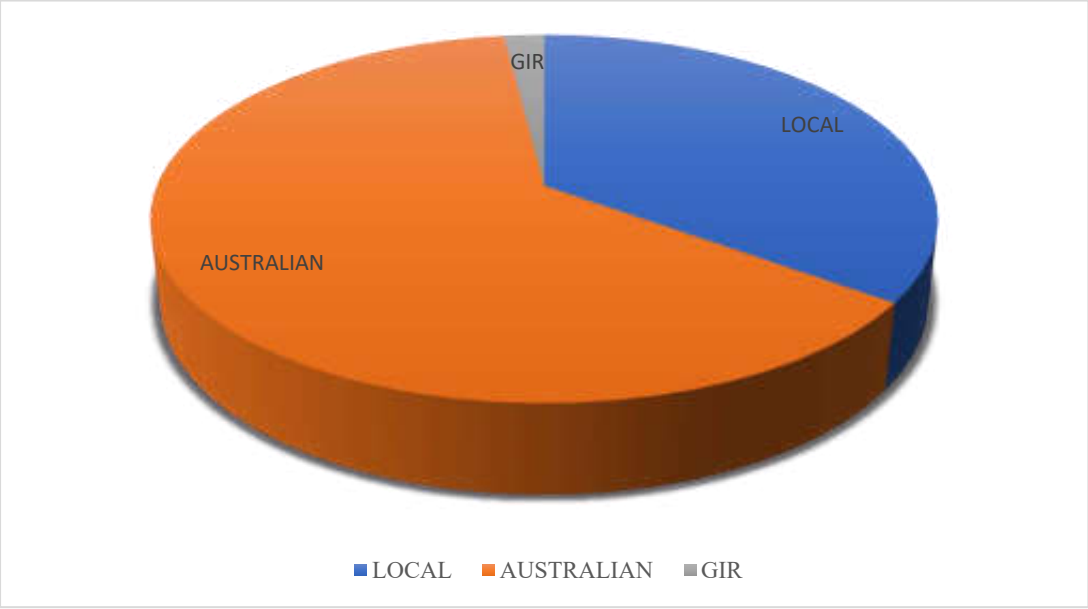


Figure 3.5 : Annual Milk Production

Findings showed that in the cow farm there were total 800s of cows where three main types of cow breeds were seen such as local, Australian, and Gir. The above **figure 5,** showed Annual milk production, where a large percentage of milk were produced by Australian cow breeds about (45%), second highest milk were produced by Gir about (30%), and about (25%) were produced by local cows. From that it is shown the cow farm plays an important role to creating income generation activity where they gave employment to the 18 persons. They earned total annual income Rs. 16,200,000 from 324000 lt. annual milk production.

Plates 3.1: Showing Cow shelter

- **2.Buffalo farm**

Table 3.7: Detail Showing Data set of Buffalo farm.

Income generating activity	NO. of Buffalo	NO. of workers	Annual Milk Production (In Lt.)	Annual Income	Total Income
Buffalo	32	6	36500	2190000	2190000

Source: Primary survey,

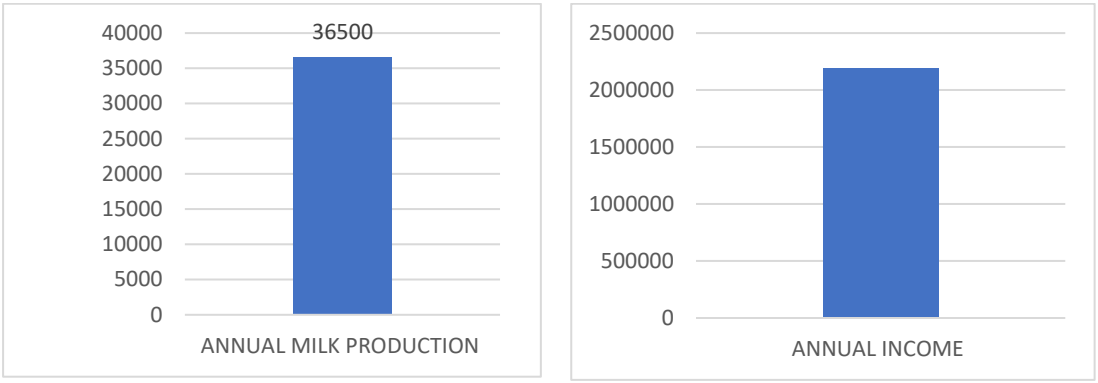


Figure 3.6: showing annual milk production (in liter) and annual income.

From analyzing the above **table 3.7**, and the **figure 3.6** the finding showed that in buffalo farm they produced 36500 liters of milk from the 32 buffalo and their annual income from the farm is Rs.2190000. its also found that 6 working people are engaged in the farm.

Plates 3.2: Showing buffalo farm of kanyaka

3.2.3 Poultry farming

Poultry farming is the raising of birds domestically or commercially, primarily for meat and eggs. Chicken is one of the greatest animals for poultry farming. It's been 10th month of started poultry farming in study area, and the chicken breeds are went from kalkata for the purpose of commercial eggs production. The kanyaka invest in poultry farm about five lakhs and produced best egg quality in north east, about 3700 eggs were produced by kanyaka daily. For the protection of chicken breeds the management used cleanliness and sanitization of the farm. The feeding, watering, egg gathering and cleaning operation are highly mechanized in kanyaka's poultry farm.

Table 3.8: showing data set of Poultry farm

Type	No. of chicken	No. of workers	Monthly Egg Production	Monthly Income
Chicken	4000	03	104160	90000

Source: Primary data

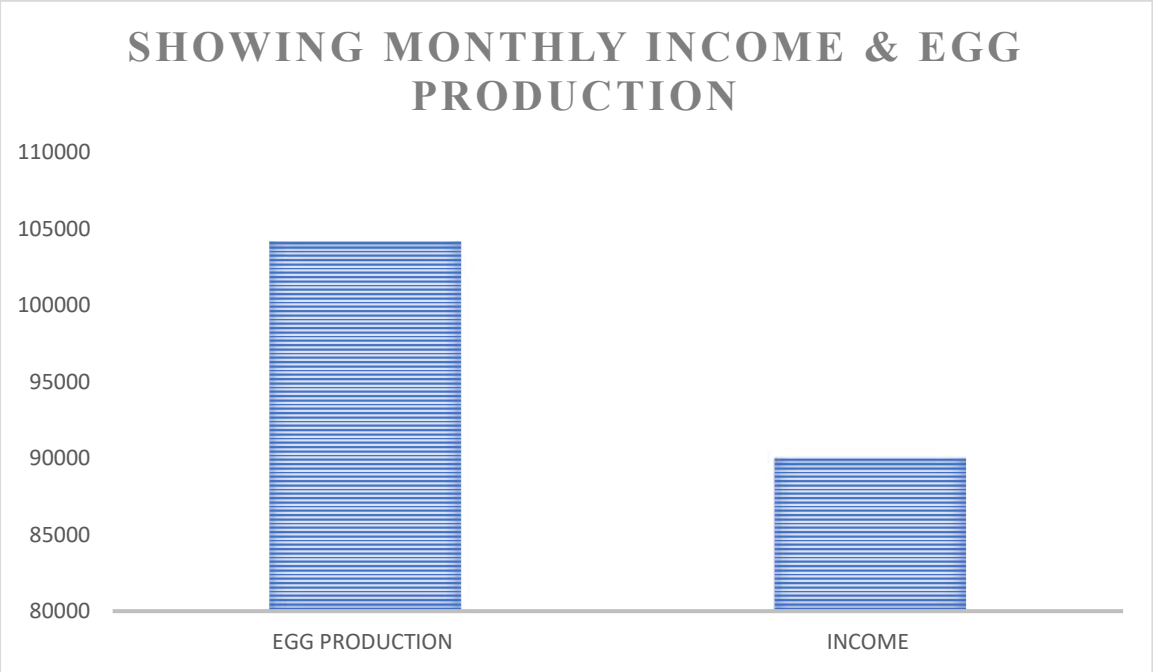


Figure 3.7: Showing monthly income and egg production.

Findings showed in chicken farm that there were 4000 of chicken. The above figure shows monthly egg production and monthly income from the farm. Where they produced total 104160

eggs monthly and monthly income is 90000. From this it can be said that poultry farming plays an important role in generating income sources.

Plates 3.3: Showing poultry farming

3.2.4 Swine Husbandry

Swine husbandry or pig farming is the raising and breeding of domestic pig for the purpose of commercial meat production. Pigs or domestic swine have been raised for their meat since ancient time. In study area researcher have found three pigs farm where three varieties of pig

breeds were seen. Corn is usually the basic feed for the pigs, although the wheat and other foods are often included in their diet. The pigs were supplies to the nearest daily market, chariduar, and sotia market for the purpose of meat.

Table 3.9: Detail showing data set of Pig farm.

Type	**No. of pigs**	**No. of worker**	**Production** (In 3 month)	**Income** (In 3 month)
Pig farm	65	5	40	70000

Source: Primary survey

Table 3.10: Detail showing production of pigs in 3 months.

Variety of pigs	**Production**	**Percentage**
Yorkshire	17	42
Hampshire	09	23
Null	14	35
Total	40	100

Source: Primary survey

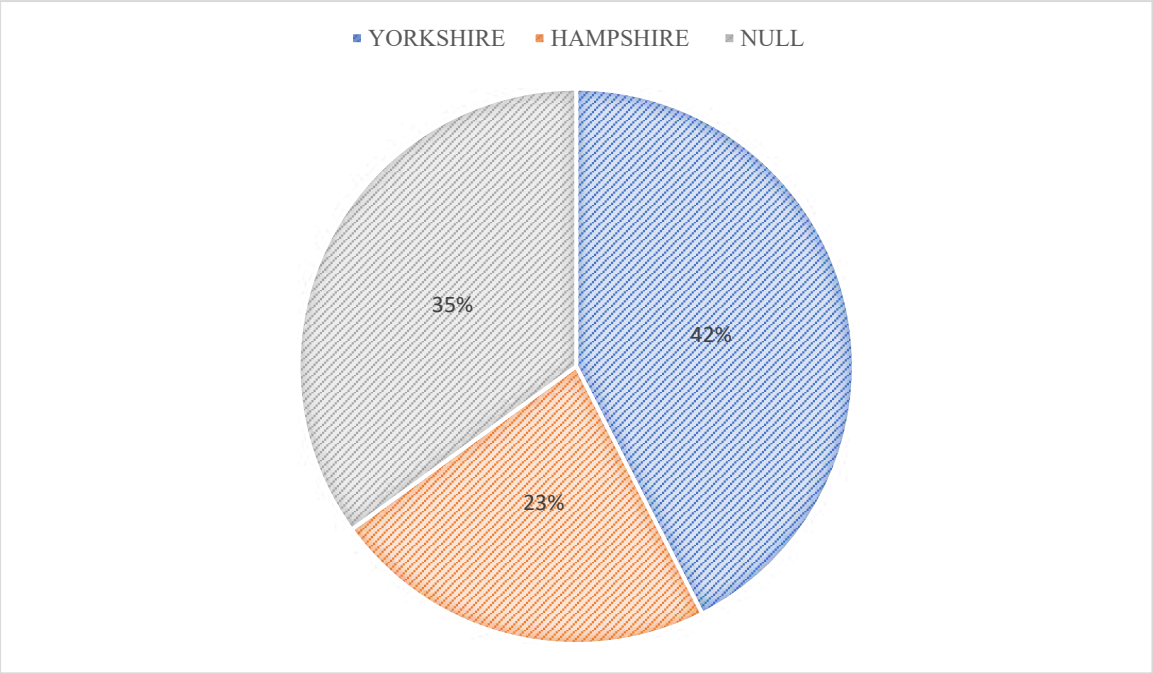


Figure 3.8: Pig Production

Finding showed that in swine husbandry there were total 65 of pigs where 3 main types of pig breeds were seen such as Yorkshire, Hampshire and Null. The above figure shows the pig production in 3 months where a large percentage of pigs were produced by Yorkshire about (42%) and the second highest were produced by Null pig breeds (35%) and about (23%) were produced by Hampshire pig breeds. From that it is shown the pig farm plays an important role

to creating income generation activity where they gave employment to the 5 persons. They earned total annual income Rs. 70000 in 3 months. months.

Pates 3.4: Showing pig farm

3.2.5 Pisciculture

Pisciculture is a process of growing fish and selling it or using its products for domestic or commercial use. Pisciculture provide us fish food, cod liver oil etc. In kanyaka researcher have found a huge area is covered by pisciculture about 11000 bigha's. where they breeds different types of seeds of fishes. They have artificial ponds for pisciculture, and aerator use for oxygen supply to the ponds.

Table 3.11: Details showing data set of fisheries

TYPE OF IGA	NO. OF TOTAL PONDS	NO. OF ARTIFICIAL PONDS	CAPACITY (2022-23)	PRODUCTION (2022-23)	AREA
FISHERY	12	02	10 CR.	15 CR.	11000 BIGHA

Source: primary survey, 2023

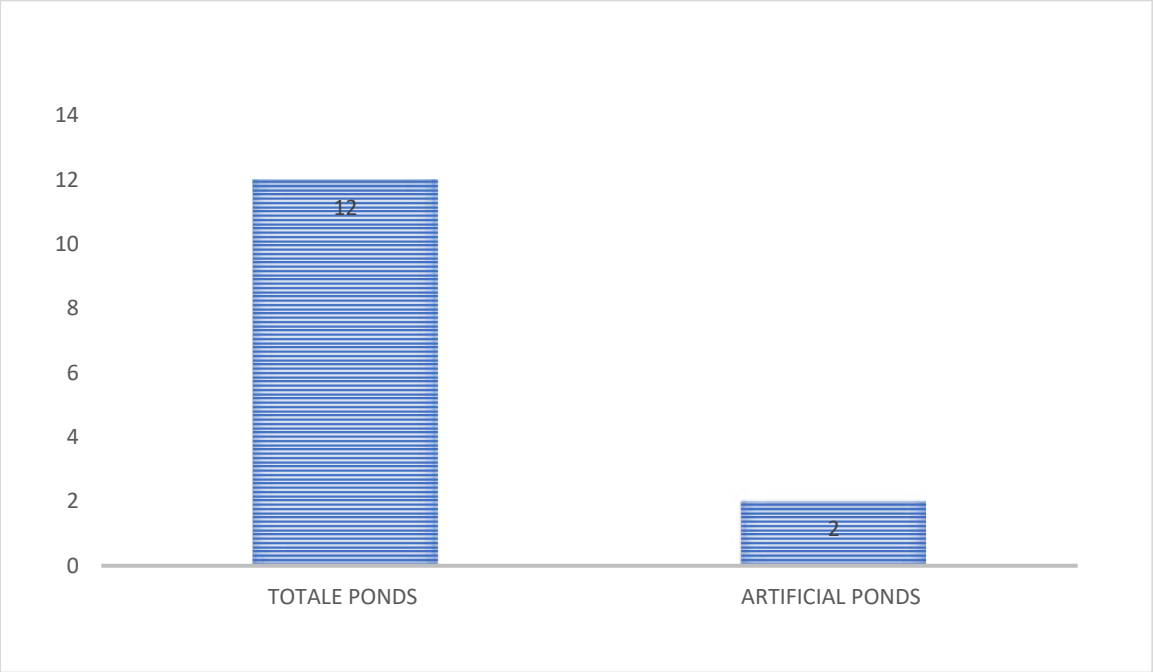


Figure 3.9: Showing no. of total ponds and artificial ponds.

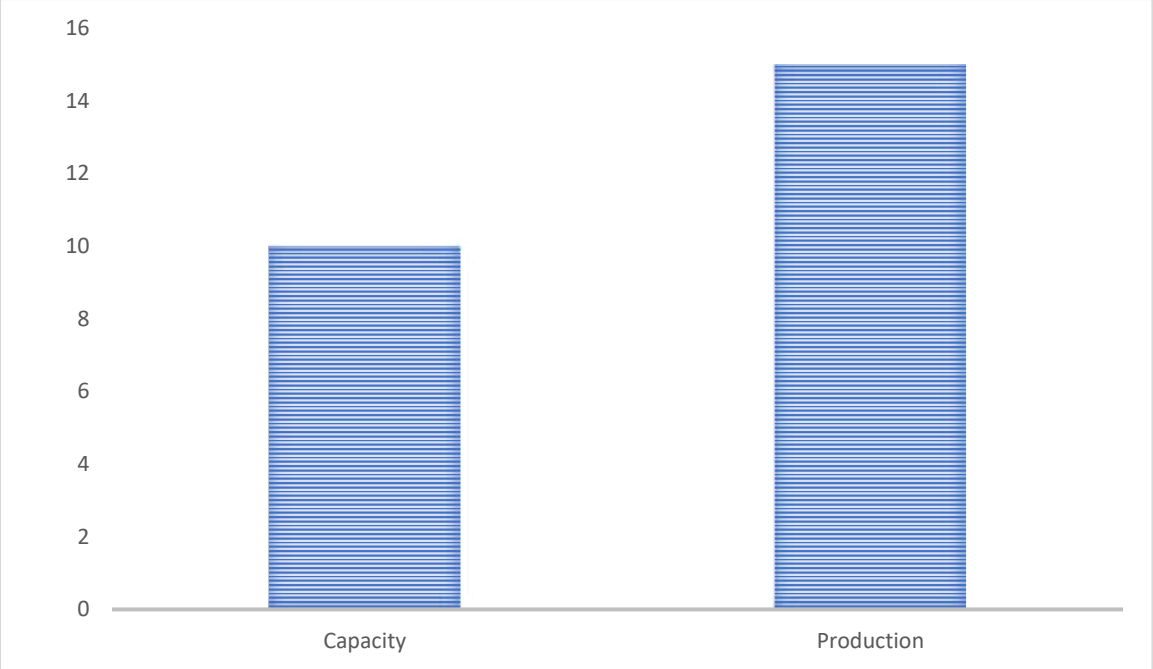


Figure 3.10: showing fishing capacity and production.

Findings showed that the Pisciculture of kanyaka which covers an area about 11000 bigha. The above **figure 3.10,** shows the total no of ponds (12) and the no. of artificial ponds (2). And the figure 8, showed the fishing capacity about 10cr. And the total production of 15cr. In the period between 2022-23 they income Rs. 40 lakhs from this 15cr. Production. Aerator used for oxygen supply to the ponds.

Plates 3.5: Showing ponds

3.3 ROLE OF INCOME GENERATING ACTIVITIES OF KANYAKA IN TEZPUR MARKET:

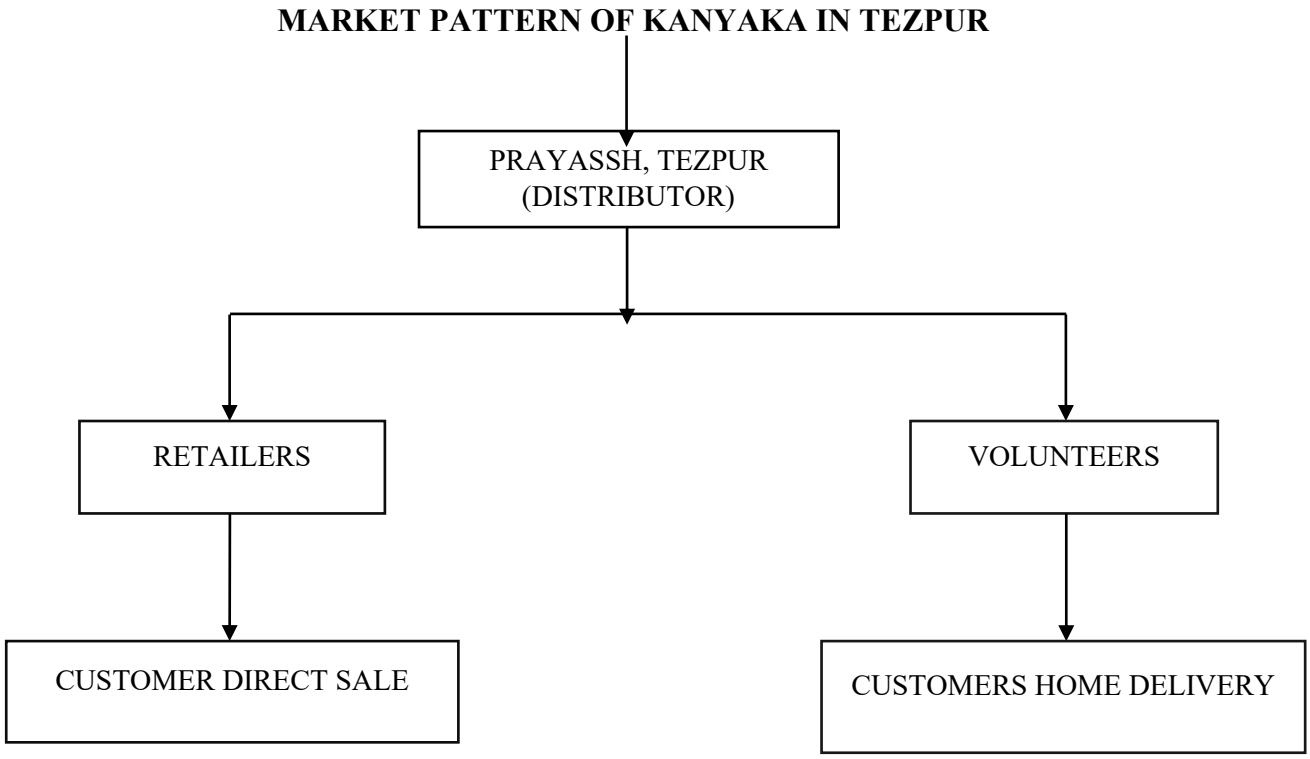
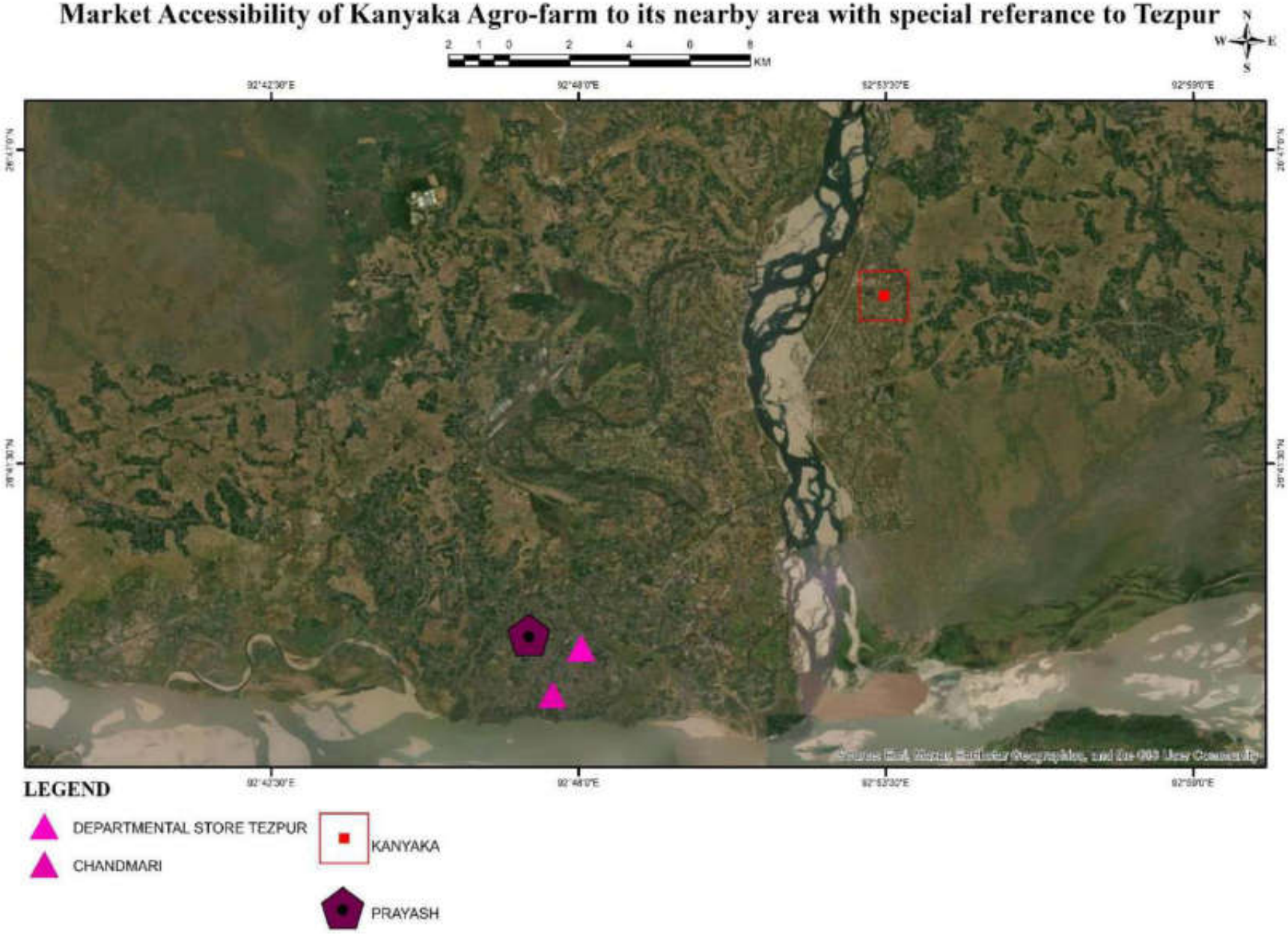


Figure 3.11.: Flow chart showing market pattern of kanyaka in Tezpur.

The society "Bharalipara Kanyaka Bohumukhi Paam" (Konyoka) is covering a large market of surrounding area like Jamugurihat, Tezpur, Dhekiajuli, Sotia, Dhalibil, Balipara, Chariduar, Tupia, Khanamukh and so on by distributing their goods from various sectors like agriculture, pisciculture, goods from dairy farming, and poultry farming.

The above **figure 3.11**: shows the market pattern of kanyaka in Tezpur, as the Tezpur brings most of the goods directly from kanyaka to the center point named as Prayassh, the kanyaka has other centers in Tezpur known as daily needs departmental store, and Bhogali. Prayassh has two sub-branches in chandmari and parbatinagar, Tezpur. The above figure shows that prayassh distribute goods in two form through retailers (direct sale to customers), and through volunteers (indirectly sale to the customers through home delivery).

Market Accessibility of Kanyaka Agro-farm to its nearby area with special referance to Tezpur



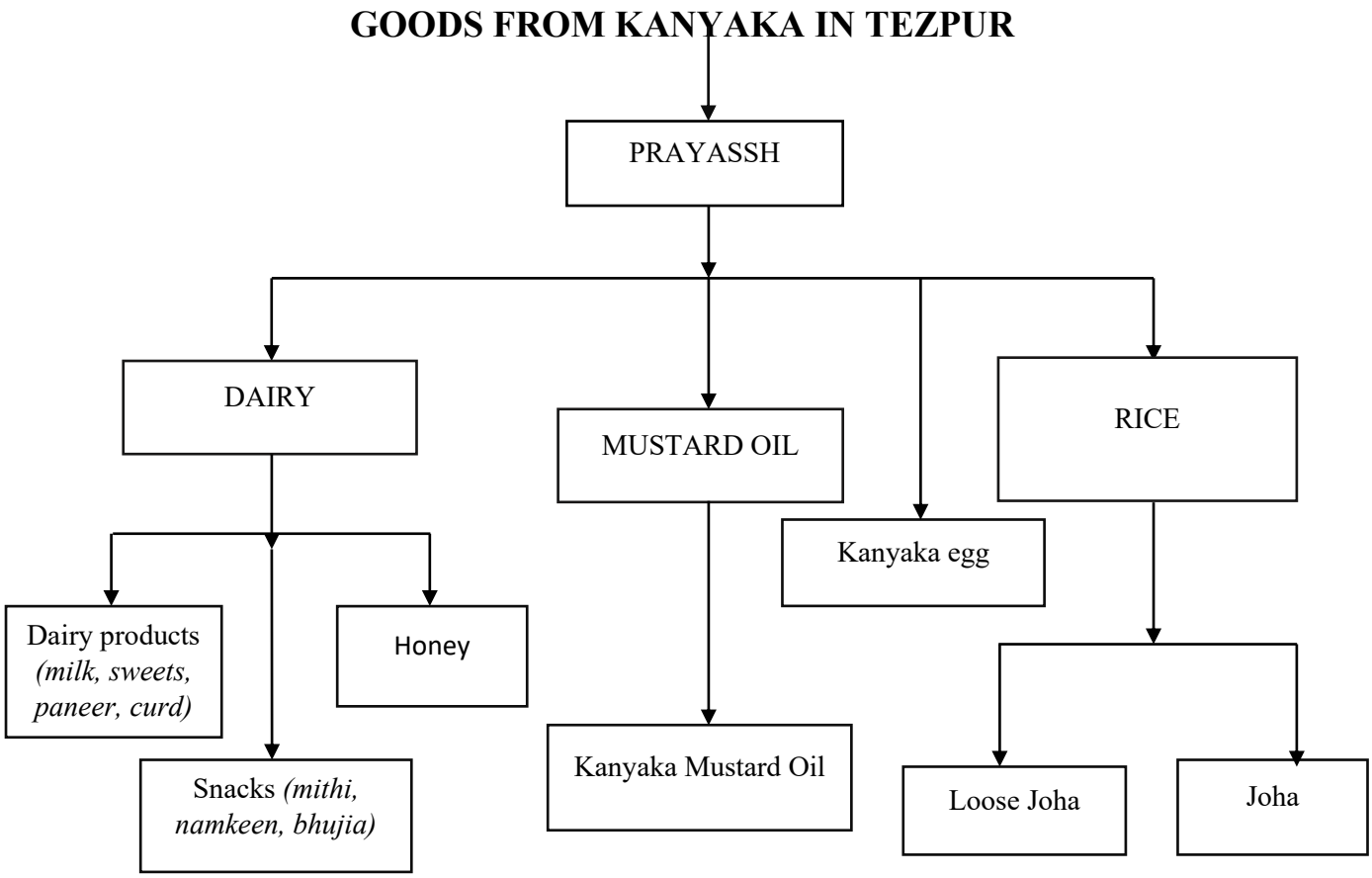


Figure 3.12: flow chart showing goods from kanyaka in Tezpur

The above **figure 3.12**: shows the goods bring from kanyaka to Tezpur market. Where various goods are supplying through the Prayassh which is the major center of kanyaka. Its brings major products of kanyaka such as- dairy product (milk, sweets, paneer, curd, honey), snacks (mithi, namkeen,bhujia), Agro-products [mustard oil, rice(loose joha and joha)] and kanyaka eggs.

Table 3.12: Detail showing average monthly income of prayah.

Products	Monthly income (Rs.)	Percentage
Dairy	21000	70
Mustard oil	4000	13.33
Rice	5000	16.66
Total	**30000**	**100%**

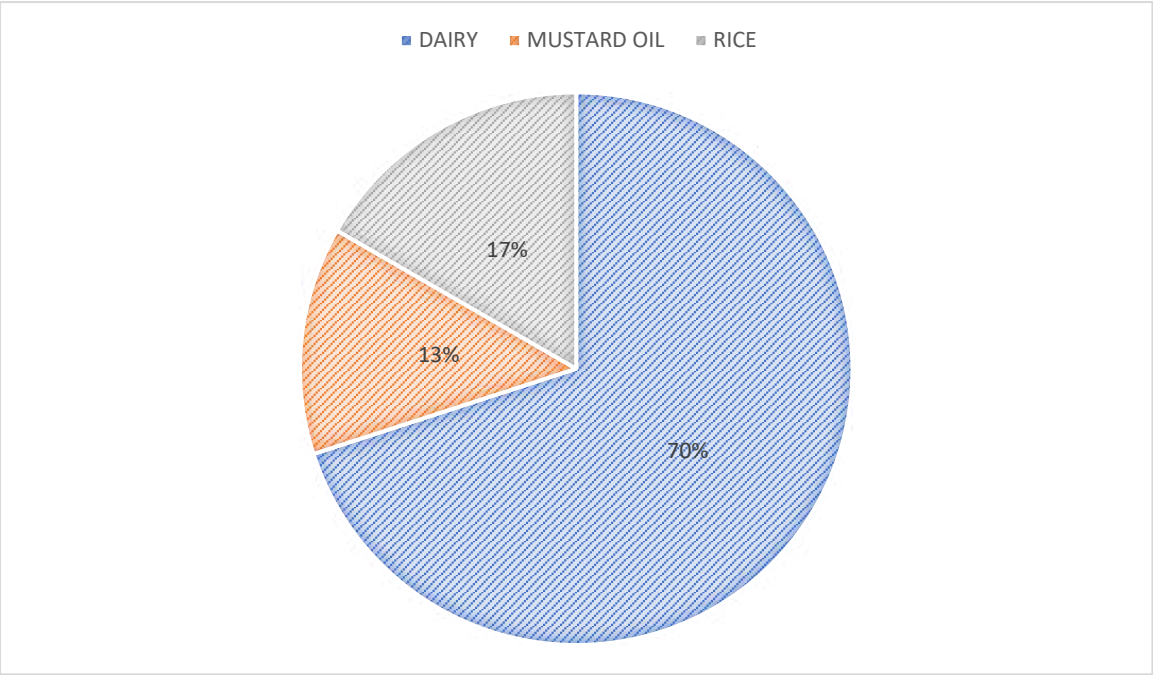


Figure 3.13: Showing average monthly income

The above **figure 3.13** shows the average monthly income from major goods of prayash bring from kanyaka. Where a large percentage of monthly income is covered by dairy products about 70%, while mustard oil covered about 13% and 17% income is covered by rice.

The role of income-generating activities provides a visible solution to the employment creation and poverty alleviation. The income-generating activities are crucial to the economy, as they have provide a major contribute to the officials of kanyaka through prayash in Tezpur over the year. In Tezpur the prayash provides a large no. of income generation activities where they gave employment to the 10 person in prayash centre which means it plays a vital role for the growth of kanyaka agro-farm. Thus, income-generating activities of kanyaka in tezpur play a vital socio-economic role. These activities create a social safety of the people in Tezpur by providing income and employment, particularly to the underemployed or those who cannot find jobs in the formal sector.

3.4Impact of Income Generating Activities

- The income generating activities of kanayaka made a significant impact to the community of surrounding area by creating the job opportunities.
- The income generating activities of kanyaka reduced the unemployment of the people who cannot find the jobs in the formal sector.
- The agriculture sector of kanyaka don't use any kind of pesticides and its provides the pure food or fresh vegetables to the people of local area.
- These income generating activities of kanyaka made a significant development of the surrounding area.
- To produce a large amount of dairy products kanyaka's dairy farm distribute cow's to the families of nearby areas which made a significant impact on the livelihood of surrounding villages.
- These income generating activities of kanyaka can made a significant growth of economy of the Sonitpur district.

CHAPTER 4:

SYNTHESIS

4.1 Findings

From the analysis chapter, I had identified five major income generating activities such as agriculture, dairy farming, poultry farming, swine husbandry and pisciculture. 68 percent of income is from dairy farming, and the contributors of the other sources go like this-agriculture 14 percent, pisciculture 14 percent, poultry farming 3 percent, and swine 1 percent. (figure: 3.1) and in the study area the different income generation activities generate a large no of employment where agriculture sector generates employments of 100 person and the contribution of other sectors go like this- dairy farming (24 person), poultry farming (4 person), swine husbandry (5 person), and pisciculture generate employment of 5 persons **(figure:3.2).**

By the study of these tables (**Table 3.1 and 3.2) and figure (fig: 3.1 and 3.2**) it is found that dairy farming is the main source of income generation and agriculture is the main source of employment creation of kanyaka agro-farm. Where 68% of income is from dairy farming and permanent employment of 100 person is from agriculture sector. Different categories of income generation activities are also plays an important role which shown in chapter 3.

These income generating activities influence the market pattern of surrounding areas, by analysis the market pattern of Tezpur shown in previous chapter it is found that market pattern of Tezpur is highly influenced by the income generating activities of kanyaka agro-farm. Where the major center of kanyaka “prayash, in Tezpur brings major goods like dairy, mustard oil and rice. By studying the **table 3.12**. its found that in Tezpur also dairy covers a large percentage of income about 70%.

4.2 Suggestion

The society “Bharalipara Kanyaka Bohumukhi Paam” (Konyoka) was incorporated September 2016 with an objective of starting multi – cropping projects in 2000 acres of barren land on the flood plains of Jia Bharali river. Its supports various income generating activities which plays an important role to generate income. During the study the researcher have observed a good or wealthy environment of the kanyaka bahumukhi paam but there are some other steps which should take by the kanyaka such as-

- The paam like kanyaka which is very large in size and supported various income generating activities but in compared to these activities they provide a small unit of employment.
- Kanyaka should focuses on the generating of women employment.
- They can earn more income from pisciculture by increasing the artificial ponds.
- The kanyaka is going to be a tourism spot if they take care of its aesthetic view.s
- The agriculture sector can provide a great extent of income if they focus on it more and use technically developed machines.
- The kanyaka bahumukhi paam is covering a large area which can support more income generating activities.
- The establishment and improvement of poultry rising can lead to a good or wealthy income to the paam.

4.3 Summary & Conclusion:

By going through the field visit in kanyaka bahumukhi paam in jamugurihat in sonitpur, Assam. I collected various knowledge of the kanyaka bahumukhi paam.

The present field work essentially attempts to build up an idea about the income generating activities and their implementation in kanyaka agro-farm. This field work involves the general picture of the surveyed area.

By studying it can be said that income generating activities are the vital foundation of the source of livelihood for the communities of surrounding area of kanyaka. It's the community resource for the people of jamugurihat and its provide all the production of goods to the surrounding markets. The presence of bharali river also plays an important role to economic activities of kanyaka by providing its water resources. The income generating activities like agriculture, fishery and the animal husbandry directly or indirectly depend on availability of water, spacially water from bharali river. From the above mention analysis, it can be concluded that all the income generating activities of kanyaka influenced the socio-economic life of the study area in particular to the jamugurihat, sonitpur district in general, by providing the employment, producing a large amount of the goods, which influence the market patterns of surrounding area and generate income from these economic activities.

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QUESTIONAIRIE

1. Location?
2. State?
3. Sharing District?
4. When It Was Established?
5. Total Area Covering?
6. In Which Area It Was?
7. Sub- Division of The Location?
8. What Are the Types of Kanyaka?
9. Directore Of Kanyaka?
10. Total Number of Workers?
11. Number of Firms?
12. Number Of –
    a. Cow…….? b. Pigs…….?

    C. chicken…….? d. Buffalo……?

    e. Fishery……..? f. Others…….?

13. Types of cow breeds……..?
14. Types of pig breeds……..?
15. Types of chicken……..?
16. Types of buffallo……?
17. Types of agriculture……?
18. Socio-cultural and economic information
    a. How many people engaged as employment with the kanyaka……?
    b. Number of permanent workers …….?
    c. No. of non-permanent workers……?
    d. Any problem facing by workers-(yes/no) …..? if yes mention ……..?
    e. Other income source……..?
19. Total revenue earned from all the income generating activities –
    a. Annually …….?
    b. Monthly ……...?
20. Production of milk-
    a. Daily ……..?

b. Monthly ……..?

c. Annually ……..?

21. Production of egg –

a. Daily ……..?

b. Monthly …….?

c. Annually …….?

22. Total area covered by fisheries ……..?

23. How many fisheries are there ……?

24. Total production of fish ……?

25. Income from fisheries ……?

26. Types of crop cultivated ……..?

a. Total production ……..? b. Total income……**?**

Thank you

PROJECT WORK SESSION 2023

BHARTENDU HARISHCHANDRA KE NATAKO KI MOOL SAMBEDNA

PROJECT REPORT SUBMITTED IN PARTIAL FULFILLMENT OF COURSE CURRICULUM OF BACHELOR OF ARTS (HONOURS) 6TH SEMESTER 2023 UNDER GAUHATI UNIVERSITY

SUBMITTED TO
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ASSISTANT PROFESSOR
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DARRANG COLLEGE
TEZPUR(ASSAM)

SUBMITTED BY
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REGN NO:-20044690
DEPARTMENT OF HINDI
TEZPUR(ASSAM)

DEPARTMENT OF HINDI

Darrang College, Tezpur (Assam)

CERTIFICATE

This is to certify that the Project Report is entitled "**BHARTENDU HARISHCHANDRA KE NATAKO KI MOOL SAMBEDNA**" submitted by **BHASWATI SAIKIA** of Bachelor of Arts (Honours) 6th semester 2023. Darrang College, Tezpur bearing Roll:-**UA-201-225** No:-**0103** is a bonafide record of project work done by his/her under my guidance and supervision.

Signature
(Name of the Supervisor)

Devi

Assistant Professor
Department of Hindi
Darrang College
Tezpur

Place:-Tezpur

Date:-

आभार प्रकट

अपने परियोजना कार्य को पूरा करने के लिए मैं अपने हिन्दी के शिक्षक रुनु देवी जी के अभारी हुँ जिन्होंने परियोजना कार्य को यथासमय संपन्न करने में मेरी कदम कदम पर मार्गदर्शन किया ।

मुझे यह परियोजना कार्य को पूर्ण करने में बहुत खुशी मिला है और इस कार्य के दौरान मुझे बहुत कुछ सिखने को मिला ।

इस परियोजना कार्य को पूर्ण करने में सभी गुरुजनो के प्रति भी आदर आभार एवं कृतज्ञता अर्पण करती हुँ । इस विषय के अंतर्गत मैंने जिन विद्वानो के संग से ज्ञानर्जन किया है, उन सबको प्रति मैं अभार अर्पण करता हुँ ।

नाम :- भास्वती शईकीया
कक्षा :- छठा छमाही,
दरंग महाविद्यालय
तेजपुर (असम)

विषय - सूची

भूमिका

भारतेन्दु हरिश्चंद्र हिन्दी साहित्य के बहुमुखी प्रतिभा सम्पन्न साहित्यकार थे। भारतेन्दु हरिश्चंद्र के नाटकों का मूल सम्बन्ध भारतीय संस्कृति और समाज से है। उनके नाटक वर्तमान समय से पूर्व के भारतीय समाज की जीवन शैली, संस्कृति, तथा सामाजिक व मानसिक मुद्दों से संबंधित होते है। भारतेन्दु हरिश्चंद्र के नाटको में भारतीय संस्कृति, धर्म, इतिहास, समाज और राजनीति के विषयों पर विचार किए जाते है। इन नाटकों में समाज की मुख्य समस्याओं पर ध्यान दिया जाता है और समाज के विभिन्न वर्गों के लोगो की समस्यायों को दर्शाया जाता है। भारतेन्दु हरिश्चंद्र जी ने नाटको के माध्यम से भारतीय समाज में सुधार लाने के लिए बहुत कुछ किया। उनके नाटको का मुल संबेदना उनके समाज सुधार कार्यो से भी प्रभावित हुआ है। भारतेंदु हरिश्चंद्र के नाटक उनकी समाज सेवा और संदेशो का एक महत्वपूर्ण साधन थे। उनकी रचनाए अनेक विषयों पर होती थी

जैसे स्वतंत्रता संग्राम, महिला सशक्तिकरण, शिक्षा आदि। उनके नाटकों में समाज की असुरक्षा, गरीबी छाप की अनुपस्थिति, धर्म राजनीति और संस्कृति जैसे विषय शामिल होते थे।

३) भारतेन्दु हरिश्चंद्र जी की व्यक्तित्व एवं कृतित्व : भरपूर पाला में गद्य-पद्यात्मक रचनाएँ प्रस्तुत करने, अनगिनत-लेखको को विविध प्रकार से श्रम, धन तथा सहानुभूति द्वारा सहायता पहुँचाने वाले निराले व्यक्ति हरिश्चंद्र का लौकिक जीवन 34 वर्ष 3 महिने एवं 27 दिन का ही था। 16-17 वर्ष के काल की साहित्य साधना द्वारा हिन्दी का प्रचार करने में जितना अधिक योग भारतेन्दु का रहा है उतना कदाचित अन्य किसी व्यक्ति का नही। 175 पुस्तकों से भी अधिक महत्वपूर्ण उनकी साहित्य सेवा लेखक मण्डल तैयार करने मे तथा जन-अवश्यकता कुल भाषा के निमाण में है।

भारतेन्दु का जन्म 9 सितम्बर 1850 ई मे काशी शहर में हुआ। 34 वर्ष से कुछ अधिक का यह जीवन काल भारतेन्दु को साहित्य साधना का मात्र

का काल नहीं है बल्कि उनके व्यक्तित्व के निरालेपन को इतनी स्मृतियों का फुग है कि यह स्वंय अपने आप में अत्यन्त रोचक, आकर्षक तथा संवेदनाओं से समृद्ध है। जब वे 5 वर्ष की थे उस समय उनकी माता का तथा 10 वर्ष की अवस्था में इनके पिता का देहांत हो गया। पिता की असामयिक मृत्यु होने से शिक्षा-दीक्षा अभिवस्थित रही। बनारस में क्वींस कॉलेज में तीन-चार वर्ष पढ़े। काव्य रुचि बचपन से ही भारतेन्दु में थी। 5-6 वर्ष की आयु में ही इनकी काव्य प्रतिभा अंकुरित होने लगी थी। पिता के साहित्यिक-संस्कार भारतेन्दु में ढल गए थे।

13 वर्ष की अवस्था में भारतेन्दु की शादी हुई थी। 2 साल बाद इन्होंने सपरिवार जगन्नाथ पुरी की यात्रा की। 1866 ई. में बलन्दशहर तथा कुचमरे का भी भ्रमण किया। 1871 ई. में पुष्कर यात्रा में अजमेर गए और उसी वर्ष हिन्दी-वर्द्धिनी सभा के निमंत्रण पर

प्रयाग गए । 1879 ई. में पुनः प्रयाग आए और उस समय आर्य नाट्य सभा द्वारा लाला श्री निवासदास के नाटक "रणधीर-प्रेममोहिनी" का अभिनय देखा। 1884 ई. में उन्होंने अपनी जीवन की अंतिम बलिया यात्रा की । बलिया में इन्होंने स्वदेशी तथा "निज भाषा उन्नति" पर जोर देते हुए भाषण दिए । ये आरंभ भारतेन्दु के प्रगतिशील तथा उदार एवं विस्तृत अस्तित्व के परिचायक हैं ।

भारतेन्दु के अपने परिवार में दो पुत्र तथा एक पुत्री थी । पुत्र जीवित नहीं रहे थे । बेटी की परिवेश एवं शिक्षा का उन्होंने समुचित प्रबंध किया था । उस समय में लड़की शिक्षा का रिवाज नहीं था । परंतु प्रगतिशील भारतेन्दु ने इस पर विशेष ध्यान दिया था ।

पंडित रघुनाथ ने एक बार रुष्ट होकर उनको 'भारतेन्दु' पुकारने का निश्चय किया क्योंकि उनमें विशिष्ट गुणों के साथ अवगुण भी थे । पण्डित सुधाकर द्विवेदी द्वितीया के चंद्र के समान

पुण्य दर्शन इन्दु के रूप में मानते हुए इस नाम है। 'प्रस्तुत प्रहसन में हमकी भारतीय एवं पाश्चिमी नाट्यशैलीयों के समन्वित-स्वरूप के दर्शन होते है।' इस प्रकार भारतेन्दु जी इस नाटक में प्रहसन के मार्म से अपनी सर्वतोमुखी प्रतिभा का परिचय देते है। "वैदिक-हिंसा न भवति" भारतेन्दु का एक ऐसा प्रहसन है जिसमें उन्होंने समसामयिक आंदोलन से प्रेरित होकर धर्म के नाम पर हो रहे पाखण्ड और थिंतडावाद का पर्दाफास किया है। इसलिए यह प्रहसन भारतेन्दु की मौलिक रचना का एक बहुत बढ़िया उदाहरण प्रस्तुत करता है।

इस पूरे नाटक में चार अंक है। गंभीर नाटको के समान इसका रोल है। किंतु वस्तु-योजना में वर्ग्य का प्राधान्य है। हिन्दी नाटकों के पितामह भारतेन्दु जी ने इस नाटक की प्रहसन पूर्ण बनाकर अंग्रेजी प्रशासन पर एक करारी चोट की है।

नाटक में अत्यन्त संस्कृत नाट्यशास्त्रीय नियमों का पालन करने की चेष्टा है। प्रारंभ में नंदी पाठ सूत्रधार एवं वार्ता तथा नाटक परिचय आदि से युक्त प्रस्तावना है। अंत भारत वाक्य है। अंकों का विभाजन गर्भांको आदि में स्वीकार किया। उनके समकालिन राजा शिवप्रसाद की सरकारी कृपा से 'सितारे हिंद' का खिताब मिल चुका था। राजा साहब की भाषा नीति से विरोध करनें वालों ने भारतेन्दु उपाधि द्वारा 'सितारे-हिन्द' से अधिक सम्मानप्रद स्थान देकर बाबु हरिश्चंद्र का ही नहीं वरन उनकी साहित्यिक सेवाओं तथा भाषा तथा भाषा नीति का सम्मान किया। "27 सितम्बर 1880 ई. को 'सारसुधानिधि' से पण्डित रामेश्वर दत्त व्यास ने लेख में प्रस्ताव रखा और उसका समर्थन करते हुए सम्पूर्ण साहित्यिक जगत ने 'भारतेन्दु' के नाम से बाबू जी" की पुकारना प्रारंभ किया। कालांतर में हरिश्चंद्र से भारतेन्दु अधिक लोकप्रिय हुआ साहित्य में यह नाम अमर हो गया।

इस प्रकार 6 जनवरी 1885 ई. को इनकी मृत्यु हो गई। हिन्दी साहित्य में भारतेन्दु हरिश्चन्द्र का नाम बड़े फक्र से लिया जाता है। इनका व्यक्तित्व का विवरण जितना भी इकट्ठा किया जाय वह कम है क्योंकि भारतेन्दु जी का व्यक्तित्व बचपन से जवानी तक साहित्यिक सेवाओं में भी गुजरा था। इन्होंने 1811 ई. में श्रीनिवासदास कृत 'रणधीर प्रेम मोहिनी' के प्रथम प्रदर्शन के अवसर पर प्रस्तावना लिखते हुए भारतेन्दु ने इसी विचार की प्रकट किया- 'सचमुच नाटक के प्रचार से इस भूमि का बहुत कुछ भला हो सकता है। दिलगी से इन लोगों को जैसी शिक्षा दी जा सकती है, वैसी और तरह से नहीं। इस तरह स्पष्ट रूप से सच तो यह है कि भारतेन्दु का सम्पूर्ण व्यक्तित्व रंगमंच था।

भारतेन्दु की नाट्य यात्रा : प्रतिपाद्य तथा शिल्प
मौलिक नाटक
भारतेन्दु के मौलिक नाटक कृतियों की संख्या नौ है जो इस प्रकार :

1) "वैदिकी हिंसा हिंसा न भवति" (1873 ई.)
2) 'प्रेमयोगिनी' (1875 ई.)
3) 'विषस्य विषमौषधम्' (1876)
4) 'चंद्रावली' (1876 ई.)
5) 'भारत दुर्दशा' (1876 ई.)
6) 'भारत जननी' (1877 ई.)
7) 'नीलदेवी' (1880 ई.)
8) 'अंधेर-नगरी' (1881 ई.)
9) 'सती प्रताप' (1884 ई.)

वैदिकी हिंसा हिंसा न भवति (1875 ई.)

भारतेन्दु के जन्म उक्त प्रहसन का उद्देश्य सामाजिक एंव धार्मिक जीवन के विकृत अंगी की आलोचना करना मे नही किया गया है।

नाटक के आरम्भ में गौरा - गादेश आदि के सेवी राजा तथा उसके वेदमान मन्त्री एवं वैंगी पुरोहित का परिचय मिलता है। भागवत, मनुस्मृति, गीता आदि के तोड़-मरोड़े श्लोको के माध्यम से पुरोहित मांस-मदिरा सेवन को परम धर्म सिद्ध करते है। इस प्रदसनपूर्ण नाटक में चार अ अंको में पहले तीन अंको में स्थिति की सघनता और जटिलता तथा चौथे में परिणम अर्थात कर्मफल दिखाया गया है।

"इस तरह इस प्रदसन में धार्मिक पाखण्ड और अनाचार के व्यापपूर्ण परिणाम दिखाए गए है।"

विषस्य विषमोषधम (1876 ई.)

इस नाटक मे कथावस्तु का कई सुनिश्चित स्वरुप एंव विकास नही है। अनाटकीय कथावस्तु तथा चमत्कारहीन सम्वाद और रस परिणाक के अभाव के कारण उक्त

भारत रूपक कला की दृष्टि से त्रुटिपूर्ण है। इस नाटक कहकर यदि एक राजनीतिक घटना का रेखाचित्र मूलक वक्तव्य कहा जाए तो उपयुक्त होगा।

भारत दुर्दशा (1876 ई.)

भारतेन्दु की ~~उपयुक्त~~ उन्मुक्त राष्ट्रीय भावना का यथार्थ स्वरूप हमको 'भारत दुर्दशा' में देखने को मिलता है। राष्ट्रीय दुर्दशा एवं अधःपतन के कारणों को परीक्षा करते हुए नाटककार ने समसामयिक राष्ट्रीय अवनति के वास्तविक एवं रोचनीय स्वरूप को प्रस्तुत कर दिया है। नैराश्य का आपक स्वर इस रूप में गुंजित है। 'भारत दुर्दशा' नाटक को हिन्दी का प्रथम प्रतीकवादी नाटक कहा जा सकता है। नाटककार ने सामाजिक, राजनितीक अथवा अन्य क्षेत्रों में जहां भी विकृत को देखा है वहीं पर इन अमानवीय पात्रों के माध्यम से आघात किए है। इस नाटक की वस्तु सामाजिक स्वरूप का संग्रा-

अक दर्शन करती है ।

रूपान्तरित नाटक

रूपान्तरित नाटकों में नाटककार मूलकथा को आधार रूप में ग्रहण करते हुए उसके कलेवर में अनेक परिवर्तन अपनी दृष्टा तथा आवश्यकता के अनुसार कर देता है । रूपान्तरित कृति में नाटककार की वैयक्तिक अभिरुचि तथा उसके अपने युग की परिवर्तित कला- भावना एवं वस्तु दृष्टि आदि भी दिखाई पड़ती है । इन कृतियों के अनुशीलन में यह परिवर्तित स्वरूप विशेष आकर्षण का होता है । इसमें रूपान्तरित नाटकारों की मौलिक प्रतिभा के दर्शन युग के परिवेश में करते हुए उसकी उपलब्धि की आँकना होता है ।

नाटक के पितामह भारतेन्दु जी ने बंगला भाषा से प्रेमप्रधान नाटक 'विद्या-सुन्दर' तथा संस्कृत साहित्य से पौराणिक

उपाख्यान पर आधारित 'सत हरिश्चंद्र' की रचना हिन्दी में की ।

i) विद्यासुन्दर :-

1868 में महाराज यतीन्द्र मोहन ठाकुर कृत "विद्यासुन्दर" की छाया पर भारतेन्दु ने इसकी रचना की ।

ii) सत हरिश्चंद्र :- भारतेन्दु हरिश्चंद्र ने "सत हरिश्चंद्र" नाटक की रचना सन 1885 में की थी।

अनुदित नाटक :-

भारतेन्दु कृत छः नाटक अनुवाद में मिलते है - संस्कृत से 'रत्नावली', 'पाखण्ड विडम्बन', 'धनंजय विजय' तथा 'मुद्राराक्षस' प्राकृत से 'कर्पूरिमंजरी' तथा अंग्रेजी से 'दुर्लभ बंधु' इत्यादी ।

नाट्येत्तर लेखन

भारतेन्दु का व्यक्तित्व और साहित्यिक कृतित्व मुख्यतः एक कवि का था। भारतेन्दु एक अच्छे नाटककार होने के अलावा एक अच्छे कवि, आख्यान, निबंधकार उपन्यासकार एंव पत्रकार रहे हैं।

कविता :- भारतेन्दु का कृतित्व मुख्यतः एक कवि का था। व्यक्ति और श्रृंगार के अतिरिक्त युगीन समस्याओं पर भी काव्य-रचना करके उन्होंने मध्ययुगीन काव्य परम्परा से स्वतंत्र विचरण भी किए हैं। भारतेन्दु की कविताओं में भक्तिकाल, रीतिकाल तथा प्रगतिशील आधुनिक काल - सभी सजीव हो उठे हैं। इसी कारण उन्हें हिन्दी काव्य का प्रतिनिधि कवि माना जा सकता है। भारतेन्दु हरिश्चंद्र के सम्पूर्ण काव्य को देखने से स्पष्ट ही जाता है। कि वे एक सहृदय तथा रसवक्त व्यक्ति थे।

उपन्यास :- भारतेन्दु के अनेक उपन्यासों के उल्लेख मिलते है तथापि उनके द्वारा पूर्ण किया हुआ उपन्यास उपलब्ध नही है। 'हम्मीर हठ' अधुरा उपन्यास है जिसका मात्र एक ही परिच्छेद लिखा जा सकता है। 'मदालसोपाख्यान' को भारतेन्दु ने ही पूरा करके छपवाया था, यह निर्विवाद नही है। एक कहानी कुछ आपबीती कुछ जगबीती' भी अपूर्ण रहा गया। इस प्रकार भारतेन्दु की उपन्यास एंव कहानी मे रुचि कम ही दिखाई देती है।

निबन्ध :- भारतेन्दु की रचनाओ में निबंध का अपना एक विशिष्ट मकाम रहा है। इनके निबंधो मे विषय-वैविध्य, सहज-विनोद और सजग चेतना इनके निबंधों की समान विशेषताएँ है। "इंग्लैंड और भारत वर्ष", हम मूर्तिपूजक है", "कृति रक्षण", "सुर्योदय", "मित्रता", "सामाजिक विषयों पर निबंध आदि में भारतेन्दु के बहुमुखी

व्यक्तित्व की अभिव्यक्ति देखा जा सकता है। गंभीरता, व्यंग्य एवं आक्षेप, मनमौजी वृत्ति आदि में उनके व्यक्तित्व के विभिन्न पक्ष दिखाई देते हैं।

इस प्रकार कहा जा सकता है कि भारतेन्दु के निबंधों का उद्देश्य विषय के साथ पाठक के ज्ञान की वृद्धि भी रहा है। सच कहा जाये तो भारतेन्दु, बहुतेरे निबंध मन की तरंग ही प्रस्तुत करते हैं क्योंकि भारतेंदु के बहिर्मुखी व्यक्तित्व की छाप उस युग के अधिकाँश निबंधकारों में पाई जाती है।

पत्र पत्रिकाएँ :- पत्रकारिता के क्षेत्र में भी भारतेन्दु के व्यक्तित्व का बहुत योगदान रहा है। 17 वर्ष की अल्प आयु में ही अपने 'कविवचन सुधा' का प्रकाशन किया।

मासिक पत्र के रूप में इसका प्रारम्भ हुआ और इतना लोकप्रिय हुआ कि कुछ समय पश्चात ही पाक्षिक और उसके पश्चात साप्ताहिक कर दिया गया।

इसी प्रकार साहित्यिक प्रयास के रूप में "हरिश्चंद्र मैगजीन" का नाम भी महत्वपूर्ण रहा है। 1873 ई. की ही आधुनिक हिन्दी के निर्माण की तिथि कहा जाता है। यदि 'हरिश्चंद्र चन्द्रिका' के नाम से दूसरे वर्ष से छपने लगा था।

नारी समाज के लिए 1875 ई. में "बाला-बोधिनी" का प्रकाशन किया गया। इसके अतिरिक्त वैष्णवधर्म प्रधान "भगवद्तोषिणी" भी कुछ समय के लिए निकली थी, लेकिन कुछ कारण वश उसे बन्द कर देना पड़ा था।

इस प्रकार स्पष्ट है पत्र पत्रिकाओं में भारतेन्दु का बहुत बड़ा योगदान रहा

जी हिन्दी साहित्य की आगे बढ़ाने में काफी मदद करता रहा ।

अन्ततः भारतेन्दु के नाटकेत्तर लेखन में सिर्फ नाटकों तक ही वह सीमित नहीं रहे अपितु अन्य साहित्यिक विधाओं में उनका बड़ा योगदान रहा जो हिन्दी साहित्य की अमूल्य देन समझी जाती है ।

व्यक्तित्व तथा कृतित्व की एकरूपता :-

भारतेन्दु आधुनिक हिन्दी साहित्य में नाटक-कला के मुख्य प्रवर्तक माने जाते हैं । वह नाटकों के कर्ता एवं स्रष्टा ही नहीं थी, अपितु वह अपने युग के लिए द्रष्टा एवं महान प्रेरक शक्ति भी थे । भारतेन्दु की प्रतिभा ही अपूर्व नहीं थी, प्रस्तुत इनका व्यक्तित्व भी अत्यंत प्रभावशाली था इसलिए समूचा युग उन्हीं के व्यक्तित्व एवं प्रतिभा के प्रभाव व प्रेरणा से उन्हीं

की धारा में प्रवाहित हुआ है।

भारतेन्दु के कृतित्व का परिचय पाने पर हमें उनके व्यक्तित्व की इमानदारी एवं निश्छलता तथा उनकी प्रतिभा के बहुमुखी प्रसार के साथ ही युग-प्रवृत्तियों की दशा देने वाली चेतना, क्षमता तथा अथक प्रयत्न और लगनशीलता के दर्शन होते हैं। निस्संदेह वे हिन्दी साहित्य में सबसे अधिक प्रखर व्यक्तित्व सम्पन्न तथा विलक्षण प्रतिभा वाली साहसी व्यक्ति हैं। साहित्य के प्रत्येक क्षेत्र के कोने को उन्होंने सुनाधिक स्पर्श किया है।

1868 ई. में जब शीतला प्रसाद त्रिपाठी के 'जानकी मंगल' का मंचन बनारस थियेटर में हुआ तब भारतेन्दु के कृतित्व का परिचय खुद-ब खुद हिन्दी साहित्य के रंगमंच का एक नवोन्मेष हुआ

दम पाते है क्योंकि 'जानकी मंगल' नाटक मे लक्ष्मण की भूमिका अनुपस्थित रहने वाले अभिनेता का अभिनय भारतेन्दु ने खुद किया था। सिर्फ तीस मिनिट में ही उन्होने अपनी भूमिका का पाठ ही याद नही किया अपितु सारा नाटक पढ़कर उसे याद कर लिया था। इस प्रकार वह एक नाटककार तो थे ही साथ ही वह खुद अभिनेता भी थे। और दर्शक भी थे। क्योंकि वह रंगमचीय स्थल से गुजर चुके थे। इसलिए वह रंगमच से अली प्रकार से परिचित थे।

भारतेन्दु के अभिनय और कृतित्व का यह झलक हमे उनके साहित्य को देखने से मिलती है कि कितने सुंदर ढंग से तथा गहन भाव से उन्होने आधुनिक हिन्दी में अपना परिचय खुद दिया।

इस प्रकार स्पष्ट है कि भारतेन्दु का

व्यक्तित्व तथा कृतित्व जो भी था वह हिन्दी साहित्य के लिए ही था। उन्होंने अपने जीवन की सारी पूँजी हिन्दी सेवाओं में ही लगा दी।

2) भारतेन्दु हरिश्चंद्र के नाटकों की विशेषता :

भारतेन्दु हरिश्चंद्र एक प्रसिद्ध नाटककार थे जो नाटक लिखने और निर्देशन करने के लिए जाने जाते थे। उन्होंने हिन्दी नाटक की दुनिया में अपनी विशिष्ट पहचान बनाई है। हरिश्चंद्र के नाटक भारतीय संस्कृति, समाज और राजनीति पर आधारित होते हैं। उनकी रचनाएं समाज के मुद्दों, राजनीतिक समस्याओं और मानवीय रिश्तों को उजागर करती है।

हरिश्चंद्र का नाटक लेखन अपने समय में एक नई और अभिनव धारा थी। उन्होंने भारतीय नाटक को उसके नए रूप में पेश किया जो भावनाओं को आवाज देने

और लोगों को समझाने के लिए सामाजिक विषयों पर ध्यान केंद्रित करता है। हरिश्चंद्र के नाटकों में वास्तविकता की एक मजबूत झलक होती है जो उनकी रचनाओं को एक स्थानीय और समस्याओं से भरपूर दुनिया में स्थान देती है। उनकी रचनाएं सामान्य लोगों की जिंदगी के मुद्दों पर ध्यान केंद्रित करती है और उन्हे समझाने की कोशिश करती है। उनके नाटकों की विशेषता कुछ इस प्रकार है :-

1) राष्ट्रीय भावना :

भारतेन्दु जी की नाटकों में राष्ट्रीय भावना का प्रबल रूप दिखाई पड़ता है। उन्होंने अपनी रचनाओं के माध्यम से राष्ट्रवादी चेतना को न केवल रूपायित किया बल्की जनजन को प्रेरित भी किया। उदात्त राष्ट्रीय भावना से भारतेन्दु की रचनाएं ओत-प्रोत है। वे देश और समाज की चिंता लगातर करते है और अपने अतीत को

याद करते हुए भारत की इस दशा से दुखी है। भारतेन्दु के राष्ट्रीय भावना उनके नाटकों में बार बार दिखाई देती है। 'अंधेर नगरी' इसका उदाहरण है। उनके नाटक 'भारत दुर्दशा' में भी राष्ट्रभावना दिखाई पड़ती है।

३) हास्य - व्यंग्य भावरसंपूर्णता :

भारतेन्दु ने अपने नाटकों के माध्यम से अंग्रेजी शासन के खिलाफ फिर सारी बातों को अधिकतर व्यंग्य के माध्यम से प्रस्तुत किया है। उनके नाटकों में सामाजिक-विकृतियों पर, धार्मिक पाखण्ड पर, धर्मपोषित जाती पर, राजनीतिक विद्रूपताओं पर, सरकारी आर्थिक नीतियों पर व्यंग्य देखने को मिलता है। भारतेन्दु द्वारा रचित 'पाखण्ड विडम्बना', 'अंधेर नगरी', विषस्य विषयमौषधम आदि प्रमुख रूप से व्यंग्य नाटक है।

3) राष्ट्रभाषा प्रेम :

राष्ट्रभाषा प्रेम भारतेंदु की नाटकों का एक अन्यतम विशेषता रही है। निज भाषा उन्नती अहे सब उन्नति को मूल' तथा हिन्दी, हिन्दू, हिन्दुस्थान' के अभियान भारतेन्दु के युग की जातीय भावना के परिचायक है। भाषा की एकता राष्ट्रीय एकता की बोधक थी। इसी से भारतेन्दु युग के लेखकों ने हिन्दी भाषा के प्रचार का बीड़ा उठाया था।

4) विषयगत एंव शैलीगत विविधता :

विषयगत एंव शैलीगत विविधता भारतेन्दु की नाट्यकला की महती विशेषता है। प्रवृत्ति की दृष्टि से जातीय एंव राष्ट्रीय होते हुए भी भारतेन्दु के नाटक विषय-वैविध्य के परिचायक है। उन्होने सभी प्रकार-के-ऐतिहासिक (नीलदेवी), सामाजिक (पाखण्ड-विडम्बना आदि), दृश्य-श्रव्य-प्रधान पद्यसन

(अंधेर नगरी), पौराणिक (सती प्रताप, चन्द्रावली), बँगला - अंग्रेजी - संस्कृत - प्राकृत से लेकर अनूदित व मौलिक नाटक, प्रहसन, इंकाकी, भाण, प्रयोग, रूपक आदि लिखकर भारतेन्दु ने हिन्दी नाट्य सृजन का वास्तविक नेतृत्व किया।

5) खड़ीबोली भाषा का प्रचार-प्रसार :

भारतेन्दु ने ही सर्वप्रथम खरी हिन्दी भाषा के प्रयोग की क्षमता दिखाई। पद्यभाग ब्रजभाषा में ही रहा, पर भारतेन्दु की ब्रज भी सरल है और खड़ी बोली के अधिक निकट आई। खड़ी बोली का परिष्कार का श्रेय तो उन्हे प्राप्त ही है।

6) भारतीय जनता को प्रबुद्ध करना :

अंधकार मे पड़ी भारतीय जनता को प्रबुद्ध करना भारतेन्दु जी का पहली आवश्यकता थी। उसके बाद ही स्वतंत्र का संघर्ष सम्भव था। भारतेन्दु उनके रचनाओं के

माध्यम से जनता को जागृत करने की कोशिस करते हैं, भारत के अतीत गौरव का स्मरण कराके वे हिन्दु जाती को वीर, कर्मठ, सुसभ्य और उन्नत बनाना चाहते थे।

३) सामाजिक विषयों पर ध्यान केंद्रित करना:

उनके नाटक आम आदमी की समस्याओं और सामाजिक विषयों पर ध्यान करते हुए लिखे जाते थे। उनके नाटको में विविध विषयों पर विचार अक्त किए गए थे जैसे की नारी अधिकार, समाज में जातिवाद और अन सोशल इजूज।

४) अंग्रेजी नाटकों की अनुकरणी से अलग होना:

भारतेन्दु हरिश्चंद्र अंग्रेजी नाटकों की अनुकरणी से अलग थे। उनके नाटकों की अनुकरणी से अलग थे। उनके नाटकों में भारतीय संस्कृति और विरासत का उल्लेख था।

9) रंगमंच के माध्यम से समाज को जागरुक करना :

भारतेन्दु हरिश्चंद्र के नाटक रंगमंच के माध्यम से समाज को जागरुक करने का काम करते थे। उनके नाटक अपने समय के आधार पर बहुत उच्च स्तर पर थे जो आज भी नाटक संस्थाओं के द्वारा नाटक नाम के साथ चलाए जाते हैं।

10) सरल भाषा और उदारता :

भारतेन्दु हरिश्चंद्र की नाटकों की और एक विशेषता यह है कि वे सरल भाषा में लिखे गए हैं जो आसानी से समझ में आती है। उनकी नाटकों में उदारता और रसवृष्टि भी होते हैं।

11) भारतीय संस्कृति के विषयों पर लेखन :

भारतेन्दु हरिश्चंद्र भारतीय संस्कृति और इतिहास के विषयों पर बहुत से लेख लिखे हैं। उनकी नाटकों में भारतीय संस्कृति के विभिन्न पहलुओं को उजागर करने का

प्रयास किया गया था।

३) भारतेंदु हरिश्चंद्र के नाटकों की मुल संवेदना : ('अंधेर नगरी' और 'भारत दुर्दशा' के विशेष संदर्भ में)

भारतेन्दु हरिश्चंद्र ने अपनी रचनाओं के माध्यम से भारत की सांस्कृतिक और राजनीतिक धार्मिक विरासत को आगे बढ़ाने का काम किया। भारतेंदु हरिश्चंद्र के नाटकों की कहानीयों में उस समय के सामाजिक, राजनीतिक, आर्थिक और सांस्कृतिक परिस्थितियों को दर्शाती है जब भारत में ब्रिटिस-शासन था। इन नाटकों मे भारतेन्दु हरिश्चंद्र ने उस समय के रुढ़िवादी समाज को चुनौती देने के लिए अपनी कल्पना और समझ के साथ समाज की मूल संवेदनाओं को प्रस्तुत किया।

भारतेन्दु की विलक्षण प्रतिभा ने नाट्य जगत में युगान्तरकारी परिवर्तन किए। वे एक जागरुक साहित्य कार थे। देश और

राष्ट्र के महत्व से परिचित थे। भारतेन्दु एक समाज सुधारक होने के नाते उन्होंने प्रहसन को समाज सुधार के लिए उपयुक्त साधन रूप समझा और अपने प्रहसनों के माध्यम से कुरीतियों पर करारे व्यंग्य भी किए। उनके नाटक अंधेर नगरी चौपट राजा टके सेर भाजी टके सेर खाजा में भारतेन्दु अपने युग का सजीव चित्र उपस्थित करने में सफल रहे हैं। लोभ से बचना चाहिए और भले-बुरे की पहचान नितांत आवश्यक है। उनके अन्य एक नाटक 'भारत दुर्दशा' भारत वर्ष के दुर्भाग्य का मार्मिक चित्रण प्रस्तुत किया है। इसमें भारत, भारतदुर्दैव, आशा निर्लज्जता, भारत सौभाग्य आदि को ही पात्र रूप में प्रस्तुत किया है। उनकी इन नाटकों में भारतेन्दु जी ने अपनी नाटकों रचना की मुल उद्देश्य की पूर्ती में सफल रहे हैं। इन नाटकों को पढ़ने से स्पस्ट हो जाता है कि भारतेन्दु ने देश के प्रति अनुराग के भाव

को अमूर्त रूप में ग्रहण नहीं किया था। वे भारत की तत्कालीन परिस्थितियों के प्रति लोगों को चाहते थे। केवल प्रेम के प्रेम नहीं वरन देश दुर्दशा को समाप्त करने और उसे उन्नती के राह पर ले जाने के लिए वे देशवत्सालता की बात करते हैं। यही कारण है कि वे भारत दुर्दशा नाटक के आरंभ में ही लिखते हैं :

"अँगरेजराज सुख साज सजे सब भारी।
पै धन विदेश चलि जात इहै, अति खारी।
ताह पे मँहगी काल रोग विस्तारी।
दिन दिन दूने दुख ईस देत हा हा री।
सबसे ऊपर टिक्कस की आफत आई।
हा हा। भारत दुर्दशा न देखी जाई।"

अंधेर नगरी नाटक की गणना भी हम इस श्रेणी नाटकों में कर सकते हैं।

अंधेर नगरी में भारतेन्दु हरिश्चंद्र की नाट्यकला का चरमोत्कर्ष हुआ है। प्रहसन और व्यंग्य-कला का इतना चुटीली और

शजीब रूप उनकी सजगता और मानव जीवन में उनकी गहरी पैठ का परिणाम है। जन प्रचलित एक छोटी सी लोकोक्ति के आधार पर रचित यह छोटा नाटक अपने भीतर समग्र वर्तमान सन्दर्भ छिपाए हुए है। एक लोक कथा में नए प्राण फूँकना और लोक-जीवन और राजनीतिक चेतना को एक दूसरे के करीब लाते हुए उनमें निहित यथार्थ यथार्थ को व्यंग्य के द्वारा व्यक्त करना भारतेन्दु की मौलिकता है। अंधेर नगरी भारतेन्दु के समय का ही नहीं हमारे समय का भी यथार्थ है। यह दृष्टि और व्यंग्यात्मकता भारतेन्दु के लेखन की केंद्रीय विशेषता है, जिसने 'अंधेर नगरी' को प्रहसन होते हुए भी प्रहसन मात्र नहीं बनने दिया। बल्की प्रहसन के बहाने उन्होंने अपने समय की यथार्थ का विडंबनात्मक रूप प्रस्तुत किया है। इस नाटक में तत्कालीन राजसत्ता के

दमनकारी चारित्र की संयकेतिक अभिव्यक्ति है और सामान्य जनता की शक्ति का चित्रण भी। भारतेन्दु भारत दुर्दशा और अंधेर नगरी के द्वारा सुधारवाद का कार्य ही नहीं करते, न यथार्थ चित्रण करके मुक्त हो जाते हैं बल्कि उन्होंने एक आशावादी दृष्टि से मोह ग्रस्त, रूढ़िग्रस्त, आपसी फूट से खंडित, परवश देश वासीओं को जागृत करने का काम किया है। यह रचना व्यापक स्तर पर उदासीनता और जडता को तोड़ने और मुक्ति की मानसिकता तैयार करने का काम करती है। अंधेर नगरी में जनचेतना की अभिव्यक्ति है उनकी संघर्ष-क्षमता है ठोस यथार्थ का व्यंजक-मनोरंजक रूप है। परिवर्तन की जरूरत को ध्यान में रखते हुए भारतेन्दु जनता तक प्रभावशाली रूप में पँहुच सकने वाली विधा नाटक द्वारा साहित्य को ठोस सक्रिय दिशा देना चाहते थे। यह नाट्य रचना नाट्य विधा की सामाजिकता और सामूहिकता

का प्रमाण है। अंधेर नगरी आज के भारतवर्ष को प्रतिबिम्बित करती है। इसका बकरी वाला भी है, मानवता भी और मूल्य भी। इसकी प्रतिकात्मकता बहुत गहरी और व्यापक है। भारतेन्दु हरिश्चंद्र की नाटकों की कहानीओं में उस समय की सामाजिक, राजनीतिक, आर्थिक और संस्कृतिक परिस्थितियों को दर्शाती है जब भारत में ब्रिटिश शासन था। जैसे 'अंधेर नगरी' में उन्होंने औपनिवेशिक सामन्ती व्यवस्था की विसंगतियों को उभारकर तथाकथित न्याय और आजादी की इतनी दूरदेशो से खिल्ली उड़ाई की यह प्रदसन आज भी हमें मनोरंजन देने के साथ साथ आत्म सचेत करता है। इस प्रकार स्पष्ट है कि भारतेन्दु ने अपने अंधेर नगरी नाटक के माध्यम से भारतीयों को आगाह किया है कि वे अपने समाज की संस्कृति, सभ्यता की पवित्र बनाए रखे क्योंकि हम नव परिस्थिति में भी झूलते

चा रहे हैं कि हम उसी देश के वासी हैं जिस पर दुनिया नाज करती थी।

उनके अन्य दूसरा नाटक 'भारत दुर्दशा' में भारतेन्दु जी का राष्ट्रीय भावना का सही रूप प्रकट हुआ है। भारतेन्दु के 'भारत दुर्दशा' नाटक विशेष रूप से राष्ट्रीय भावना से ओत-प्रोत है। 'भारत दुर्दशा' रूपक में भारतेन्दु ने भारत के दशा का बड़ा दर्दनाक चित्र उपस्थित किया है। यह देश असहायावस्था को प्राप्त हो गया है। 'भारत दुर्दशा' में भारतेन्दु जी ने राष्ट्रप्रेम और समाज सुधार की प्रबल आकांशा व्यक्त की है। भारतेन्दु और उनके सहयोगियों ने कांग्रेस के स्वदेशी आन्दोलन से 40-50 वर्ष पूर्व देशी का प्रचार किया। निज भाषा, निज भेष, निज खान-पान, वेशभूषा, निज धर्म पर वे सदा बल देते रहे। पश्चात्य संस्कृति के बाढ़ को रोकने के लिए उन्होंने स्वदेशी की आवाज बुलन्द की। भारत-दुर्दशा

में भी महाराष्ट्री महाशय कहता है, "तो सार्वजनीक सभा का स्थापन करना, कपड़ा बीनने की कल मँगानी, हिन्दुस्तानी कपड़ा पहनना यह भी सब उपाय है (भारतदुर्दैव के प्रतिकार का)।" अंत में भारत भाग्य द्वारा अचेत और संज्ञाशुन्य मूढ़ भारत को जगानेका प्रयत्न किया गया है। भारतभाग्य खिन्न है जो भारत वीरता, ज्ञान, सांस्कृतिक उच्चता, धन बल में संसार शिरोमणि था, वही आज दीन हीन बना अचेत पड़ा है।

उपसंहार : भारतेन्दु की नाट्य दृष्टि और उनके दो नाट्य 'अंधेर नगरी' और 'भारत दुर्दशा' के सन्दर्भ में इस इकाई में हमने देखा कि किस तरह भारतेन्दु हरिश्चंद्र ने नाटक के दृश्यात्मक पक्ष और लोकपक्ष को समझते हुए नाटकों की रचना। उनके लिए नाटक साहित्य भी था और रंगमंच भी। वह नाटक को समाज और राष्ट्र के जागरण और युग

परिवर्तन का सशक्त माध्यम मानते थे। हमने यह भी जाना के भारतेन्दु को पूर्वप्रचलित और अपने युग की विभिन्न नाट्य परंपराएँ मिली जिनका प्रभाव इनके लेखन पर दिखाई देता है। पश्चिम की नाट्य रचना का आधार लेते हुए उन्होंने मुख्य रूप से लोकधर्मी चेतना को अपनाया। हमने जाना है कि भारतेन्दु ने अनेक मौलिक नाटक भी लिखे और भारतीय भाषाओं और अंग्रेजी के नाटकों का अनुवाद भी किए। उनके नाटकों से यह स्पष्ट हो जाता है कि वह स्वाधीन चेतना के नाटककार थे। भारतीय नाट्य परंपरा हो या पाश्चात्य, उनका अनुसरण करना मात्र उनका उद्देश्य नहीं था। वह बदलते युग और रुचि के अनुसार हिन्दी नाट्यकला का विस्तार करना चाहते थे। अपनी पैनी दृष्टि उनके नाटक में दिखाई देती है।

हमने इस इकाई में देखा है कि भारतेन्दु हरिश्चंद्र के नाटकों में समाज के दुख दर्द

और उसके विभिन्न पहलुओं को जीवंत करने की मूल संवेदना होती है। भारत के दुर्दशा और अंधेर नगरी जैसे समाज के विभिन्न मुद्दों को नाटकों के माध्यम से दर्शाने की यह कोशिश करते हैं।

नाटक "अंधेर नगरी चौपट राजा" में नायक राजा की मृत्यु के बाद उसकी राजधानी चौपट हो जाती है और उसे संशय और अवरोधों से लड़ना पड़ता है। इस नाटक में समाज की अंधेरी ओर जाने वाली स्थिति का जीवंत वर्णन किया गया है। यह नाटक समाज में दिखाई देने वाले राजनीतिक, सामाजिक और धार्मिक, आर्थिक असमंजय को जीवंत करता है।

दुसरी नाटक 'भारत दुर्दशा' में भारत के स्वतंत्रता के बाद के समय के समाज की अंधेरी ओर जाने वाले स्थिति का वर्णन किया गया है। नाटक में समाज के

विभिन्न वर्गो के लोगो के जीवन के विभिन्न पहलुओं का वर्णन किया गया है जैसे असहिष्णुता, भ्रष्टाचार, लोभ आदि। भारत दुर्दशा में भारतेन्दु ने युग की राजनीतिक गतिविधियों सामाजिक परिस्थितियों और भारतीय द्वारा अंग्रेजी सभ्यता के गुणों को छोड़कर दुष्प्रवृत्तियों को अपनाया है। सामाजिक अंधविश्वासों और अज्ञात तथा असंगठित प्रवृत्तियों में फसे रहने की उन समस्त समस्याओं का सजीव चित्रण किया है, जिनसे भारत उस समय ग्रसित था और इसके लिए उन्होंने अपने नाटक का नायक भारत को बनाया है।

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A STUDY OF RUSSELL'S PARADOX

PROJECT REPORT SUBMITTED IN PARTIAL FULFILLMENT OF COURSE CURRICULUM OF B.Sc. (MAJOR) 6TH SEMESTER 2023 UNDER GAUHATI UNIVERSITY

Submitted To:-

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Submitted By:-

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Session:- 2022-23
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CERTIFICATE

This is to certify that the project report is entitled **"A STUDY OF RUSSELL'S PARADOX"** Submitted by **Kuldeep Kashhyap** of B.Sc. (Major) 6th semester, 2023, Darrang College, Tezpur bearing Roll No:-US-201-225-0082 is a bonafide record of project work done by him under my guidance and supervision

Kuldeep Kashyap
Signature of Student

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Place:- Tezpur
Date:- 15/5/2023

CONTENT

1. ABSTRACT

This dissertation delves into the significance of Russell's paradox in the history of mathematics and philosophy. Ultimately, the paradox challenges traditional views of mathematical knowledge and highlights the need for openness to new ideas and a willingness to question assumptions.

2. INTRODUCTION

Russell's paradox is a well-known problem in the foundations of mathematics that has been extensively studied and debated since it's discovery by Bertrand Russell in 1901. The resolution of Russell's paradox has been a major topic of research in mathematical logic and philosophy of mathematics. Various approaches has been proposed to avoid the paradox.

This dissertation will explore the different approaches to resolving Russell's paradox, as well as their implications for the foundations of mathematics and philosophy of mathematics. This dissertation will provide a comprehensive overview of the history of the paradox, its significance for the development of set theory, and going debates surrounding its resolution.

3. HISTORY

In the late 19th century, mathematicians and logicians were trying to formalize the foundations of mathematics. The foundations of mathematics refer to the philosophical and logical basis upon which mathematical knowledge and reasoning is built. In other words, it is the study of underlying assumptions and principles that allow us to develop and use mathematical concepts and theories.

The foundations of mathematics are typically studied within the framework of set theory, which is a powerful and flexible tool for describing mathematical structures and objects. However, set theory itself is not without its foundational issues as it led to arise paradoxes in the early development of set theory. This led to the development of axiomatic set theory.

One of the pioneers in this field was George Cantor, who developed the concept of a set and showed how it could be used describe the size and structure of infinite collections.

Cantor's work was enormously influential but it also revealed some unexpected and difficult problems in set theory. For example, Cantor showed that there are different sizes of infinity and that some collections are too large to be sets. This led to a debate among mathematicians and logicians about the nature of sets and how they should be defined and used

Fig: Georg Cantor

Russell became interested in these problems and started to work on them himself. In 1901, he discovered a paradox that showed that the naive conception of sets that he and others had been using was inconsistent.

4. THE NAIVE SET THEORY

Naive set theory is an informal approach to understanding sets and their properties. It is any of several theories of sets used in discussion of foundations of mathematics. Naive set theory is defined informally in natural language. It describes the aspects of mathematical sets familiar in discrete mathematics for eg. Venn diagrams and symbolic reasoning about their boolean algebra, and suffices for everday use set theory concepts in contemporary mathematics. sets are of great importance in modern formal treatments, most mathematical objects are defined in terms of sets. Naive set theory for many purposes while also serving as a stepping-stone towards more formal treatments.

4.1. MEMBERSHIP

If x is a member of a set A, then is also said that x belongs to A, or that x is in A. This is denoted by $x \in A$. The symbol $\in$ is a derivation from the lowercase greek letter epsilon "ε". The symbol

$\notin$ is often used to write $x \notin A$, meaning "x is not in A"

4.2 EQUALITY

Two sets A and B are defined to be equal when they have precicely the same elements, that is, if every element of A is an element of and every element of B is an element of A.

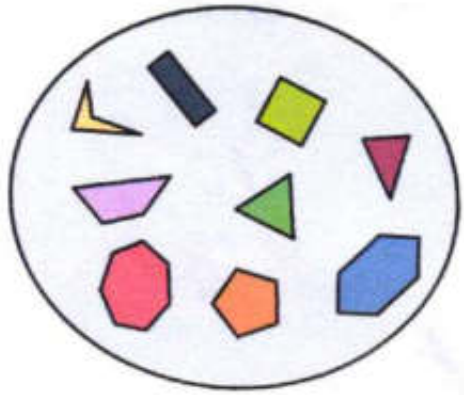

Fig: A collection of objects

If sets A and B are equal it is denoted symbolically as $A = B$

4.3 EMPTY SET

The empty set, denoted as $\varnothing$ and sometimes $\{\}$ is a set with no members at all. Because a set is determined completely by its elements, there can be only one empty set. Although the empty set has no members it can be a member of other sets. Then $\varnothing \neq \{\varnothing\}$

4.4 SPECIFYING SETS

The simplest way to describe a set is to list its elements between curly braces. Thus $\{1,2\}$ denotes the

sets whose elements are 1 & 2.

- The order of element is immaterial; for example

  $\{1,2\} = \{2,1\}$

- Repetition of elements is irrelevant; for example

  $\{1,2,2\} = \{1,1,1,2\} = \{1,2\}$

The notion can be informally abused by saying something like {dogs} to indicate the set of all dogs, but this example would usually be read by mathematicians as "The set containing the the single element 'dogs'".

The notion $\{x : P(x)\}$ or sometimes $\{x \mid P(x)\}$ is used to denote sets containing all objects for which the condition P holds. For example $\{x \mid x \in \mathbb{R}\}$ denotes the set of real numbers.

This notation is called set-builder notation.

4.5. SUBSETS

Given two sets A and B, A is a subset of B if every element of A is also an element of B. In particular, each set B is a subset of itself; a subset B that is not equal to B is called a proper subset.

If A is a subset of B, then one can also say that B is a superset A, that A is contained in B, or that B contains A. In symbol $A \subseteq B$ means that A is a subset of B, and $B \supseteq A$ means that B is a superset of A.

4.6. UNIVERSAL SETS AND ABSOLUTE COMPLEMENTS

In certain contexts, one may consider all sets under consideration as being subsets of some given universal sets. Given a universal set U and a subset of U; the complement of A in (U) is defined as

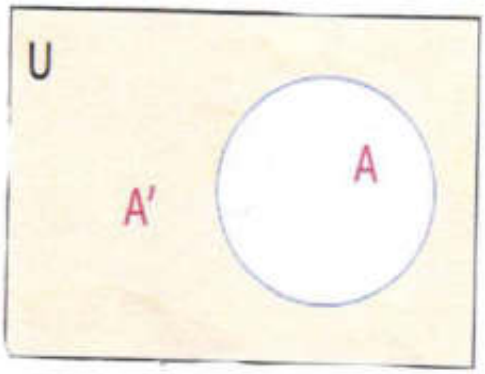

Fig: Complement of a set A

$$A^c = \{x \in U \mid x \notin A\}$$

In other words, A^c is the set of all members of U which are not members of A. Thus if $\mathbb{Z}$ is the set of integers then O^c is the set of even integers.

4.6. UNIONS, INTERSECTIONS AND RELATIVE COMPLEMENTS

When two sets A and B, their union is the set of all objects which are elements of A or of B or of both. It is denoted by $A \cup B$

The intersection of A and B is the set of all objects which are both in A and B. It is denoted by $A \cap B$

Finally, the relative complement of B relative to A, also known as the set theoretic difference of A and B, is the set of all objects that belong to A but not to B. It is written as $A \setminus B$ or $A - B$.

Symbollically, these are respectively

$$A \cup B = \{x \mid (x \in A) \vee (x \in B)\}$$

$$A \cap B = \{x \mid x \in A \wedge (x \in B)\} = \{x \in A \mid x \in B\} = \{x \in B \mid x \in A\}$$

$$A \setminus B = \{x \mid (x \in A) \wedge \neg (x \in B)\}$$

4.7 ORDERED PAIRS AND CARTESIAN PRODUCTS

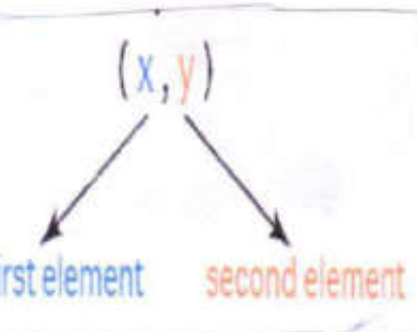

Fig: Ordered pair

Intuitively, an ordered pair is simply a collection of two objects such that one can be distinguished as the first element and the other as second element, and having the fundamental property that, two ordered pairs are equal if and only if their first elements are equal and their second elements are equal.

Formally, an ordered pair with first co-ordinate a, and second co-ordinate b, usually denoted by (a,b) can be defined as a set.

It follows (a,b) and (c,d) are equal if and only if $a=c$ and $b=d$

If A and B are sets, the cartesian product is defined by

$$A \times B = \{(a,b) \mid a \in A \text{ and } b \in B\}$$

That is, $A \times B$ is the set of all ordered pairs whose first co-ordinate is an element of A and whose

second co-ordinate is an element of B.

4.8 THE AXIOM SCHEMA OF UNRESTRICTED COMPREHENSION

Naive set theory assumes that any property can be used to define a set, and that any collection of sets can be combined to form a new set.

However this assumption led to one of the most famous paradoxes that changed the whole perspective of set theory, the Russell's paradox.

5. A MATHEMATICAL PARADOX

A mathematical paradox is any statement (or a set of statements) that seem to contradict itself or (each other) while simultaneously seeming completely logical. Paradoxes are captive, cajole, provoke, amuse and exasperate. More importantly they arouse curiousity, stimulate, and motivate

In the history of mathematics, paradoxes have inspired clarification of basic concepts and introduction of major results.

6. RUSSELL'S PARADOX

In mathematical logic, Russell's paradox is a set-theoretic paradox published by British philosopher Bertrand Russell in 1901. Russell's paradox shows that every set theory that contains an unrestricted comprehension principle leads to contradiction.

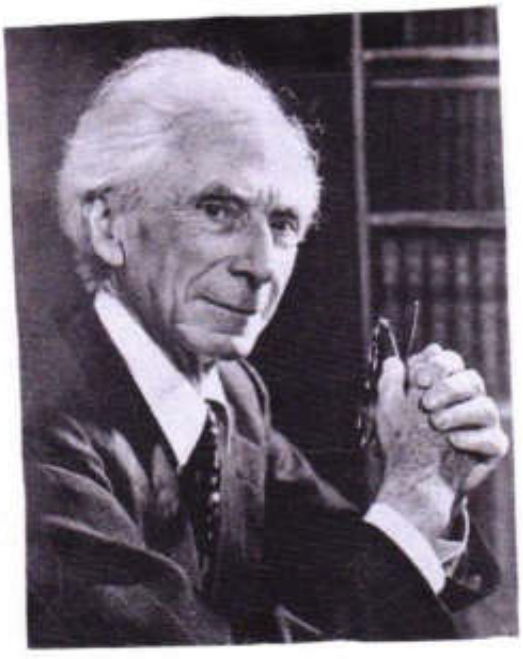

Fig: Bertrand Russell

According to the unrestricted comprehension principle, for any sufficiently well-defined property, there is the set of all and only the objects that have that property. Let R be the set of all sets that are not members of themselves. If R is not a member of itself, then its definition entails that it is a member of itself; yet, if it is a member of itself, then it is not a member of itself, since it is the set of all sets that do not contain themselves. The resulting contradiction is Russell's paradox. In symbols

Let,

$R = \{x \mid x \notin x\}$, then $R \in R \Leftrightarrow R \notin R$

6.1. INFORMAL PRESENTATION

Most sets commonly encountered are not members of themselves. For example, consider the set of all squares in a plane. This set is not itself a square in the plane, thus it is not a member of itself. Let us called a set "normal" if it is a not member of itself and "abnormal" it is a member of itself. Clearly every set must be either normal or abnormal. The set of squares in the plane is normal. In contrast, the compelmentary set that contains everything which is not a square in the plane is itself not a square in the plane, and so it is one of its own members and is therefore abnormal.

Now we consider the set of all normal sets, R and try to determine whether R is normal or abnormal. If R were normal, it would be contained in the set of all normal sets, and therefore be abnormal; on the other hand if R were abnormal, it would not be contained in the set of all

normal sets and therefore be normal.

6.2. FORMAL PRESENTATION

The term "naive set theory" is used in various ways. In one usage, naive set theory is a formal theory, that is formulated in a first-order language with a binary non-logical predicate $\in$, and that includes the Axiom of extensionality:

$$\forall x \forall y (\forall z (z \in x \iff z \in y) \Rightarrow x = y)$$ and axiom schema of unrestricted comprehension

$$\exists y \forall x (x \in y \iff \varphi(x))$$

for any formula φ with variable x as a free variable inside φ. Substitute $x \notin x$ for $\varphi(x)$ to get

$$\exists y \forall x (x \in y \iff x \notin x)$$

Then by existential instantiation (refusing symbol y) and universal instantiation we have

$y \in y \iff y \notin y$ a contradiction.

Therefore this naive set theory is inconsistent.

6.3 SET THEORETIC RESPONSES

Prior to Russell's paradox, a common conception of the idea of the set was the "extensional concept of set", as recounted by von Neumann and Morgenstern:

A set is an arbitrary collection of objects, absolutely no restriction being placed on the nature and the number of these objects, the elements of the set in question. The elements constitute and determine the set as such, without any ordering or relationship of any kind between them

In particular, there was no distinction between sets and proper classes as collections of objects. Additionally, the existence of each of the elements of a collection was seen as sufficient for the existence of the set of said elements. However, paradoxes such as Russell's paradox showed the impossibility of this conception of set, by examples of collections of objects that do not form sets, despite all said objects being existent.

6.4 CONSEQUENCES

Russell's paradox had profound consequences for development of set theory and foundations of mathematics. Here are some of the key consequences

- Incosistency of the naive set theory :
- Importance of the axiomatic method
- Influence on philosophy of mathematics
- Development of new areas of mathematics
- Influence on computer Science

7 CONCLUSION

From the principle of explosion of classical logic, any proposition can be proved from a contradiction. Therefore, the presence of contradictions like Russell's paradox in an axiomatic set theory is disastrous; since if any formula can be proven true it destroys the conventional meaning of truth and falsity. Farther, since theory was seen as the basis for an axiomatic development of all other branches of mathematics, Russell's paradox threatened the foundations of mathematics as a whole. This motivated a great deal of research around the turn of 20th century to develop a consistent set-theory.

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Dissertation on Parbatiya copper plate inscription of Banamalavarmadeva

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Parbatiya copper plate inscription of Banamalavarmadeva

0.1 Introduction to content:

We can retrieve the history of the past from various rock inscriptions and copper plates.Rock Inscriptions and copper plates are main sources of recovery of past history. The history of ancient Kamrupa can be based on rock inscriptions and copper plates. For example - dimbeswar sharma wrote his book " Pragjyotishor itihas " based on information found in copper plates and rock inscription. Similarly padmanath vidyabinodan wrote his book "kamrup rajavali" based on rock inscriptions and copper plates. Sources of kanaklal Barua's "Early history of Kamrupa " was also based on rock inscriptions and copper plates. We are also able to get the identity of the Barman Dynasty kings from the dubi and nidhanpur copper plates. Among the copper plates found in Assam so far is the "parbatiya copper plates of banamalavarmadeva" . Parbatiya copper plates of banamalavarmadeva were discovered in a village named parbatiya,three miles away from tezpur town of darrang district of Assam. No certain date of composition of the parbatiya copper plates of banamalavarmadeva is found yet.But tezpur rock inscription banamala's father harjara is regarded as the first dated inscription of Assam. It was dated in Gupta year 510 corresponding to 829 A.D .So, the date of parbatiya inscription may tentatively be fixed in the middle of the 9th century A.D. It is heard that one day when a cultivatior was digging his field, a set of three copper plates along with a seal was discovered.As the copper plates were discovered in the village named parbatiya,those inscriptions were named as parbatiya copper plates.At present, parbatiya copper plates of banamalavarmadeva are preserved in the District Museum of Assam. Through this paper the Parvatiya copperplates of Banamalbarmadev have been discussed.

0.2Objective of the study:

The objective of this study is to prepare a systametic discussion of the parbatiya copper plates of banamalavarmadeva,an important copper plate inscription of Assam.

0.3 Scope of the study:

Only the parbatiya copper plates of banamalavarmadeva have been covered for the study. No other discussions are included in this study.

0.4 study methodology:

This research paper uses analytical and descriptive methods for the study.

0.5 Sources of study:

Mukunda Madhav Sharma's *Inscription of Ancient Assam* and Dimbeswar Sharma's *Kamrupasasanavali* are the primary source of study of this research paper. Some other books related to this subject has been considered as secondary source.

1.0 Main content:

1.1 Grouth and development of Assamese script:

As Brahmi is regarded as the source of Indian alphabets, Assamese script also derived from Brahmi script. Actually Brahmi script itself has a long journey of development and that is why it is known by different names such as- Ashokan Brahmi , Mauryan Brahmi, Sunga Brahmi, Kusana Brahmi, later Brahmi or Gupta Brahmi script etc.The inscriptions of ancient Assam are basically written in proto Assamese kutila or sidhamatrika script. In the context of the origin Assamese script, T.P Verma remarks that the Assamese script can seek their parentage to the Brahmi script which later on devloped in North India into proto - regional script, popularly called by the paleographers as kutila or ‘acute angled' or ‘sidhamatrika script ' . From the earliest times, Sanskrit occupied a prominent position in the field of language and literature. The early kings of Kamrupa also used Sanskrit as the medium of writing and that is why the inscriptions of ancient assam were written in Sanskrit language. The inscriptions are composed in prose passages and verses. Sometimes some lines are also found in some inscriptions. Most of the inscriptions of ancient assam have no certain date of composition.

Most than fifty inscriptions belonging to the early period have so far been discovered. Tezpur rock inscription of king Harjarvarman is the earliest known dated inscription of ancient assam. It is dated 510 of the Gupta eta corresponding to 829 A.D .Most of these inscriptions are copper plate grants .In those inscriptions basically the genealogy of the kings are described. The kings of ancient Assam issued the charter. Among those inscriptions,Umachal rock inscriptions of surendravarman , Barganga Rock Inscription of the time of Bhütivarman, Dubi Copper Plates of Bhaskaravarman, Nalanda clay seals of Bhaskaravarman, Nidhanpur Copper Plates of Bhaskaravarman provide information about the Varman dynasty of ancient Assam. Tezpur Rock Inscription of Harjaravarman, Hayunthal Copper Plates of Harjaravarman, Tezpur Copper Plates of Vanamala, Parbatiya Copper Plates of Vanamala, Nowgong Copper Plate Grant of Balabarman III discuss the history of Salastambha dynasty ruled from 675 A.D to 725 A.D. in ancient Assam. Moreover, the history of the Pala dynasty can be known from Bargaon Copper Plate Grant of Ratnapala, Suwalkuchi Copper Plate Grant of Ratnapala, Gauhati Copper Plate Grant of Indrapala, Guwakuchi Copper Plate

Grant of Indrapala, Gachtal Copper Plate Grant of Gopalavarman, Khanamukh Copper Plates of Dharmapala, Subhankarapamaka Copper Plates of Dharmapala and Pushpabhadra Copper Plate Grant of Dharmapala. Apart from these dynastic inscription. Thus, the inscriptions of ancient Assam contribute to a great extent in providing information and establishing the facts of history of ancient Assam.

Today we will discuss the Parbatiya copperplate of Banmalvarmadeva.

1.2 introduction to parbatiya copper plates of banamalavarmadeva:

1.2.1 Place & History:

A set of three copper plates along with a seal was dis- covered by a cultivator while tilling his field at the village of Parbatiya, three miles away from the Tezpur town of District Darrang, Assam. Through Shri Biswadev Sarma, then a student of Earl Law College, Gauhati, and till recently a Cabinet Minister in Assam, and Shri S. K. Dutta, then the Principal of the said Law College and now the Vice-Chancellor, Kurukshetra University, the set of plates reached the Assam Provincial Museum, Gauhati, where it is preserved as a property.

1.2.2 Description:

The plates measure 10 ^ prime prime *6.2^ prime prime . The attached seal measures 4.7 ^ prime prime in length and 4.3" in breadth, and it is of almost the same description as of the other seals of the Kamarupa kings. The legend of the seal reads:

1. स्वस्ति श्रीमान् प्राग्ज्योतिषाधिपान्व-
2. यो महाराजाधिराज - श्रीवनम
3. लबर्म्मदेव

The text of the charter covers the inner pages of the first and the last plates and both the pages of the middle plate. The number of lines in the pages is as follows: Plate 1, inner side-15 lines; Plate 2, obverse- 16 lines: reverse-15 lines; and plate 3, inner side-13 lines; total being 59 lines.

Like the enigmatic ka, ha letters of the Tezpur plates of Vanamala, there are certain redundant enigmatic letters in these plates also. Thus, in the margin, of the inner page of plate 1 there is a sri ; in the second page of plate 2 there is a sa and in the first page of plate 2 there are the letters śri, śri, sa, sa, sta and two other enigmatic signs.

1.2.3 Script:

"The characters employed belong to the East-Indian variety of the Sidhamatrika or Kutila script of the ninth century. Sometimes called Early Nagari or Proto-Bengali. Some of the aksharas (cf. a, kh, g, j, s, medial e and au, etc.) closely resemble their Bengali-Assamese forms". In this inscription the letters are very clear and hence this can be very conveniently and profitably used to improve on many an incorrect reading of the earlier inscription of Vanamala.

1.2.4 Language:

The language of this inscription is Sanskrit. The language is generally chaste and elegant. There are, however, a few metrical errors and a few grammatical mistakes which are noticed in the notes. There are also many mistakes caused by the inadvertence of the scribe like the one noted in foot note No. 1 to line 52. The formal part of this grant from the beginning up to Vanamalavarmadevah kusali (in line 48 of the present grant) is common with the Tezpur grant of the king except in case of two passages of considerable length, which have been omitted from the present inscrip- tion. There are thirty verses (one of them being a half- verse), two of them being common mangala slokas. Due to omission of a half verse and four more stanzas and a long prose passage it appears that the inscription has been less carefully copied from the draft.

1.2.5 Date:

The inscription is not dated. No regnal year is mentioned therein. As the Tezpur Rock Inscription of Vanamala's father Harjara is dated, Gupta 510 corresponding to 829 A.D. the present inscription may be roughly placed in the middle of the ninth century A.D.

1.2.6 General remark:

There is hardly any room for improving on the text and the translation of this inscription published in the Epigra phia Indica. The introductory notes, given there, are com- prehensive and highly informative. We have, however, prefered to reproduce the original text with all the linguistic peculiarities, generally found in the Kamarupa inscriptions. The following orthographical features are noteworthy:

(i) No distinction between b and v.
(ii) Only v and n are reduplicated after a repha.
(iii) Retention of a final anusvara.

The first 25 verses are common with those of the Tezpur grant. After v. 25 there are another 8 verses in the saidgrant and in the present grant v. 25 is followed by 5 more,

which are not common to the Tezpur grant.

1.2.7 Metres :

v. 1, Sragdhara: vv. 2, 18, 29-30; Anustubh; vv. 3-6, 8, 9, 11, 15, 17, 19, 21-23, Arya; vv. 7, 12, 13. Indravajra ; v. 10, Giti variety of Arya; v. 14, Vasantatilaka; vv. 16. 25, Mandakanta; v. 20. Rathoddhata vv. 24, 26, 27, Sardulabikridita; v. 28, Upajati (of 3 Indravajras and 1 Upendravajra).

1.3 Translation of parbatiya copper plates of banamalavarmadeva:*

First Plate (Inner Side)

Line 1: May there is success! May it be well (with us)!

Verse 1: May that (sea like) river Lauhitya protect you, which wets the host of the riders of celestial cars with its showers that rise from its striking the multitude of big golden rocks belonging to the glorious Mount Kailasa (and) that are icy cold (and) mixed with golden mud; the water of which is reddened by the flowers of the trees (in the garden) of the lord of heaven; which are fallen from the hands and the (braids of) hair of the best heavenly damsels engaged in water-sport.

Verse 2: May (the god) Pinaka (i. e., Lord Siva) purify you; (the god), at whose dance, the water of the celestial river Ganges being scattered by his exhaling breath; shines like the multitude of stars.

Verse 3: A son, named Naraka, of Adivaraha (i. e. the Boar incarnation of lord Visṇu) was born of the (goddess) Earth at (the time of) her rescue; (the son) who stole away the prowess of Hari (i. e., Indra, the son of Aditi) as well in (the affair of) the carrying away of Aditi's ear-rings.

Verse 4: Krishna killed him (i. e., Naraka), But his heart being moved by the lamentations of his (i.e., Naraka's) wife, allowed his sons, named Bhagadatta and Vajradatta, to go (unpunished).

Verse 5: As Bhagadatta received the lordship of the glorious Pragjyotisa, the other (i.e., Vajradatta) then, having repaired to the forest, propitiated Isvara (i. e., Lord Siva) by penance.

Verse 6: The lordship of Uparipattana was granted to him (ie., Vajradatta) by him (i.e., the god who was pleased); (the god also granted that) the sovereignty of Pragjyotisha would belong to his descendants after some time.

Verse 7: In his family was born one whose foot-stool was shining with the luster of jewels on the heads of kings; who was the lord of Pragjyotisa; who destroyed the warriors of the enemies; (and) who bore the majestic name Salamba.

Verse 8-9: Now there became a king by the name Arathi, unequalled in valour and magnanimity; who was the brother of the king (i. e., Salamba); who was endowed with the royal qualities of past kings beginning with Salastambha and ending with Harsa, who had ascended heaven and coloured the horizon with the colour of the flood of the richness of merits of the good kings of old.

Verse 10: His (Arathi's) queen, named Jiva Devi, became pleasing to his heart; (the queen) who was adorable for many people (and) who was the source of great splendour as the morning twilight is of strong light.

Verse 11: The son of that king (Arathi) from her, was the king of kings the illustrious Harjara, whose two feet were worshipped by the heads of kings (and) who was embraced by the goddess of fortune of her own accord..

Second Plate (Observe)

Verse 12: who was (the very) Yudhisthira in religious discourses, Bhima to the host of enemies, (and) Jisnu (i.e., Arjuna) in the battle field; who, although one, attained the identity of all the sons of Kunti by virtue of several good qualities.

Verse 13-15: The goddess of fortune, having left, like a jealous woman, the breast of Vishnu whose heart was amused by the milk- maids, (and) having gathered (in herself) the beauty pertainting to srimangala, the best of best the persons of all women, came here (and) became that king's queen gratifying to his heart, by name among the women, thinking thus: "This person (i.e. Harjara) bears all the qualities, beginning with the complexion of my husband Rathangapani (i.e. Visnu) who is incomparable in valour. Hence by being the chief queen of this ruler of the earth, I do not become the object of disrespect in the world."

Verse 16: The son of that king (i.e., Harjara), the footstool under whose lotus-like feet used to have friction with the touched of the crowns of all kings, was king Vanamala by name, who was born of that queen, who was as beautiful as moon, famous in the world and who was adorned with the garland of big jewels that are royal qualities.

Verse 17: (and) whose name the god of destiny made Vanamala was found to fit for the lordship of the earth bordered by the row of forests on the shores of the ocean (around it).

Verse 18: (and) who, in the battle fields behaved like the sun by dispersing the huge mass of darkness in the form of the hosts of the intoxicated elephants of the enemy.

Verse 19: (and) who, having dispersed the mass of darkness in the form of the enemies, had shined distinctly like the moon in the clear sky that was the kings born in the family of the emperor, who was the son of the Earth (i.e., Naraka)

Verse 20: (and) by whom, having destroyed completely with his sword of great strength, the whole host of armies, who were like the (very) thunderbolt, to the hills that were the armies of the warriors of their excessively proud enemies, the goddess of fortune was made for a long time to enjoy only one husband (i.e., his own self);

Verse 21: (and) for the fear of whose valour, some of the kings, though they could defeat numerous enemies, hurriedly ran away towards (different) directions while others readily took up the chowrie (to become his attendants),

Verse 22: (and) out of fear for whom, even the kings, who in a battle against (other) rulers shot sharp arrows, (themselves) left their territories far away (behind them);

Verse 23: (and) to whom the possessor of valour is the only weapon, the same kings, who against (their own) enemies arranged the huge crowds of intoxicated elephants, were making (salute with) folded palms.

Verse 24: who was the king that bore the burden of Nahusa by making new again, out of devotion, the white temple of Hetuka- Sulina (i. e., Lord Śiva) whose feet are worshipped by the host of all the best gods bowing down through respect ;(the temple), that had become falling down owing to the passage of time, was as high as a peak of the Himalaya, (and) was endowed with incomparable villages, elephants and prostitutes (who were attached to the temple as devadasis)

Second Plate (Reverse)

Verse 25: (and) whose extremely white fame excels the sparkle of (the jewel of) Ananta in the world of snakes and the row of water particles raised by the breaths of the quarter-elephants in (different) directions.

Line: 33-47 (This charter is being issued) From the famous village named Hadapesvara which has the people of all the Varnas and Asramas well contented; which is the abode of innumerable good soldiers, virtuous and learned men; the big main roads of which (country) are crowded by the great kings who are seated on beautiful elephants and horses and in palanquins and are going and coming with a view to attending on the lord of the earth (i.e., Vanamala); which has the whole of its space always filled by the armies of innumerable elephants, horses and foot-soldiers; (and which is situated on the bank of river Lauhitya) (the river) which has its water perfumed by the fragrance of the flowers fallen (into it) from the numerous creepers shaken by the hissing sounds

produced by the host of serpents frightened by the cries of the peacocks resting in the woods of tall trees rising from the hills on both of its banks; which carries the fragrant flood-waters showeredby the clouds arising from the smoke of the black sandal trees (at the time of their) being burnt by the fire of the forests near the gardens in it (i.e., Hadapesvara).

Which has its current filled by the waters that are purer due to their constantly washing the slopes of Mount Kamakuta, the top of which is the abode of glorious Kamesvara and Mahagauri Bhattarika, whose foot- stools are beautified by the luster of the crest-jewels of all the gods and demons.

Which has the people living in the whole neighborhood of its banks delighted by the fragrance of the musks of the musk-deer, that graze on the shoots of durva grass in the forests on the hills on its two banks, here (some of the deer) dead by themselves, there a herd of them killed by tigers (and) elsewhere some of them left by a group of wolves after having killed them and eaten up half of their flesh.

Which has its water scented (as it is) mixed with the musk ointment applied to the sides of the pot-like breasts of the girls, which (i.e., the breasts) float up on the surface of water in course of taking a deep (for water-sport) (and which has the lands adjoining both its bank adorned with boats).

(The boats) which have their (upper) part open and adorned with numerous loads like the prostitutes having their limbs visible and adorned with many ornaments; which are endowed with garlands of tinkling bells like the young girls; the speed of which is enhanced by sharp strokes (of the ores) as the passion of the women of Karnami increases (at violent sexual enjoyment); (and) which bear cowries like the prostitutes.

Third Plate: Inner Side

Line-47-48: From (the city of) Hadapesvara (this document is being issued by) Paramesvara (great king), Paramabhattaraka (great master), Maharjadhiraja (the king of kings) the famous Vanamalavarmadeva, who is a devout worshipper of mahesara (i. e., Siva), meditates on the feet of his mother and father, (and) is in good health. Lines- 48-51: (By this grant, the village called) Haposagrama attached to the Svalpamangoka district in Uttara-küla, is rendered free from visits of policemen and armymen and also from (the obligation to pay) the taxes payable by temporary tenants as far as it eight boundaries viz. Akshidahika in the east, tank of Candika in the south-east, Dirghänga in the south, a banyan tree in- the south- west, a bush of bamboos or reeds in the west, a Sälmalī tree in the north-west, a big embankment in the north and the tank of Dhavala in the east.

Verse 26: A great Bhata (i.e., learned Brahmin), named Jejjata, was born in the Kaliyuga, who was munificent, absolutely truthful, kind to others, honest (and) respected, by the good people; whose mind was contented by (drinking) the nectar in the form of the meaning of scriptures; who was the sole repository of the three Vedas; who was engaged in the study of the Vedas; who belonged to the Charana of the Samaveda (and) the Sandilya gotra; who was a store of virtues; (and) who was respected by the kings.

Verse 27: His (Jejjta's) sons viz., Cudamani, Demobha and Garga and the noble-minded Sambhu, who were endowed with good qualities; (who) illuminated their own family (and) were skillful in the performance of religious ceremonies; who applied their minds to the good of living beings; who were modest; (and) who were united and did not separate from one another for fear of the loss of virtue.

Verse 28: The king of admirable nature has been pleased to donate the village named 'Haposa' to the Brahmins, who was the eldest among them (i.e., the four sons of Jejjata)

Lines 57-68: (the gift has been made) for the increase of the merit and fame of his parents and himself; therefore (the gift of the king) should be approved of by all.

Verse 29: Many kings beginning with Sagara have donated earth (i.e., land) to others. Everyone has enjoyed proper merit for the donation of lands.

by others, rots with manes assuming the form of worms in vistha. Verse 30: Whoever takes away the land given by himself or by others, rosts with manes assuming the from of worms in vistha.

1.4 Personality of king Vanamala as reflected in the Parbatiya copper plates of Vanamalavarmadeva :

In the copper plates of Vanamalavarmadeva, we find about the magnanimity of different rulers of Pragjyotishpura. Some of them are viz., Naraka, Bhagadatta, Vajradatta, Salambha, Arathi, Harjara, Vanamala etc. King Vanamala was a great ruler who had the capacity of being the emperor of the whole world. He was the son of king Harjara and Mangalla.

Personality of Vanamala was scattered in all over the places through his virtues and heroism. He was as beautiful as the moon and was very famous in the world. He was embellished with a garland of large jewels in the form of royal qualities.

In power and strength king Vanamala was like intoxicated elephants for his enemies. In the battlefield he was like the Sun which dispersed the huge mass of darkness.

Among the kings belonging to the royal family of Naraka, king Vanamala possessed distinct qualities. As the moon is distinctly or so to say as more brightly noticed in the sky, king Vanamala was also distinctly noticed among the kings of Naraka family.

Vanamala was also a very mighty king. Valour is the only weapon of him. He could defeat many enemies of him, the enemoes ran away in different directions leaving behind their own territories far behind.

Vanamala was a devotee of lord Siva. Though he was burdened by Nahusa, he rebuilt the white temple of Hetuka-Sulin i.e., lord Siva. The fame of king Vanamala had been scattered everywhere. His fame excelled the luster of the jewels of Ananatanaga, the king of snakes; as well as the whiteness of water particles. His footstool was always sparkled with the rays of the stones of the crowns of other kings. When the kings bowed their heads in front of him, the rays of the stones of their crowns were reflected in his footstool. As an administrator, king Vanamala attained a remarkable place among his subjects. During his reign, eight sides of Haposagrama viz., Aksadahika in the east, tank of Candika in the south-east, Dirghanga in the south, a banyan tree in- the south-west, a bush of bamboos or reeds in the west, a Salmali tree in the north-west, a big embankment in the north and the tank of Dhavala in the north- east belonging to the Svalpamangoka district of the Northern bank of river Brahmaputra were rendered free from visits of militant personals. King Vanamala never collected taxes from his subjects.

1.5 The social life of that time as reflected in parbatiya copper of Vanamalavarmadeva:

According to the description found on the parbatiya copperplate of Banmalvarmadeva, Brahmins were given the highest position in the society of that time after the kings. The third plate of the parbatiya copperplates also mentions a great wise Brahmin named Jejjata who was highly respected by the kings . This third plate mentions that the kings donated land, villages, to the Brahmins at that time. It is said that they donated land to Brahmins to increase of the merit and fame of their parents and themselves.

There is evidence of tax payment at that time and King Banmal exempted many areas from taxes

The mountain copperplates suggest that the Shiva community was predominant at that time. The main evidence for this is that Shiva is praised in the Mangalacharana at the beginning of the Parvatiya Tamrashasana. King Banmaldeva himself was a great devotee of Lord Shiva. He devoutly rebuilt the Shiva temple called "Hetuk Shulin" which had fallen into disrepair.

There are also beautiful descriptions of the appearance and qualities of queens such as Jivadevi, wife of King Arthi, and Mangala, wife of King Harjar. This suggests that women were given the same dignity as men at that time and had a special place in society.

1.6 Descriptions of rivers found in parbatiya copper plates of banamalavarmadeva:

The first Mangalacharana at the beginning of the parbatiya copperplate describes the river Louhitya Sindhu or Brahmaputra as follows - “May that (sea like) river Lauhitya protect you, which wets the host of the riders of celestial cars with its showers that rise from its striking the multitude of big golden rocks belonging to the glorious Mount Kailasa (and) that are icy cold (and) mixed with golden mud; the water of which is reddened by the flowers of the trees (in the garden) of the lord of heaven; which are fallen from the hands and the (braids of) hair of the best heavenly damsels engaged in water-sport." The second plate also describes the Brahmaputra as follows:“ The river which its water perfumed by the fragrance of the flowers fallen (into from the numerous creepers shaken by the hissing sounds duced by the host of serpents frightened by the cries of the pacocks resting in the woods of tall trees rising from the hills on h of its banks; which carries the fragrant flood-waters showeredby the clouds arising from the smoke of the black sandal trees (at the time of their) being burnt by the fire of the forests near the gardens in it (ie., Hadapesvara).

Which has its current filled by the waters that are purer due to their constantly washing the slopes of Mount Kamakuta, the top of which is the abode of glorious Kamesvara and Mahagauri Bhattarika, whose foot- stools are beautified by the luster of the crest-jewels of all the gods and demons.

Which has the people living in the whole neighborhood of its banks delighted by the fragrance of the musks of the musk-deer, that graze on the shoots of durva grass in the forests on the hills on its two banks, here (some of the deer) dead by themselves, there a herd of them killed by tigers (and) elsewhere some of them left by a group of wolves after having killed them and eaten up half of their flesh.

Which has its water scented (as it is) mixed with the musk ointment applied to the sides of the pot-like breasts of the girls, which (ie., the breasts) float up on the surface of water in course of taking a deep (for water-sport) (and which has the lands adjoining both its bank adorned with boats)". Furthermore, the word "Uttarakula" found on mountain copperplates refers to the north bank of the Brahmaputra River.

1.7 Temples, villages and towns as described in parbatiya copper plates:

In verse 24 of plate 2 of the parbatiya copperplate, there is a description of a Shiva temple called “Hetuka Shulina”. Which temple was rebuilt by King Banamalavarmadeva. Plate 2 also describes a city called "Hadpeshwar" as follows: From the famous town ,named Hadapesvara which has the people of all the Varnas and Asramas well contented; which is the abode of innumerable good soldiers, virtuous and learned men; the big main roads of which (country) are crowded by the great kings who are seated on beautiful elephants and horses and in palanquins and are going and coming with a view to attending on the lord of the earth (ie., Vanamala); which has the whole of its space always filled by the armies of innumerable elephants, horses and foot-soldiers; (and which is situated on the bank of river Lauhitya) . The third plate also mentions the names of places like Svalpamangoka district, Hapush villege, Aksadahika, Candika, Dirghanga, dhavalpukhuri etc.

1.8 Summary of Parbatiya copper plates of Vanamalavarmadeva:

The inscription begins with the auspicious word svasti which denotes success and welfare. Moreover, two verses are recited as the benediction of this literary piece. The first in the honour of the Lauhitya-sindhu,(river Brahmaputra) and the second is in the honour of the god Pinaka,(Siva). After that we find about the king Naraka, son of Adivaraha and the goddess Earth. He has stolen the ear-rings of Aditi. He was more powerful than Hari i.e. Indra as he was able to defeat Indra.King Naraka was killed by Krisna. But Krsna's heart was melted with the lamentation of Naraka's wife who gave birth of two sons viz., Bhagadatta and Vajradatta. Being sad, Krsna did not give punishment to the sons of Naraka. When Bhagadatta obtained the lordship over Pragjyotisa, his brother Vajradatta went to the forest where he propitiated Isvara (probably the god Siva) by his penance. Thus he obtained the lordship over Uparipattana as well as the future lordship ofPragjyotisa for his descendants. After that we find about a later king named Salambha of Pragjyotisa belonging to Vajradatta's lineage. After Salambha his brother Arathi became king. He was endowed with the qualities of the past kings of the country beginning with Salastambha and ending with Harsa. Arathi's wife Jivadevi gave birth to a Son named Harjara. King Harjara was a very magnanimous king. His footstool was always brightened with the reflection of the stones of the crowns of other kings. King Harjara was like Yudhisthira in religious aspects. He was the host of his shoulders like Bhima. In battle field, he was like Arjuna. So, it can be said that even being one person he performed every role of Kunti's sons. Vanamalavarmadeva, son of Harjaravarman and Mangala was a very valorous king of the linage of king Naraka. Out of his fear, many great kings who could defeat many enemies and shoot sharp arrows in the battle field, had run away and even left their territories. He rebuilt a fallen temple of the god Hetuka- Sulina (i.e., lord Siva) into a magnificent building.

King Vanamalavarmadeva was a devout worshipper of Mahesvara. We find a lengthy description of the city of Hadapesvara situated on the bank of the Lauhitya-bhattaraka (i.e., the river-god Brahmaputra). The river is said to have passed by the Kamakuta hill where God Kamesvara and the goddess Mahagauri were installed. The king made a gift of the village called Hadapesvara, which was attached to the mandala or district of Svalpa-Mangoka situated in Uttara-kula. Eight sides of Hadapesvara viz., Aksadahika in the east, tank of Candika in the south-east, Dirghanga in the south, a banyan tree in the south-west, a bush of bamboos or reeds in the west, Śalmali tree in the north-west, big embankment in the north and the tank of Dhavala in the east were located. In his reign people were free from taxes. Again, there was a learned Brahmin named Jejjata who had four sons viz., Cudamani, Detobha, Garga and Sambhu. Among them, the eldest one Cudamani donated a village named Haposa to the Brahmins. The grant is said to have been with a view to increase the merit and fame of the king's parents with the request that it might be approved by everyone,

2.0 Conclusion:

Parbatiya copperplates of Banmaldeva, which begin with the auspicious word 'Swasti', give at least some idea of the society of that time and the customs prevalent in the society .The Parbatiya copperplates contain various information about the religion, monarchy, social system, the place of women in the society of that time, the influence of rivers, etc. The parbatiya copperplates of Banmalvarmadeva are an excellent source of information about the kings of the Shalastambha dynasty who expanded their empire from 675 to 725 AD.

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A Statistical Analysis of Impact of Modern Technologies on Agricultural Production nearTezpur, Assam

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Abstract

Technological innovations have greatly shaped agriculture throughout time. From the creation of the plough to the global positioning system (GPS) driven precision farming equipment, humans have developed new ways to make farming more efficient and grow more food. Agricultural researchers are constantly working to find new ways to irrigate crops or breed more disease resistant varieties. These iterations are the keys to feeding the ever-expanding global population with the decreasing freshwater supply. With the deep combination of both modern information technology and traditional agriculture, the era of agriculture 4.0, which takes the form of smart agriculture, has come. Smart agriculture provides solutions for agricultural intelligence and automation. However, information security issues cannot be ignored with the development of agriculture brought by modern information technology. In this paper, three typical development modes of smart agriculture (precision agriculture, facility agriculture, and order agriculture) are presented.

Keywords: Agriculture, AI, Innovation, Modern Technologies,Population.

Introduction:

India is home to 1.3 billion people, and globally ranks second in terms of the agricultural output. The agriculture, forestry and fishing sector accounted for 16.4% of the gross value added (GVA) in 2021. In contrast, the sector is serving as a primary source of livelihood for

more than 50% of the country's population. Low and stagnant income across these sectors remains a focal point of policy debate in India. These sectors accounts for the majority of the poor of the country. Recent estimates show that about 220 million people are poor in India. One of the most prominent pathways to enhance farmers' income is the adoption of improved agricultural technologies. The literature reveals that adoption of improved technologies is the key to increase agricultural productivity and farmers' income. While most other states in India are gradually moving away from their traditional agriculture-based economy toward industry or service-oriented economy, Assam is still heavily dependent on the agricultural sector. Compared to most other states in India, Assam is considered a less developed state, which depicts a gloomy picture the economic condition of the state given that India is considered a less developed country (LDC). While the socio-political problems afflicting the state since the last few decades are partly to blame for a lack of conducive environment for economic development of the state, particularly in industry or service-oriented areas, there are various economic reasons (e.g., fragmented land) responsible for the lagging agricultural sector in the state.

Agriculture is the primary industry in the world, and it plays an important role in social stability and economic development. Overcoming the contradiction between the population explosion and the limited grain yield is a challenge that motivates an increasing number of studies on smart agriculture. Thedevelopment of agriculture is based on boththe improvement in productivity and the restrictions of the era, and the progress of science and technology drives the revolution of agriculture (Yokamo, 2020).

Smart agriculture is a new agricultural production mode that contributes to agricultural information perception, quantitative decision-making, intelligent control, precise investment, and personalized service through the deep integration of modern information technologies,

e.g., the internet, Internet of Things, big data, cloud computing, and Artificial Intelligence (AI) with agriculture. In short, the new mode is a smart agricultural solution that combines agriculture with modern information technology. Although modern information technology brings new opportunities to the development of agricultural production, it also creates great demands and challenges to security and privacy in the field of smart agriculture.

Uses of Modern Technology In Agriculture In India

Improved productivity from the mechanization of agriculture – Manual labor and hand tools used in agriculture have limitations in terms of energy and output, especially in tropical environments. Resistance to agricultural mechanization, especially among smallholder farmers due to accessibility, cost, and maintenance issues, often acts as a detrimental factor. To reduce manual labor and make processes faster, combine harvesters are finding greater use. Indian farming is characterized by small landholdings, and the need is to partner with others to take advantage of modern machines.

Climate/ weather prediction through artificial intelligence– A major advance in agriculture is the use of artificial intelligence (AI). Modern equipment and tools based on AI enable data gathering and assist in precision farming and informed decision-making. Drones, remote sensors, and satellites gather 24/7 data on weather patterns in and around the fields, providing farmers with vital information on temperature, rainfall, soil, humidity, etc. However, AI finds slow acceptance in a country like India where marginal farming, fragmented landholdings, and other reasons act as impediments. But there is no doubt that technologies based on AI can bring precision to large-scale farming and lead to an exponential rise in productivity.

Agriculture Sensors– Communications technology has evolved rapidly in India and made smart farming a possibility. Sensors are now being used in agriculture to provide data to farmers to monitor and optimize crops given the environmental conditions and challenges. These sensors are based on wireless connectivity and find application in many areas such as

determining soil composition and moisture content, nutrient detection, location for precision, airflow, etc. Sensors help farmers save on pesticides, and labour, and result in efficient fertilizer application. They allow farmers to maximize yields using minimal natural resources.

Improving farm yields and supply chain management use Big Data – The collection and compilation of data and its further processing to make it useful for decision-making/problem-solving are expanding the way big data functions. Big data is slated to play a major role in smart farming, and the benefits percolate across the entire supply chain and the markets. Agriculture is becoming larger, and it depends on a large number of variables.

Livestock monitoring– The use of chips and body sensors can help prevent disease outbreaks and are crucial in large-scale livestock management. Chips and body sensors measure vital parameters and indicators that could detect illness early and prevent herd infection. Similarly, ultrasounds are a useful tool to judge the quality of meat. This helps control and improve the quality of the meat.

Benefits of Using Technology In Agriculture

Increases agriculture productivity; prevents soil degradation; reduces chemical application in crop production; efficient use of water resources; disseminates modern farm practices to improve the quality, quantity and reduced cost of production; changes the socio-economic status of farmers.

Impact of Modern Technology on Agriculture

Technologies can enable the transition of modern agriculture in the field. While some technologies have transformed the way we operate, there is a need for spreading technological advancements in agriculture, like artificial intelligence and machine vision. The use of modern technology in agriculture can enable millions of farmers to benefit from the

acquisition of real-time farm information. Farmers can have ready availability of weather information and disaster warnings, and also have instant access to farm data.

As we can clearly predict that the world population is slated to grow to about 9 billion by 2050. The challenge is to find ways and means to produce enough to feed it. The challenge of reducing acreage under agriculture and food wastage in production and distribution is having a major impact on the world. The increasing role of technology in agriculture to address these issues is the only way forward to a food-secure future. Technology can help save foreign exchange for countries, increase productivity, and lead to an improvement in the overall standard of farmer communities. India has a long way to go in the adoption of modern farming practices through technology. The pace is slow and path-breaking efforts need to be made to educate farmers about the benefits to be had with technology. Transcending the barriers of archaic farming practices and medieval mind-sets is a challenge that needs to be overcome for a better tomorrow. Technology in agriculture has the potential to truly lead India to be "Atmanirbhar Bharat" in all respects, and be less dependent on extraneous factors.

Review of Literature:

A review of previous studies on agriculture is essential to get a bird's eyeview about the sector. Several authors have dealt extensively with various aspects of agriculture sector. The introduction of technology in agriculture has led to a massive increase in food productivity as well as removing any concerns relating to a scarcity of food in the future. Singh, et. al., (2014) found thatadvancements in technology such as crop sensors, irrigation systems and fertilizers have all helped crop yields meet their maximum potential, and variable rate technologies have also ensured that fields obtain the required amount of input that will as a result lead to huge increases in production.History has shown that farmers have been relatively good down through the years at adopting new methods and technologies. It has

been 285 well documented in recent years that food production will need to rise by up to 70% in many parts of the world within the year 2050 due to predict.

Rehmanet. al. (2016) indicates the significance of usage of technology in the agricultural sector which has been recognized with the main purpose of meeting the food requirements of the individuals. India has made progress in agriculture, but productivity of the major agricultural and horticultural crops is low in comparison to other countries. There are still deficits in the usage of technology. Yields per hectare of food grains, fruits and vegetables within the country are far the below global averages. Even India's most productive states are behind the global average. Similarly, the productivity of pulses and oilseeds can be increased, through giving consideration to the seeds, soil health, pest management, crop life-saving irrigation methods and post-harvest technology. India's population is expected to reach 1.5 billion by 2025, making food security most important social issue and food production will have to be increased substantially, to meet the requirements of an increasing population. In rural areas, there are number of people who are residing in the conditions of poverty and backwardness. Agriculture is the primary occupation of the individuals in rural areas, hence, usage of technology and modern and innovative techniques and methods will prove to be advantageous for improvement in the living conditions of the individuals and in alleviating the problems of poverty. There are numerous technologies and individuals employed in the agricultural sector and farming practices need to possess knowledge and information, how to make best use of them.

Objectives:

i. To analyse the impact on agricultural production after the adoption of different technologies along with to evaluate the role of government policies and initiatives in promoting the adoption of modern agricultural technologies.

ii. To identify the challenges faced by farmers in Tezpur, Assam in adopting and utilizing modern agricultural technologies.

iii. To compare the performance of modern agricultural technologies with traditional farming methods and highlight the advantages and disadvantages of each approach.

Methodology:

The data were collected areas near Tezpur, Assam on the basis of personal interviewing method. A questionnaire has been prepared for this purpose so that we may extract information on some important aspects of their lives. Altogether 30 sample questionnaires were filled by the farmers in the areas near Tezpur. Moreover to analyse the data, we have used Paired Sample t-test and Spearman's rank correlation.

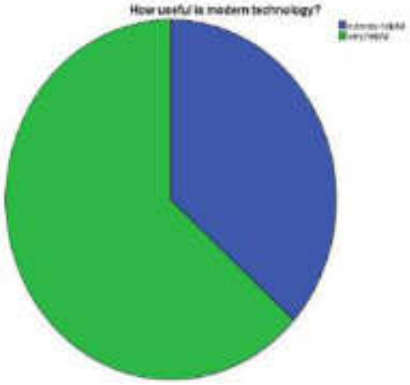
Here we have considered the following null hypotheses:

$\boldsymbol{H_{01}}$: There is no statistical correlation between getting the government schemes and the helpfulness of it.

$\boldsymbol{H_{02}}$**:** There is no significant difference between traditional method of agriculture and agriculture with modern technologies.

Result and Discussion:

The usefulness of modern technologyon agricultural production after the adoption of different technologies can be seen with the following figures.



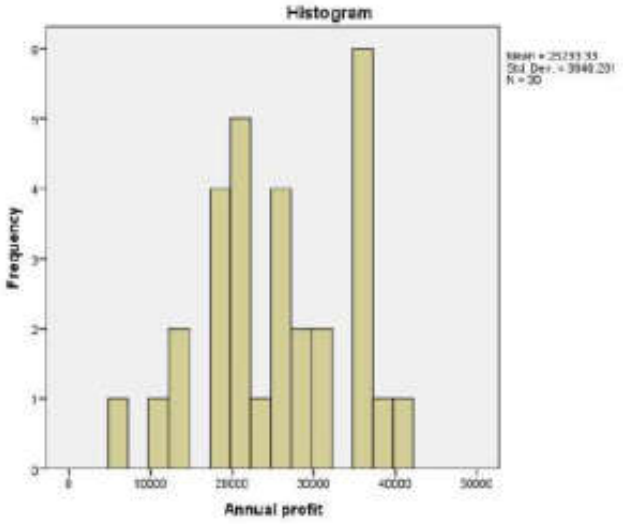


Fig.(i) : Usefulness of Modern Technology on agriculture Fig (ii): Distribution of Annual Profit earned by farmers

From fig.(i), it is clear that most of the farmers have accepted that modern technology is very helpful as compared to traditional method. At the same time, from fig.(ii) we can conclude that annual profits of farmers are also increases significantly.

Table (i): Paired Samples t-test

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 how useful is modern technology - annual profit	25232.700	880.390	164.027	28533.756	21931.644	15.633	29	.000

Since, from the Table (i), we observed that the significant value is 0.000, i.e. less than 0.05, therefore we may reject the null hypothesis at 5% level of significance. So, we can conclude that there is a significant impact of modern technologies to the annual income of the farmers, i.e. there is a significant difference between usefulness of modern technology with annual profit of the farmers. On the other hand we can conclude that there is a significant difference between traditional method of agriculture and agriculture with modern technologies.

Now to evaluating the role of government policies and initiatives in promoting the adoption of modern agricultural technologies, we have considered the Spearman's rank correlation coefficient which is given by Table (ii).

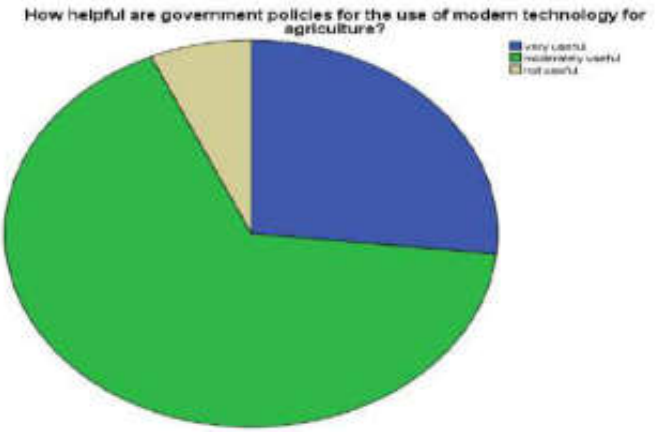


Fig.(iii) : Helpfulness of govt. policies towards modern technologies

Table (ii): Spearman's Rank Correlation

			Did you get any government schemes or policies in agricultural sector?	How helpful are government policies for the use of modern technology for agriculture?
Spearman's rho	Did you get any government schemes or policies in agricultural sector?	Correlation Coefficient	1.000	.786
		Sig. (2-tailed)	.	.025
		N	30	30
	How helpful are government policies for the use of modern technology for agriculture?	Correlation Coefficient	.786	1.000
		Sig. (2-tailed)	.025	.
		N	30	30

From fig.(iii), it is seen that government policies are helpful to almost all the farmers. A Few of them didn't find it useful. Same result is also found from Table (ii).It is seen that there is ahighly positive correlation between the government policies with their helpfulness towards the uses of modern technology for agricultural production. Since the significant value is 0.025, which is smaller than 0.05; therefore we can conclude that the null hypothesis can be rejected, i.e. there is a statistical correlation between receiving the government policies with the helpfulness of that policy for the use of modern technology for agriculture.

Again, to identify the challenges faced by farmers in near Tezpur, Assam in adopting and utilizing modern agricultural technologies, the following results were found.

Table (iii): Which method produces more wastage?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	traditional	11	36.7	36.7	36.7
	Modern	19	63.3	63.3	100.0
	Total	30	100.0	100.0	

Here we can see that the traditional method produces 36.7% of wastage and modern method produces 63.3% of wastage which is way higher than the traditional methods, which is one of the major challenges faced by the farmers near Tezpur, Assam in adopting and utilising modern agricultural technologies.

ToComparing the performance of modern agricultural technologies with traditional farming methods and to highlight the advantages and disadvantages of each approach, we have considered a number of parameters and out which we found that in traditional method of farming, at least a minimum of 6 to 7 workers are needed. On the contrary, it is found that in modern method of farming, only 2 to 3 workers are needed to cultivate, i.e. in traditional method more than 5 workers are required for cultivating over 1bigha of land which is higher than modern method which requires less than 5 workers for cultivation, which is a major advantage of modern agricultural method.Therefore we can conclude that, from workers point of view, the modern technologies are more helpful. Also it is found that the amount need to pay the workers is higher, as we need fewer workers in modern method of agriculture. Therefore this is a majoradvantage of modern technology.

1. CONCLUSION:

From the above study we found that there is a significant impact of modern technology on annual income of the farmers i.e. usage of modern technology has helped the farmers to

increasetheir income. There is no correlation between receiving the Government policies with the helpfulness of the policies for the uses of modern technology for agriculture as some ofthe Government policies are out of reach of some farmers. But relying completely on modern technology will be a major challenge as it produces more wastage as compared to traditional method of farming. Also traditional method requires more number of labours, but at the present time it is quite difficult to higher labours.

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Aquatic organisms consumed by the Bodo tribe of Udalguri district of Assam and their traditional use in medicine

A dissertation project submitted in partial fulfillment of the requirementt for the degree of master of science in zoology

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Date:

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From

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DECLARATION

I do hereby declare the project entitle “Aquatic organisms consumed by the Bodo tribe of Udalguri District of Assam and their use in medicine” submitted in part fulfilment of the requirements for the Degree of Master of Science in Zoology under the faculty of Zoology, Darrang College, has been completed by me under the supervision of Dr.Chittaranjan Baruah, Department of Zoology, Darrang College, Assam, India. I have not submitted the matter related to the project, either in whole or in part for any degree or award elsewhere.

(Daijy Kalita)

Place:

Date :

CERTIFICATE

This is to certify that M.Sc dissertation entitled ‘Aquatic organisms consumed by the Bodo tribe of Udalguri District of Assam and their use in medicine’ is a bonafied work done by Daijy kalita , M.Sc 4th semester , department of zoology,Darrang college bearing Roll No: PS-211-225-0015 during the session 2022-2023.

I have great pleasure in forwarding this dissertation work of Daijy Kalita which has been accomplished under my guidance and supervision and the results and plates presented in the dissertation are original and is of individual findings.

Dr. Chittaranjan Baruah

Assistant professor

Department of zoology

Darrang college, tezpur

Date :

CONTENTS

CHAPTER 1

INTRODUCTION

In the human diet, fish is a highly nutritious food. They include numerous other crucial elements in addition to being a source of protein. According to Roos et al. (2003), small indigenous fish species are significant as a key source of micronutrients for rural residents, including calcium, zinc, iron, and fatty acids,as well as a source of income for many fishers. The native have extensive understanding of these fish's nutritional and therapeutic benefits.

Fish and fishing play a important role in the daily lives and cultures of the many different ethnic groups who call the planet home. The Bodos are one of the largest plain groups in North- East India, and they are mostly restricted to the Bodoland Territorial Region (BTR) in Assam. North East India is a hotspot for biodiversity and is home to a vast range of traditional tribes (Shrabanti & Kachari,2015). The Bodoland region has a vast diversity of flora and fauna since there are large areas that are covered in forest and natural water sources. Numerous fresh water, coldwater , and ornamental fish species have been found in the area, according to studies (Baro et al., 2015; Baro et al., 2014) indicating the region's significant ichthyofaunal variety.

The ancestors of Bodo had developed certain methods and techniques to preserve seasonal and unseasonal(The food available all year long) food. Bodo have adopted different techniques of preservation like sun-drying, fermentation, smoking, burning, cooking etc. The bodos consume fresh fish, dried fish and rotten preserved fish (Machahari,,2004)

Fermented foods were very likely among the first foods consumed by human beings and the process of fermentation could only occur in the presence of microorganisms (Hutskin, 2006). Fermentation is an ancient technique to preserve, enrich food and increase the safety of food; and human has consumed since the beginning of civilization. But with the development of food processing techniques, it was kind of forgotten. Fortunately, it's having a comeback for its health benefits (Optimize with science, 2019). Fermentation is a natural process that unavoidably affects the human food supply worldwide and fermented foods have worldwide acceptance that arises in the human relationship to the microbial environment (Tanasupawat & Visessanguan, 2014)

The treatment of human diseases using animals and animal-derived treatments is known as zoo-therapy (CostaNeto 1999). World Health Organization (WHO 1993) reported that around 70-80% of the world's rural population relies for primary health care on traditional medicine. Using

animals and their products to treat patients suffering from various health problems has a long tradition and is still popular in many parts of the world, even at a time when great heights have been achieved in medical science (Jugli et al. 2019). WHO (2014) estimates that in developing countries the proportion of population using traditional medicine is considerably higher (60-90%) compared to developed countries (23-80%).

The knowledge and use of animals and animal parts in traditional medicine by different ethnic groups are generally passed on through oral communication from generation to generation from one (elderly) person to another in the family, and this knowledge may be lost with the death of the knowledgeable elderly person. It is therefore, vital to study and document the traditional uses of animals for the cure of different ailments. (Borah et al., 2016)

1.1 REVIEW OF LITERATURE

The use of animals by human beings for various purposes dates far back to the early times of the human race. There has been a revival of interest in the study and the use of medicinal properties of animals by the ancient people. Different groups of indigenous people around the world used fish for treatment of different ailments. Ethnic groups of people with a close proximity to the natural resources had a deep knowledge of resources used as food and medicine, for trade and ritual practices (Berkes et. al. 1998)

Many researchers have work on finding the nutritional value of edible insects. It is observed that the nutritional value of edible insects varies from species to species, their feeding habit, stage of development, environment and sex (van Huis and Oonincx, 2017). However, it is agreed by all that insects are rich in protein and other micronutrients and vitamins. Till now enormous works have been done on drug discovery from plant sources. While the field of insects have been untouched until the search for alternative protein rich food begins for future food security in 1975 (Meyer-Rochow, 1975). Since then consequential research has been going on with successful results in terms of publication and products related to insects for human consumption. From the data of ongoing investigation, it can be suggested that insects as food represent an alternative source of food rich in essential amino acid, minerals, and vitamins with less environmental hazards (Latunde-Dada et al., 2016; Mishra et al., 2003b; Shantibala et al., 2014).

Apart from its importance as food, insects are also being used as a source of medicine by different tribal people around the world (Chakravorty et al., 2011b; Meyer-Rochow, 2017; Senthilkumar et al., 2008b). Nowadays, pharmaceutical research is much more focused on natural products from plant and other invertebrates (Cragg and Newman, 2013; Dossey, 2010; Ratcliffe et al., 2014). Still, insects based natural compounds are not getting much attention for drug development. Although a little work has been done on the therapeutic potential of insects viz. antimicrobial peptides, cancer, inflammation etc., there are lots to explore with scientific validation for future drug development (Hamilton et al., 2017; Lee et al., 2013; Lee and Bae, 2016; Verma and Prasad, 2012). However, insect-based natural compounds are not getting much attention for drug development, probably due to the lack of chemical analysis and deficient investigation.

PREVIOUS WORKS ON ETHNOMEDICINAL USE OF ORGANISMS AROUND THE WORLD:

Alves and Rosa (2006) carried out field surveys in fishing villages located in the states of Maranhao and Parayba of Northeast Brazil, where a total of 100 animal species (72 families), distributed in 12 taxonomic categories, were used as medicine. Zootherapeutic resources were used to treat 62 different diseases. The local medicinal fauna is largely based on wild animals, including some endangered species. Threatened species, such as the seahorse (Hippocampus reidi, Ginsburg, 1933) and the green turtle (Chelonia tnydas, Linnaeus, 1758) represented important medicinal resources for the studied communities.

Artisanal fishermen from Siribinha Beach in the State of Bahia, Northeastern Brazil, have been using several marine/estuarine animal resources as folk medicines (Costa-Neto and Marques, 2000). Which are distributed in six scientific taxonomic categories, such as fish (62%), crustaceans (13%), reptiles (10%), echinoderms (8%)), gastropods (5%), and mammals (2%). Raw materials including scales, spur, shell, fat, skin, globe of the eye, tentacles and otolith are used in the elaboration of remedies to treat locally diagnosed aliments. These folk remedies are administered to the patients in the form of plasters, teas, smokes and food. Asthma, bronchitis, stroke and wounds are the most usual ailments treated by these animal-based medicines.

Costa-Neto (2004) describes the use of 180 animal species as medicinal resources in the state of Bahia, Northeastern Brazil. The animal-based folk medicines come from millipedes (0.5%), annelids (1.0%), amphibians (1.0%), arachnids (1.0%), echinoderms (1.5%), crustaceans (4.0%), molluscs(6.0%), reptiles (12.0%), birds (13.0%), fishes (17.0%.), mammals (20.0%) and insects (23.0%). These Bio resources provide about 300 raw materials.

PREVIOUS WORKS ON ETHNOMEDICINAL USE OF ORGANISMS AROUND THE COUNTRY :

Several studies on the fish and other organism in traditional healthcare practices in India as well as in Assam has been conducted.

Singh and Padmalatha (2004) describe the Ethno entomological practices in Tirunelveli district, Tamil Nadu. In this investigation, 11 species of insects used to prepare traditional medicine were

identified and details about their therapeutic value are enumerated. Insects are used as medicine to cure various ailments like urinary diseases, neurological problems, hair loss, skin diseases, respiratory illness etc. the insects like termites are consumed as healthy food also.

Kalita et al. (2005) studied the plant and animal based folk medicine used by people of Dibrugarh district, (Assam) for treatment of eleven different diseases, e.g. body pain, carbuncle, diabetes, epilepsy, gastritis, indigestion, obesity, piles, pimples and urinary tract infection. In this study, information on utility of 19 plant species and 4 animal species is collected.

Negi and Palyal (2007) studied the Shoka tribes of Darma and Johaar valleys, in Pithoragarh district (Uttaranchal) India. A total of 38 species (mammals-20, birds-6, reptiles-5, insects-4, fish-2, and amphibian-01) were recorded for the therapeutic purposes. A total of 19 different diseases or disorders were being treated using the animal products. Out of the total 38 species, only a minuscule 3 species had multiple usages, as regards the treatment of different diseases.

Teronpi, et al.(2012)studied about the Ethnology of the Karbis of Assam: use of ichthyofauna in traditional health –care practices and mentioned 12 fish species and their medicinal uses.

Chinlampianga, et.al. (2013) describe ethnozoological Diversity of Northeast India main uses of aquetic species and birds and other animal species of Arunachal Pradesh for food, ethnomedicine and sociocultural purposes. A total 48 faunal species having ethnozoological values among the knowledge holders of Mizoram State were documented. These animal resources used as medicines by the tribal people of Mizoram consist of : Mammals (21), birds (6), reptiles (7), arthropod (1), Amphibian(l), Annelids(2), insect(6), fish species (2), arachnida (spider) (1) and diplopods (1). These animal resources are used in the treatment of over 50 kinds of diseases or ailments for humans and as veterinary medicine.

Borah and Prasad (2017) conducted a study on animal based medicine used by traditional healers and indigenous inhabitants in the adjoining areas of Gibbon wildlife sanctuary, Assam, India and recorded a total of 44 different species of animals which are used for the treatment of 40 different ailments. Insect occupied the highest uses followed by mammals, fishes, reptiles, amphibians, annelids and gastropods.

From the above review of literature it has been found that there is no evidence of work done based on aquatic organisms consumed by the Bodo tribe of Udalguri District of Assam and their use in medicine.

1.2 AIM AND OBJECTIVES OF THE STUDY :

i) To study the diversity of commonly used aquatic organism among Bodo tribe of Udalguri district of Assam.

ii) To study the traditional belief on aquatic organism to cure disease.

iii) To study the Indigenous methods used by Bodo community to preserve aquatic organism.

1.3 SIGNIFICANCE OF THE STUDY:

Ethno-zoological drugs of animal origin have great importance to the tribal people due to limited access to allopathic medicines, a lack of proper medical facilities, and transportation problems.

It Is seen that in spite of extremely precise ecological knowledge and a strong tradition of conservation and sustainable use, certain animals become rare due to substances used in hunting for food and other uses, and only preserved parts of those animals have been used as raw materials for the treatment of diseases.

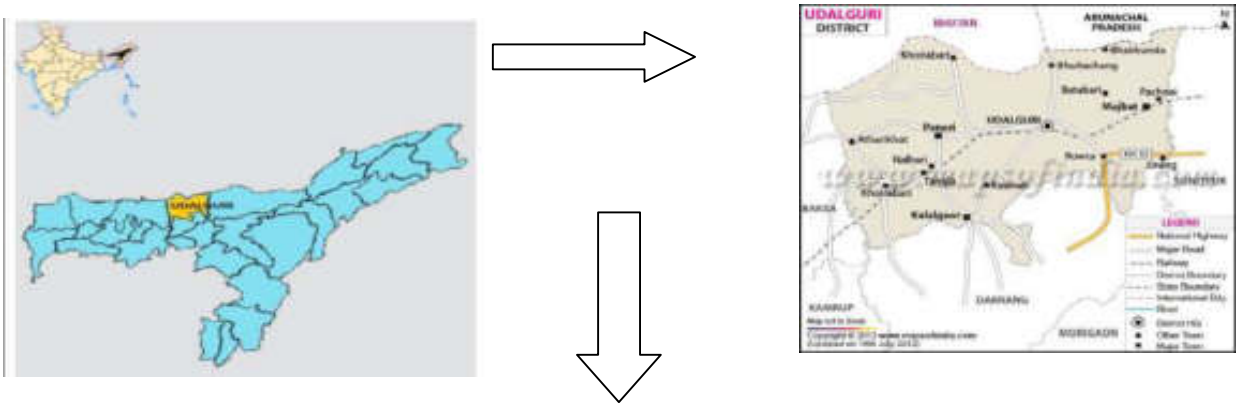
The Interest in traditional social institutions is gradually eroding among the young generation due to the intrusion and assimilation of alien cultures. Therefore, the socio-ecological system has to be strengthened through sustainable management and conservation of biodiversity. It must be established as an important step towards understanding the valuable contribution of this indigenous knowledge system so that users and sellers are aware of the legal and ecological status of the species they use as a source of medicine, food, income, and other benefits.

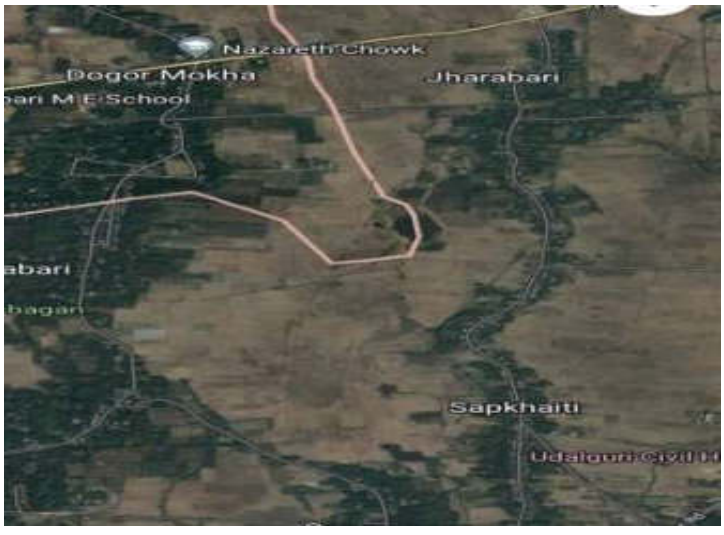
CHAPTER 3

MATERIALS AND METHODS

3.1 STUDY AREA :

Four blocks of Udalguri districts, viz., Khoirabari block, Bhergaon block, Harisinga block and Udalguri block were choosen as the tribe is mostly confined to these area of udalguri district in Assam.A total of these remote villages, inhabitated by the Bodos, and their nearby markets were selected at random for the survey, in each of the area selected. A total of 11 villages were selected from these four blocks. Khoirabari and Borbalisitha under khoirabari block; Dogormokha, Sundaridia under udalguri block; Amguri, Paneri,Harisinga under Harisinga block; No.1 Garuajhar, No 3 Suklaikhuti,Choutalpara, Dimakuchi under under Bhergaon block.





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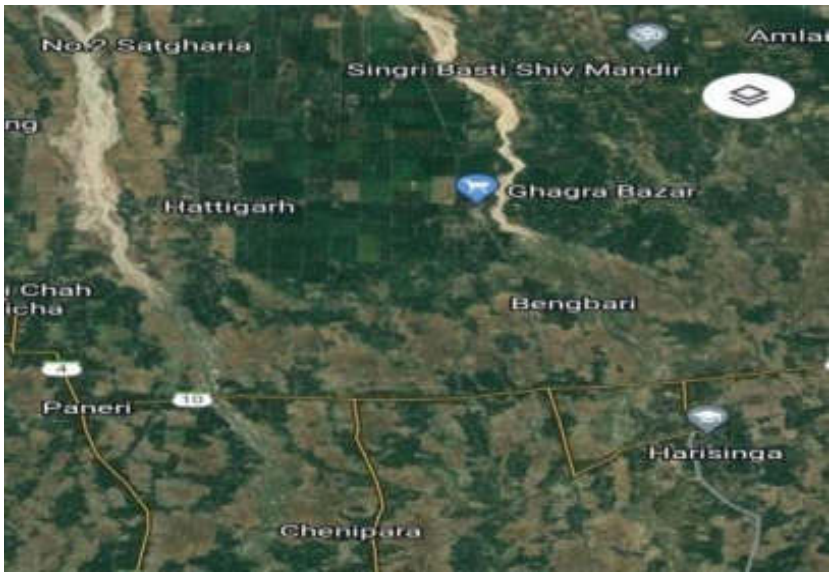
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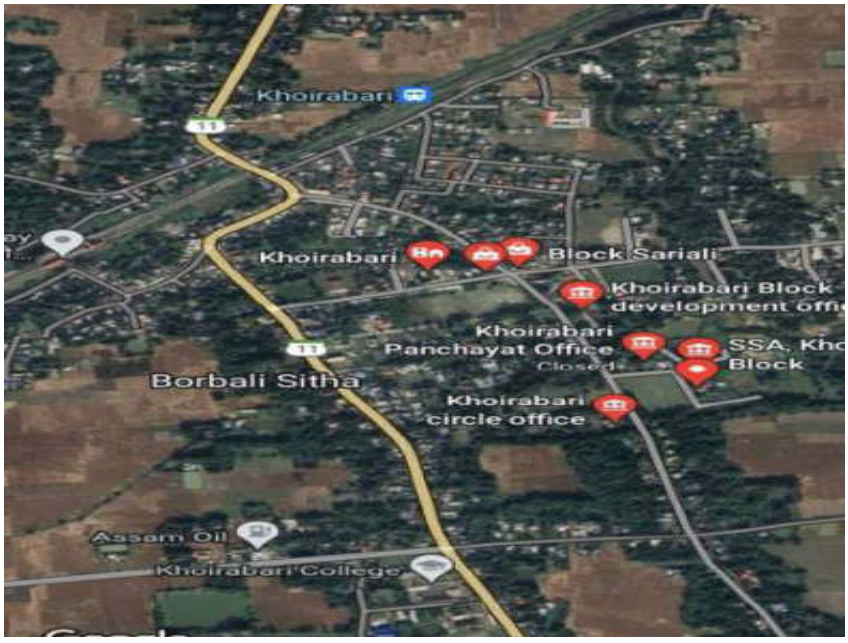
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Assam Oil
Khoirabari College

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Figure : Location map of the study area ; [A] Map of assam (souce: www.veethi.com) [B] Map of Udalguri , (source : www.mapsofindia.com) [c] Udalguri block [d] Khoirabari block [e] Khoirabari block, [f] Bhergaon block (source : maps.google.com)

3.2 Methods of data collection

The survey was conducted in the rural areas of Udalguri district from January 2023 to May 2023 by performing interviews, field studies, and structured questionnaires.

The specimens were collected with the help of local informants, who were mostly local. In the study of the use of aquatic organisms as medicine by the Bodos, the most reliable method involves field study.

This work is being undertaken through a field survey in the Bodo-populated areas in the Udalguri district of Assam.

In this study, the interview method and observation methods are adopted for data collection. Data are collected from both primary and secondary sources. During the fieldwork in villages, the villagers and village Ojas were consulted about their primary methods of treating ailments. The traditional practitioners of herbal medicines, who are experts in treating various ailments along with different methods of treatment, were consulted for some information and first-hand data. More information is collected from villages, knowledgeable persons, traditional healers, village leaders, or Gaonbura.

The fish specimen were were identified following the the literature of Talwar and Jhingran(1991) and Jayaram (2010). Insects were identified following taxonomic keys such as Pennak, 1978; Biswas et al, 1995a, 1995b; Bal and Basu, 1994; Thirumalai, 2007; Srivastava and Sinha, 1995.The macrophytes species were identified using different available published literatures of Choudhury ,2005; and Das,2013. Identification of the mollusks were done according to Ramakrishnan & Dey (2007) and the available updated literatures from IUCN. Identification of amphibian species were done following Boulenger, Chanda, Dutta and Dubois & Ohler

CHAPTER 4

RESULTS

Field study on food behavior of Bodos in undivided Udalguri district of Assam showed that the Bodos are the greater food lover. A leisurely meal of many items which requires long hours of labor, preparation and ingenuity in the kitchen has long been a major part of Bodo culture. The traditional Bodo cuisine is one of the famous cuisines of Assam.

Four blocks of Udalguri districts, viz., Khoirabari block, Bhergaon block, Harisinga block, and Udalguri block, were chosen as the tribe is mostly confined to these areas of Udalguri district in Assam. A total of These remote villages, inhabited by the Bodos, and their nearby markets were selected at random for the survey in each of the areas selected. A total of 11 villages were selected from these four blocks. Khoirabari and Borbalisitha under Khoirabari block; Dogormokha and Sundaridia Path under Udalguri block; Amguri, Paneri, and Harisinga under Harisinga block; No. 1 Garuajhar; No. 3 Suklaikhuti; Choutalpara; and Dimakuchi under Bhergaon block. A field study on the food behaviour of Bodos in the undivided Udalguri district of Assam showed that the Bodos are the greatest food lovers. A leisurely meal of many items that requires long hours of labour, preparation, and ingenuity in the kitchen has long been a major part of Bodo culture. The traditional Bodo cuisine is one of the famous cuisines of Assam. A variety of fish (table 4.1), aquatic insects (table 4.2), crustaceans (table 4.3), amphibia (table 4), gastropods (table 4. 5) and macrophytes (table 4.6) are consumed by bodo communities. Few species of fish (Table 4), aquatic insects (Table 4.8), amphibians (Table 4.9), crustaceans (Table 4.10), gastropods (Table 4.11), and macrophytes (Table 4.12) are believed to havesome medicinal value by the Bodo people of Udalguri district of Assam.

Table 4.1 : List of fish used by bodo people of Udalguri district

Sl. No	LOCAL NAME (Bodo)	SCIENTIFIC NAME	FAMILY
1.	Rou,Rohu	*Labeo rohita* (Hamilton, 1822)	Cyprinidae
2.	Bhakua,Catla	*Labeo catla* (Hamilton,1822)	Cyprinidae

3.	Mirga, Mrigal	*Chirrhinus mrigala* (Hamilton,1822)	Cyprinidae
4.	Bhangon, bhangna	*Labeo bata* (Hamilton, 1822)	Cyprinidae
5.	Lachim bhangon	*Chirrhinus reba* (Hamilton, 1822)	Cyprinidae
6.	Rougusum, kalbasu	*Labeo calbasu* (Hamilton, 1822)	Cyprinidae
7.	Kurhi	*Labeo gonius* (Hamilton, 1822)	Cyprinidae
8.	Grass carp	*Ctenopharyngodon idella* (Valenciennes , 1844)	Cyprinidae
9.	Common carp	*Cyprinus carpio* (Linnaeus, 1758)	Cyprinidae
10.	Silver carp	*Hypophthalmichthys molitrix* (Valenciennes , 1844)	Cyprinidae
11.	Bighead, Briket	*Hypophthalmichthys nobilis* (J. Richardson, 1845)	Cyprinidae
12.	Japani khawoi	*Oreochromis mossambicus* (W.K.H.Peters , 1852)	Cichlidae
13.	Java pithikhri	*Puntius javanicus* (Bleeker , 1855)	Cyprinidae
14.	Magur	*Clarius magur* (Hamilton , 1822)	Clariidae
15.	Singi	*Heteropneustes fossilis* (Bloch, 1794)	Heterpneustidae
16.	tingra	*Mystus vittatus* (Bloch,1794)	Bagridae
17	singarah	*Mystus cavasius* (Hamilton,1822)	Bagaridae
18.	thengwna	*Mystus tengara* (Hamilton, 1822)	Bagaridae
19.	Boroli	*Wallago attu* (Bloch & Schneider,1801)	Siluridae
20.	Ari	*Sperata seenghala*(Skyes, 1839)	Bagridae
21,	Kajoli	*Ailia coila* (Hamilton,1822)	Ailiidae
22.	khangkhila	*Xenontodon cancila (*Hamilton, 1822*)*	Belonidae
23.	Pabho	*Ompok bimaculatus* (Bloch, 1794)	Siluridae
24.	Basa	*Eutropiichthys vacha*(Hamilton,1822)	Schilbeidae
25.	Neria	*Clupisoma garua* (Hamilton, 1822)	Schilbeidae
26.	Gwrwi	*Channa punctatus* (Bloch,1793)	Channidae
27.	Nasrai	*Channa gachua* (Hamilton,1822)	Channidae
28.	Sol	*Channa striatus (* Bloch,1793*)*	Channidae
29.	Nisla	*Channa stewatii (* Playfair,1867)	Channidae
30.	khawoi	*Anabas testudineus* (Bloch,1792)	Anabantidae
31.	Bengshi	*Trichogaster fasciata (*Bloch & Schneider,1801*)*	Osmophronemidae
32.	Bengshi	*Trichogaster lalius* (Hamilton,1822)	Osmophronemidae
33.	Gedgedi, Thotha na	*Nandus nandus (* Hamilton, 1822*)*	Nandidae
34.	Chital	*Chitala chitala (* Hamilton, 1822)	Notopteridae
34.	Kandhuli	*Notopterus notopterus* (Pallas , 1769)	Notopteridae
35.	Maowa	*Ablypharyngodon mola (Hamilton,1822)*	Cyprinidae
36.	Piithikhri	*Puntius sophore(* Hamilton,1822)	Cyprinidae
37.	Senapiithikri	*Pethia ticto (* Hmilton,1822*)*	Cyprinidae

38.	Boliara	*Cabdio morar (* Hamilton,1822)	Cyprinidae
39.	Dwrkina	*Esomus dendricus (* Hamilton,1822*)*	Cyprinidae
40.	patmuthra	*Glassogobius giuris (* Hamilton,1822*)*	Gobiidae
41.	chelkani	*Salostomar bacaila (*Hamilton1822*,)*	Cyprinidae
42.	selkona	*Chela aptar (*Hamilton,1822*)*	Cyprinidae
43.	Chanda	*Chanda nama (Hamilton,1822)*	Ambassidae
44.	Chanda	*Parambassis ranga (Hamilton,1822)*	Ambassidae
45.	Bwthia	*Lepidocephalichthys guntea (Hamilton,1822)*	
46.	Dhanboka khusia	*Monopterus cuchia (Hamilton, 1822*	Synbranchidae
47.	Baami	*Anguilla bengalensis (Gray,1831)*	Anguillidae
48.	Thuri	*Macrognathus aral* (Blooch & Schneider,1801)	Mastacembelidae
49.	thwra	*Macrognathus pancalus* (Hamilton,1822)	Mastacembelidae
50.	Bami	mastacembelus armatus (lacepede, 1800)	Mastacembelidae
51.	Pabho	*Ompok pabda* (Hamilton,1822)	Silurudae
52.	Kos	*Pangacius pangasius (Hamilton, 1822)*	Pangasidae

Table 4.2 : List of the insects consumed by bodo community of Udalguri district.

Sl no.	Local name(Bodo)	Scientific name	Family
1.	Gangjema	*Lethocerus indicus* (Lep. & Serv.)	Belastomatidae
2.	Inkhaori	*Diplonychus rusticus*	Belastomatidae
3.	Chinkhaori	*Cybister tripunctatus asiaticus* (Sharp,1882*)*	Dytiscidae
4.	Chingkhaori	*Cybister convexus* (Sharp,1882*)*	Dytiscidae
5.	Chingkhaori	*Cybister lateralimarginalis (*De geer, 1774)	Dystiscidae
6.	Chingkhaori	*Cybister limbatus* (Fabricius 1775)	Dystiscidae
7.	Chingkhaori	*Dysticus marginalis* (Linn, 1758)	Dystiscidae
8.	Gaorema	*Hydrophilus triangularis* (Say, 1823)	Hydrophilidae
9.	Lanjai gwlao	*Laccotrephes ruber* (Linn, 1764)	Nepidae

Table 4.3 : List of some Crustacea consumed by Bodo people are :

Sl. No	Local name(Bodo)	Scientific name	family
1.	Khangkhrai gooboi	*unidentified*	unidentified
2.	Khangkhrai dubri	*Sartoriana spinigera* (Wood-Mason,1871*)*	Gecarcinucidae
3.	Khangkhrai alari	*Sartoriana trilobata* (Alock, 1909 *)*	Gecarcinucidae
4.	Khangkrai jamin	*Maydelliathelphusa lugubris* (Alcock,1909)	Gecarcinucidae
5.	Nathur	*Macrobrachium assamensis* (Wood-Malson,1871)	Palaemondae
6.	Nathur	*M. malcolmsonii* (H.Milne Edwards,1844 *)*	palemonidae
7.	Nathur	*M. tiwari* (Agarwal)	palemonidae

Table 4.4 : list of the amphibia consumed by Bodo tribe of Udalguri district.:

Sl.no	Local name(Bodo)	Scientific name	Family
1.	Ambu sitro	*Duttaphrynus melanostictus (Schneider, 1799)*	Bufonidae
2.	Ambu tetred	*Euphlyctis cyanophlyctis* (Schneider,1799*)*	Dicroglossidae
3.	Ambu tetred	*Euphlyctis hexadactylus* (Lesson,1834 *)*	Dicroglossidae
4.	Ambu bongla	*Hoplobatrachus tigrinus* (Daudin,1802*)*	Dicroglossidae

Table 4.5 : list of the mollusc consumed by Bodo tribe of Udalguri district:

Sl. no	**Local name(Bodo)**	**Scietific name**	**Family**
1.	*Samo ladai*	*Pila globusa (*Swainson,18220	Ampullariidae
2.	Samo lingri	*Brotia costula* (Brandt, 1974)	pachychilidae
3.	Samo dahwnai	*Balamya bengalensis* (Lamarck,1822)	viviparidae
4.	Samo khohe	*Lamellidens marginalis* (Lamarck,1819)	unionidae

Table 4.6 : list of the macrophytes consumed by Bodo tribe of Udalguri district:

Sl. no	**Local name(Bodo)**	**Scietific name**	**family**
1.	Ajinai	*Monochoria hastate (*Linnaeus,1753)	pontederisceae
2.	Ajinai	*Monochoria vaginalis (*Burm.f.)	pontederisceae
3.	Mande	*Isomoea aquatic* (Frossk.)	convolvulaceae
4.	Alangshi	*Enydra fluctua*	asteraceae
5.	Toblo	*Nymphaea alba*(Linnaeus,1753)	Nymphacea
6.	Toblo	*Nymphaea nouchali (*Burm.f*)*	Nymphacea
7.	Geder puni	*Pistia stratiotes*	Araceae
8.	Tharo gwswm	*Colocasia esculenta* (Linnaeus,1753*)*	Araceae
9.	Mnimuni phisa	*Hydrocotyl sibthorpioides* (Lamarck,1789)	Araliaceae
10.	Mawji kwma	*Alternanthera philoxeroides* (Linnaeus,1753*)*	Amaranthaceae

Table 4.7: Inventory of fish used for medicinal purpose by Bodo community of Udalguri district :

Sl no	Local name	Scientific name	Parts used	Medicinal use
1.	Rou	*Labeo rohita*	Gall bladder	Gastric ulcer, intestinal cancer, night blindness
2.	Magur	*Clarius magur*	Whole body	Body ache, Malaria, wound healing, weakness, Small pox, Anemia, Tuberculosis, Skin problem
3.	Singi	*Heteropneustes fossilis*	Whole body	Pain , Wound healing, Body weakness, Anemia.
4.	kuchia	*Monopterus cuchia*	Whole body	Anemia, weakness, Diabetes, Asthma, female problem

				,Kala-azar, Skin problem, tuberculosis
5.	Gwri	*Channa punctatus*	Whole body	Common cold, physical weakness, Malaria, Corn, Diarrhea, swelling of testicle, lack of appetite
6.	Nasrai	*Channa gachua*	Whole body	Increase breast milk secretion, Dysentery, Asthma
7.	Nisla	*Channa stewarti*	Whole body	Increase milk secretion, Diabetes, Pain, High pressure.
8.	Maoa	*Amblypharyngodon mola*	Whole body	Common cold, Pox, pain, Asthma,
9.	khaoi	*Anabas testudineus*	Whole body	Weakness,
10.	Bengshi	*Trichogaster faciatus*	Whole body	Common cold, weakness
11.	Thengwna	*Mystus tengara*	Whole body	Common cold, Backbone pain, Small pox
12.	Thuri	*Macrognathus pancalus*	Whole body	Common cold, weakness
13.	khangkhila	*Xenodon concila*	Mouth part	Skin diseases, joint pain
14.	phitikri	*Puntius sophore*	Whole body	Night blindness, Memory, Rheumatism, Diabetes
15.	Baami	*Anguilla bengalensis*	Fats, wholebody	Rheumatoid-arthritis, piles
16.	Baami	*Mastacembelus armatus*	Whole body	Asthma, Fever, Weakness
17.	Boroli	*Wallagu attu*	head	Liver ailment, weakness
18.	Common carp	*Cyprinus carpio*	Whole body	Fever
19.	Ari	*Sperata seenghala*	Whole body	Fever
20.	dwrkina	*Esomus dendricus*	Whole body	For good eyesight, Lactation
21.	Patmuthra	*Glassogobius gluris*	Whole body	Nocturnal enuresis

Table 4.8: Inventory of insects used by bodo community of Udalguri district:

Sl.no	Local name(Bodo)	Scientific name	Body part used	Medicinal use
1.	Gangjema	*Lethocerus indicus*	Whole body	Diarrhea, Dry cough, wound healing, Rheumatoid arthritis, stomach ach, gastritis, blood purifier
2.	Handilorebere	*Dysticus marginalis*	Whole body	cancer
3.	Lanjai gwlao	*Laccotrephes ruber* (Linn, 1764)	Whole body	Diarrhea, wound, rheumatoid arthritis, gastritis, blood purifier
4.	Chinkhaori	Cybister limbatus (Fabr,1775	Whole body	diarrhea

Table 4.9: Inventory of medicinal use of amphibia by bodo community of Udalguri district:

Sl.no	Local name(Bodo)	Scientific name	Body part used	Medicinal use
1.	Ambu sitro	*Duttaphrynus melanostictus*	Thighs, flesh,skin	Skin disease, ringworm, anti-microbial and anti - cancer property.
2.	Ambu tetred	*Euphlyctis cyanophlyctis (Schneider,1799)*	Thighs, flesh	weakness
3.	Ambu tetred	*Euphlyctis hexadactylus*	Flesh, skin, thighs	Antimicrobial property
4.	Ambu bongla	*Hoplobatrachus tigrinus*	Thighs, flesh , skin	Stomach trouble, high

				blood pressure.

Table 4.10: Inventory of medicinal use of crustacean by bodo community of Udalguri district:

Sl. no	Local name(Bodo)	Scientific name	Body part used	Medicinal use
1.	Khangkrai jamin	*Maydelliathelphusa lugubris(* Alcock,1909)	Whole body except the legs and shell	Fever, insect bite
2.	Nathur	*Macrobrachium assamensis* (Wood-Malson,1871)	Whole body	Diabetes, low blood pressure.

Table 4.11 : Inventory of medicinal use of gastropod by Bodo community of Udalguri district:

Sl. no	**Local name(Bodo)**	**Scietific name**	**Body parts used**	**Medicinal use**
1.	Samo ladai	*Pila globusa* (Swainson,18220	flesh	Dysentery, tuberculosis, asthma, burns ,wound healing, stomach problem
2.	Samo lingri	*Brotia costula* (Brandt, 1974)	flesh	Improve eye power
3.	Samo dahwnai	*Balamya bengalensis* (Lamarck,1822)	flesh	Improve eye power
4.	Samo khohe	*Lamellidens marginalis* (Lamarck,1819)	flesh	Improve eye power

Table 4.11 : Inventory of medicinal use of gastropod by Bodo community of Udalguri district:

Sl. no	Local name(Bodo)	Scietific name	**Parts used**	Medicinal use
1.	Ajinai	*Monochoria hastata*	Leaf, young shoots	Boil
2.	Ajinai	*Monochoria vaginalis*	Rhizome	Asthma
3.	Mande	*Isomoea aquatica*	Young shoots	Dysentery
4.	Alangshi	*Enydra fluctuans*	Leaf,Shoots	Blood purification
6.	Toblo	*Nymphaea alba*	Root	Head ach
7.	Toblo	*Nymphaea nouchali*	Root, fruit, leaves, seed	Diarrhea, piles
8.	Geder puni	*Pistia stratiotes*	leaf	Difficulty in urination
9.	Tharo gwswm	*Colocasia esculenta*	Leaf, shoots	Blood purification, good source of iron
10.	Mnimuni phisa	*Hydrocotyl sibthorpioides*	leaves	Loss of appetite
11.	Mawji kwma	*Alternanthera philoxeroides*	Young shoots, leaves	Stomach pain

Indigenous methods for the conservation of fish used by Bodo tribe of Udalguri district of Assam :

"NAPHAM" (Fermented fish) :

A salivary created dish prepared from fish is famously known as Napham. The dish is specially prepared from small fish. Firstly the fishes are cleaned and then sun-dried or smoke dried. They grander the small dry fishes with arum stem which were also kept for drying and then add some kharwi or alkali as needed and stored it in a dry bamboo tube (owa hashung) then the mouth of the tube is covered with the leaves of the plantain (thalir bilai) and then cover with the ash very carefully so that insect can not inter in the tube. This is called Napham and it can be preserved for two to three years. This is one of the special traditional dishes of the tribe.

[A]

[B]

[C]

[D]

[E]

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[G]

[H]

Photoplate : [A] Fresh fish that need to be dried [B] Fish is cleaned [C] Fish dried

[D] Stem of arum, *colocasia sp*. [E] Grinding or crushing of fish in traditional equipment called Uwal. [F] Filling the bamboo tube with the mixture of crushed fish and arum stem. [G] The mouth of the bamboo tube is covering with the plantain leaves [H] the mouth of the bamboo tube is covering with ash.

Medicinal use of napham : it helps to cure malaria.

CHAPTER 6

DISCUSSION :

Findings of the present work reveal the list of aquatic organisms used by the Bodo community of Udalguri district of Assam , which includes 52 fish species of fish belonging to 20 families. highest no of fish ie.,37% belonging to family cyprinidae (fig.5.1), 9 insects belonging to 4 families Out of which 56 % belongs to family Dystiscidae (fig.5.2), 4 amphibia belonging to 2 families out of which 75% belongs to family Dicroglossidae (fig.5.3), 7 crustacean belonging to 2 families out of which one is unidentified and both the family Gecarcinucidae and Palaemondae contain 43 % species each (fig.5.4), and 4 gastropod belonging to 4 families ie., 25% species belongs to each family (fig.5.5).

The study also reveal the medical utilization of aquatic organisms to cure different ailments and common diseases affecting the general public. In the study 33 animals are reported for 45 therapeutic purposes by the informants of Udalguri district,Assam out of which 21 are fish belonging to 14 families (fig.5.6), 4 are insect belonging to 3 families (fig.5.7) 2 are crustacean belonging to 2 families (fig. 5.8),4 are amphibian belonging to 2 families (fig.5.9) and 2 are gastropod belonging to 2 families (fig.5.10). These animals are used as whole or body part or byproduct like flesh, , organ, skin etc. for the treatment of different kind of ailments including tuberculosis, asthma. , cancer, gastric ulcer, night blindness etc. It was found that they eat the flesh of gastropod for better eyesight and is one of the most favorite dish of Bodo tribe. It was also found that the fermented fish called “napham” it used to cure Malaria.

Th. Ajita Chanu *et al.,* (2014) reported that *Catla catla* and *Channa orientalis* are used in treating boils. The catfishes, viz*., Clarias magur* . and *Heteropneustes fossilis* are used in treating anemia. Diarrhea can be controlled easily by feeding the patients with roasted barbels of *Wallago attu* mixed with powdered, tender leaves of *Psidium guajava*, while dysentery can be easily controlled by feeding the patients with *Mystus bleekeri* boiled with Portulaca oleracea (Leipak kundo). *Anguilla bengalensis*, known as Ngaril leina in Manipur is useful in treating piles and meningitis

Lobeno Mozhu et al.,(2021) recorded 50 insect species belonging to 28 families and 11 orders from Nagaland, North-East India, for treating at least fifty different kinds of human ailments of which the most frequently cited ones amongst the ethnic groups were coughs, gastritis, rheumatoid arthritis, stomach ache and wound healing.

According to the responders, *Clarius magur* (Magur) is the most important fish used by Bodo tribe of Udalguri district of Assam for medicinal purposes. Gastropod, *Pila globusa* (ladai

samu) are considered to have high medicinal value in treating dysentery But their populations have become drastically depleted in their natural habitats due to indiscriminate and uncontrolled habitat destruction especially by using chemicals. Detailed investigations and proper traditional management strategy is urgently required to keep each species intact before the population of species dwindle.

Narzary et al.(2017) reported 12 ethnomedicinal fishes of Bodo tribe of Kokrajhar District, Assam, India.and found Many fishes like *Channa stewartii, Xenentodon cancila* etc. are not known for their medicinal value and such species now facing serious threat to existence due to various human activities.

Labeo rohita (Rou) is used to cure Gastric ulcer, intestinal cancer, night blindness. Maheswar et al., (2007) reported the use of powdered *Labeo rohita c*ervical vertebrae for treating kidney stone blockage problem by Saharia tribe of Rajasthan.

Mozhui et al,. (2021) recorded 50 insect species belonging to 28 families and 11 orders from seven ethnic groups in Nagaland, North-East India for treating at least fifty different kinds of human ailments of which the most frequently cited ones amongst the ethnic groups were coughs, gastritis, rheumatoid arthritis, stomach ache and wound healing.

Borah and Prasad (2017) recorded a total of 36 families, 44 genera, and 44 species of animals from the adjoining areas of Gibbon Wildlife Sanctuary, Assam, India which were used to treat 40 different disease conditions. These 44 animal species belonged to both vertebrates (25 species) and invertebrates (19 species). These animal species belong to 42 taxonomic groups among which insects occupied a highest number of animals (30.9%), followed by mammals (23.8%), fish (16.7%), reptiles (11.9%), amphibians (7.1%), annelids (4.8%) and gastropods (4.8%).

Boring (1996) has made a detailed study on ethnozoological aspects among Adi tribes of Arunachal Pradesh and enlisted 95 species of animals medicinal uses. Azmi et Al (1999) described that animal fats are used as traditional drugs among tribal of Chhatisgarh, as ointment for eternal use in inflammations, muscular pain, piles, burns, wounds and sexual disability.

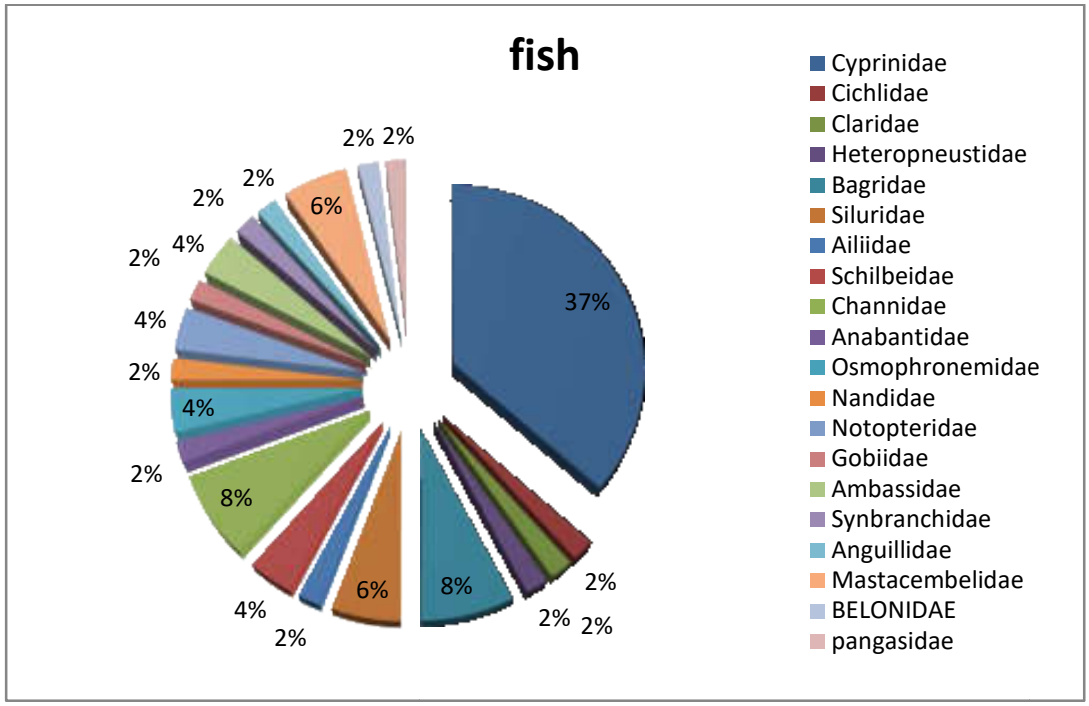

Figure 5.1: family wise percentage distribution of fish used by Bodo people of Udalguri district.

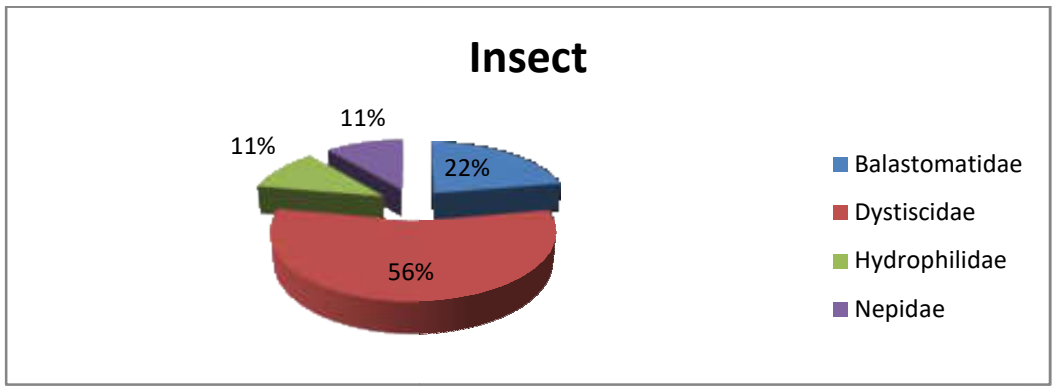

Figure 5.2 : family wise percentage distribution of aquatic insect used by Bodo people of Udalguri district of Assam.

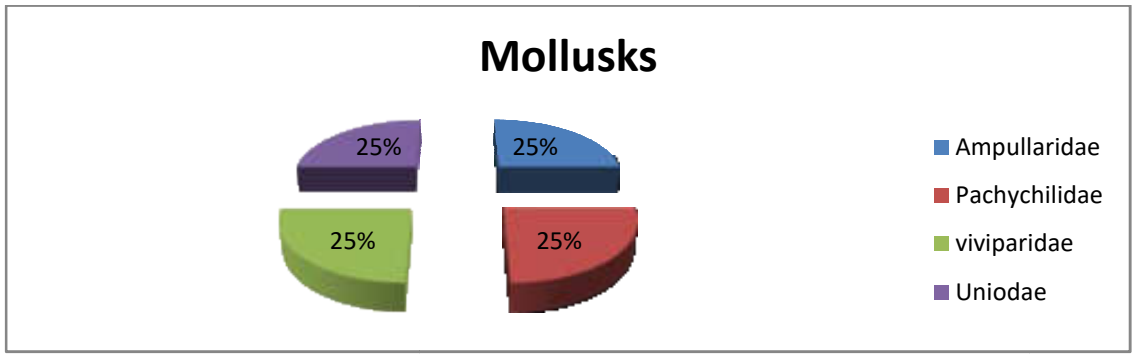

Figure 5.3 : family wise percentage distribution of gastropods used by Bodo people of Udalguri district of Assam.

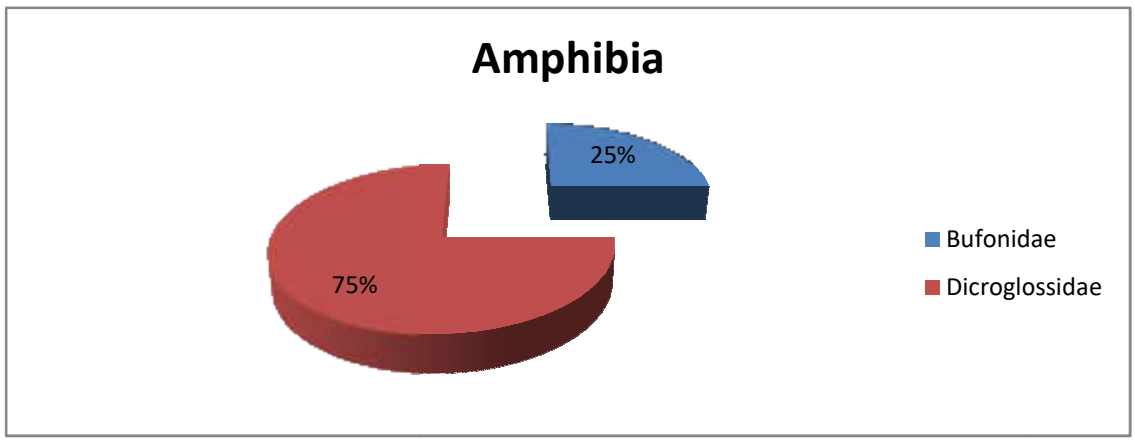

Figure 5.4 : family wise percentage distribution of amphibia used by Bodo people of Udalguri district of Assam.

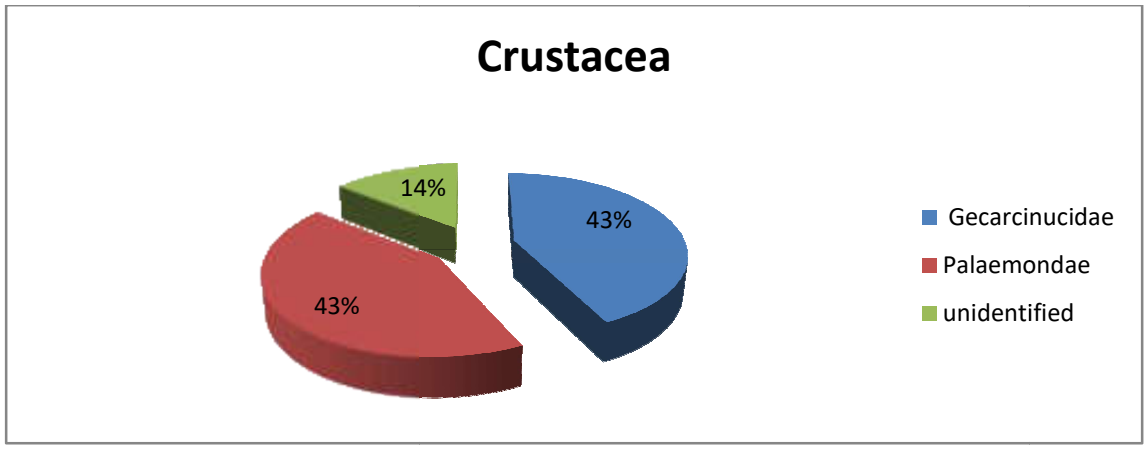

Figure 5.5 : familywise percentage distribution of crustacea used by Bodo people of Udalguri district of Assam.

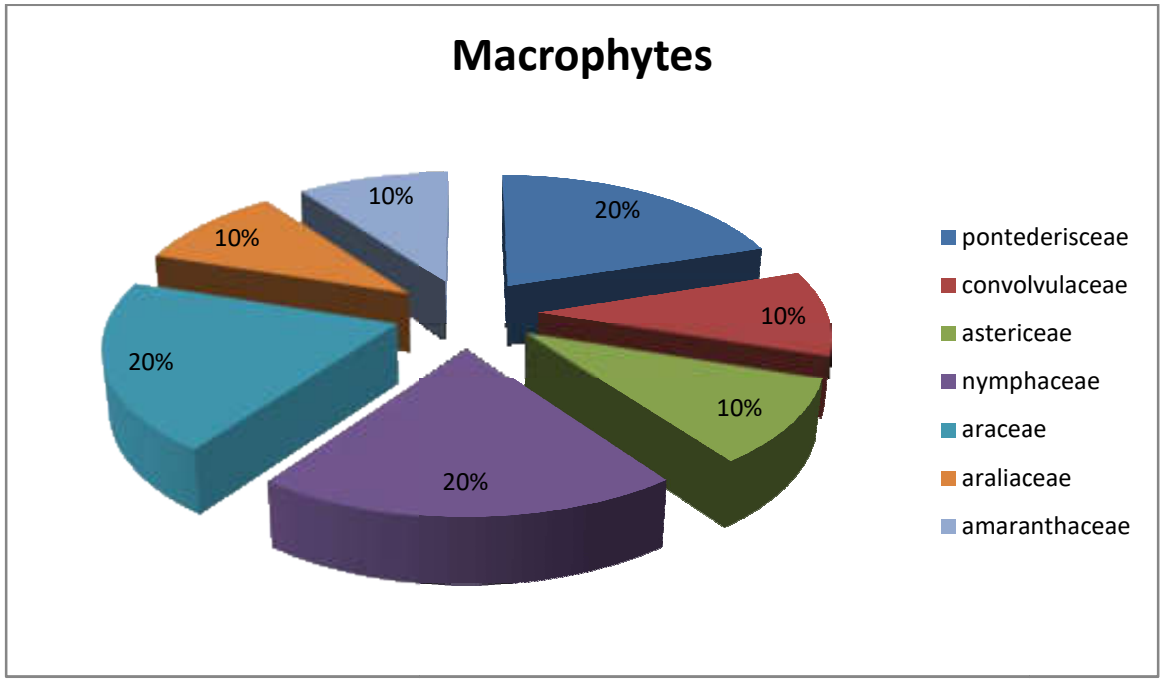

Figure 5.6 : familywise percentage distribution of Macrophytes used by Bodo people of Udalguri district of Assam.

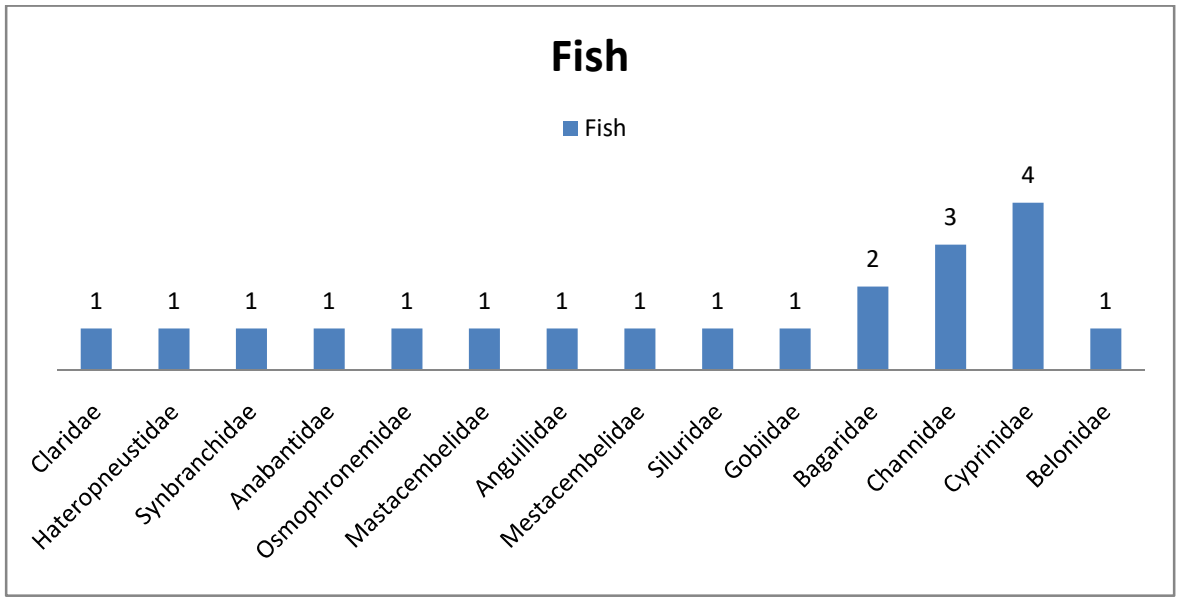

Figure 5.7 : Family wise number of fish used in medicinal purpose

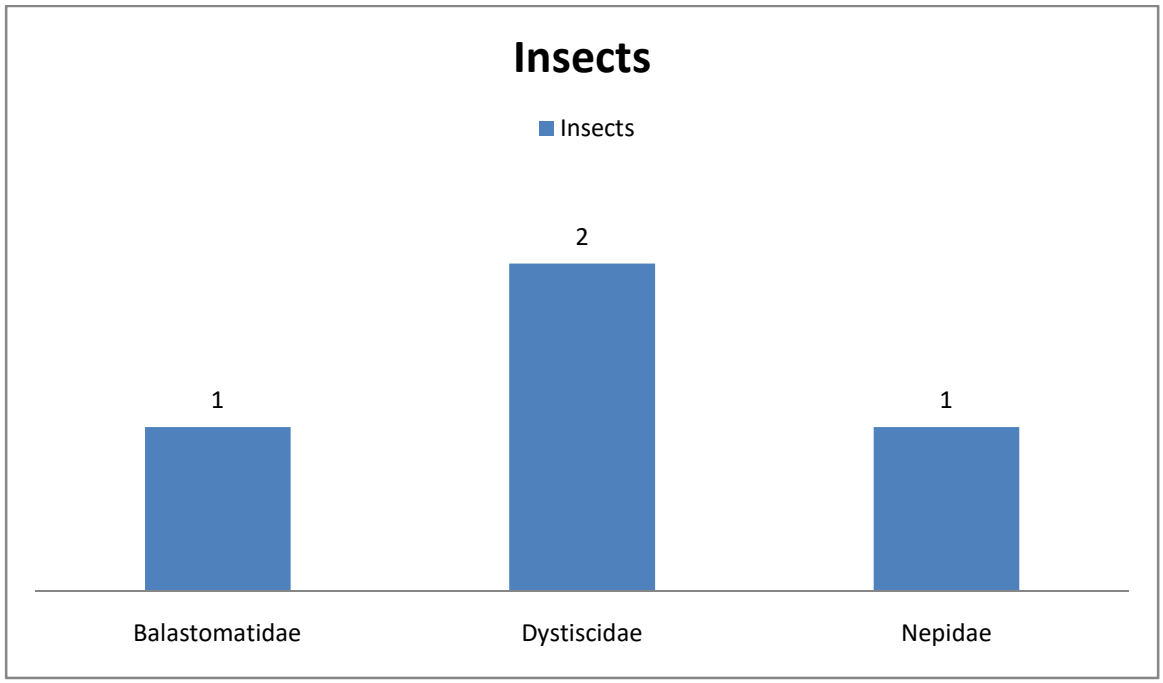

Figure 5.8 : Family wise number of insects used in medicinal purpose

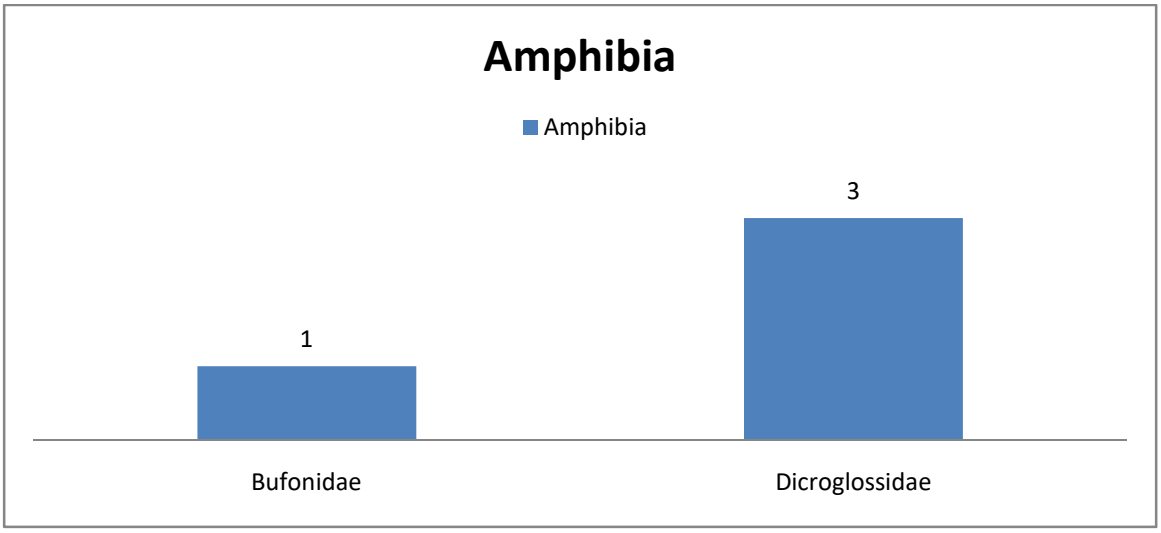

Figure 5.9: Family wise number of amphibia used in medicinal purpose

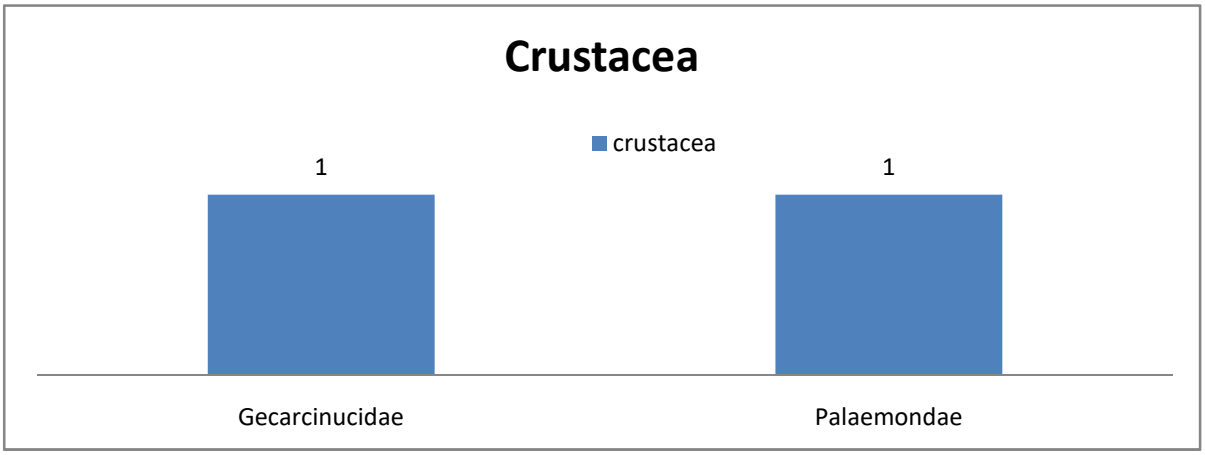

Figure 5.10 : Family wise number of crustacea used in medicinal purpose

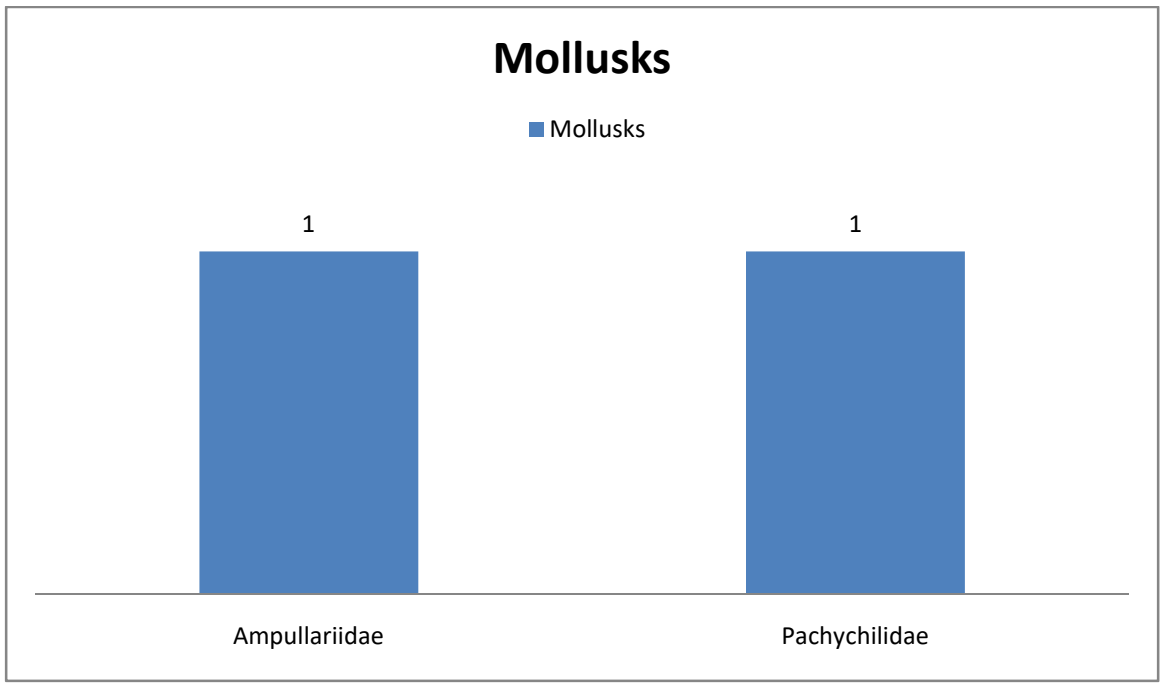

Figure 5.11: Family wise number of mollusc used in medicinal purpose

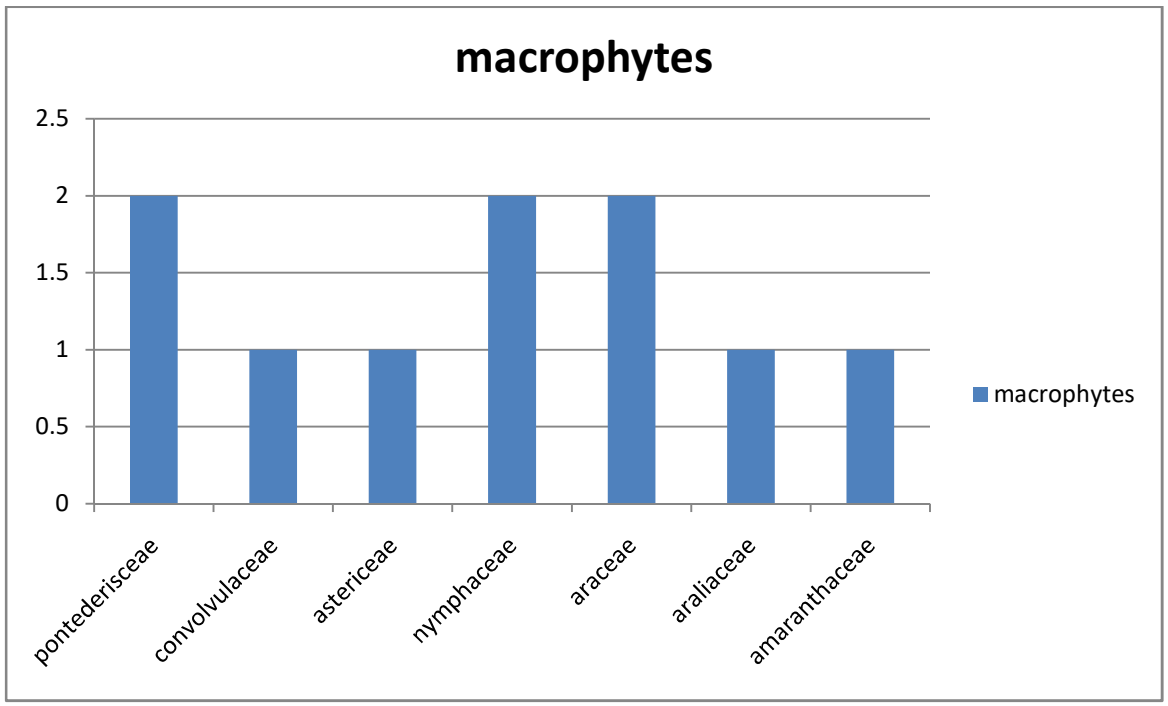

Figure 5.12: Family wise number of macrophytes used in medicinal purpose

CHAPTER 6

CONCLUSION

From the above findings, it can be concluded that the people belonging to the Bodo tribe of udalguri have a rich Ethnozoological knowledge and resources. A large number of animals had been found providing a number of substances with medicinal properties which the people use to treat a wide range of ailments. The Present study reveals the ethnozoological uses of different kinds of fishes generally practiced by the ethnic community as reported earlier by Prakash et. al (2014). The findings throw light on the fact that aquatic organisms can be used in treating a number of human ailments. Most importantly, changes in eco-system, deforestation, constraints of economy, ignorance of people, lack of awareness of conservation and preservation, unsystematic collection and destruction of identified plants and its natural habitat, besides other factors, have posed a serious threat to the existing ethnomedicinal plants and animals in North-East India (Yirga, G. et al 2011). If fish can be used as a good source of simple forms of medicine traditionally used earlier, the common people may have an easy way to avoid the high cost of modern medical treatments, thereby improving their economic condition. This approach may bring another means for encouraging the local fish populations from uncontrolled fishing.

The present study is only the record of medicinal values of fishes; traditional believes of people of Bodo Tribe, but it is a clue for further experimental study that exactly curable medicine or not. This study also gives importance of certain Indigenous fishes for conservation in future. The fish preservation method or fermentation method of napham gives an ethical and cultural importance and help to create a new method for fish fermentation for fish lovers.

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ANNEXURE 1

A. Photographs showing face to face interview with the responders of the study area:


GPS Map Camera
Uldaguri, Assam, India
Unnamed Road, Assam 784523, India
Lat 26.815317°
Long 91.892067°
22/04/23 11:51 AM GMT +05:30
Google


GPS Map Camera
No.1 Garuajhar, Assam, India
Unnamed Road, No.1 Garuajhar, Assam 784523, India
Lat 26.821048°
Long 91.8762°
22/04/23 12:38 PM GMT +05:30
Google


GPS Map Camera
Uldaguri, Assam, India
Unnamed Road, Assam 784523, India
Lat 26.822926°
Long 91.893736°
22/04/23 11:58 AM GMT +05:30
Google


GPS Map Camera
Borbali Sitha, Assam, India
Khoirabari, Borbali Sitha, Assam 784522, India
Lat 26.603127°
Long 91.813774°
23/04/23 03:13 PM GMT +05:30
Google


GPS Map Camera
Khoirabari, Assam, India
Mainao Hotel, Khoirabari, Assam 784522, India
Lat 26.600535°
Long 91.81153°
23/04/23 01:57 PM GMT +05:30
Google


GPS Map Camera
Borbali Sitha, Assam, India
Khoirabari, Borbali Sitha, Assam 784522, India
Lat 26.603064°
Long 91.813804°
23/04/23 11:41 AM GMT +05:30
Google


GPS Map Camera
Khoirabari, Assam, India
HRX9+V24, near ABSU office, Khoirabari, Assam 784522, India
Lat 26.599417°
Long 91.817195°
23/04/23 10:34 AM GMT +05:30
Google

B. Photographs showing different markets of the study area


GPS Map Camera
Dimakuchi, Assam, India
No.1, Uttar Dimakuchi, Udalguri-Tamulpur Rd, Dimakuchi, Assam 784526, India
Lat 26.741621°
Long 91.824558°
14/05/23 01:59 PM GMT +05:30
Google


GPS Map Camera
Dimakuchi, Assam, India
No.1, Uttar Dimakuchi, Udalguri-Tamulpur Rd, Dimakuchi, Assam 784526, India
Lat 26.741602°
Long 91.824606°
14/05/23 10:47 AM GMT +05:30
Google


GPS Map Camera
Dimakuchi, Assam, India
No.1, Uttar Dimakuchi, Udalguri-Tamulpur Rd, Dimakuchi, Assam 784526, India
Lat 26.741644°
Long 91.824557°
14/05/23 02:01 PM GMT +05:30
Google


GPS Map Camera
Amguri, Assam, India
PRRF+VJQ, Amguri, Assam 784526, India
Lat 26.741671°
Long 91.824401°
14/05/23 02:00 PM GMT +05:30
Google

C. Some of the aquatic organisms being used in traditional medicine by Bodo tribe of Udalguri district of Assam :

Ambypharyngodon mola

Channa punctatus

Heteropneustes fossilis

Chanda nama

Wallagu attu

Mastacembelus armatus

Trichogaster fasciata

Trichogaster lalius

Pethia ticto

Glassogobius giuris

Macrognathus armatus

Macrognathus aral

Clarius magur

puntius sophore

Labeo rohita

Aanabas testudineus

Mystus tengra

Channa gachua

Notopterus notopterus

Esomus dendricus

Nymphaea nouchali

Pistia stratiotes

Khangkhrai gooboi

Sartoriana trilobata

Lethocerus indicus

Laccotrepes ruber

Diplonychus rusticus

Hydrophilus triangularis

Brotia costula

Macrobrachium assamensis

ANNEXURE 2

QUESTIONNAIRE

Aquatic organisms consumed by the Bodo tribe of Udalguri district of Assam and their use in medicine (The data will be used for study purpose only)

Dear sir/ Madam

A study on aquatic organism consumed by the Bodo tribe of Udalguri district of Assam and their use in medicine is being carried out as a part of my M.Sc dissertation work. Your kind cooperation in filling up the questionnaire will go a long way in helping me in this academic endeavor.

Thanking you,

Daijy kalita

M.Sc 4th semester

Department of zoology

Darrang college, Tezpur

Few words about yourself:

NAME :

AGE:

GENDER:

Q.1 What are the different types of edible aquatic organisms available in the water bodies or markets of your locality ?

Ans:

Q.2 What are the fishes you usually eat?

Ans:

Q.3 what are the other aquatic organism you usually eat?

Ans:

Q.2 What fishes and other aquatic organisms you generally prefer the most in your daily diet?

Ans

Q.3) Whether the popular large fishes are used in your regular diet?

Ans:

Q.4) Do you know if any edible aquatic organism poses any kind of health benefit ? what are they?

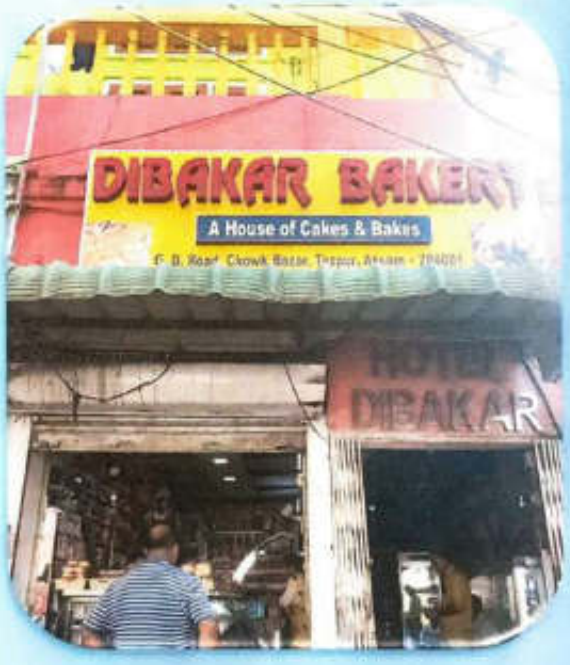
Ans :

Q.5) Do you know any process to preserve fish ? how it is prepared?

Ans:

AN ASSIGNMENT ON ENTREPRENEURSHIP

"DIBAKAR BAKERY"



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CERTIFICATE

This is to certify that the project report entitled "Entrepreneurship" submitted by "Antrisha Dutta", a student of B.Com (HONOURS), 3rd Semester have been carried out under the guidance of -

"Dr. Arpita Sharma Nath" & "Prof. Alpana Baruah".

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SELF DECLARATION

This is to hereby declare that "Antrisha Dutta", a student of B.Com (HONOURS), 3rd Semester, have done the project work entitled

"Entrepreneurship"

submitted to Commerce Department, Darrang College, is a project record of an original work done by her under the guidance of the teachers - "Dr. Arpita Sharma Nath" & "Prof. Alpana Baruah". This project work is submitted in partial fulfillment for Gauhati University.

ACKNOWLEDGEMENT

I should need to express my remarkable thanks of gratitude to my teacher Dr. Arpita Sharma Nath & Prof. Alpana Baruah, who gave me the golden opportunity to do this wonderful project of Entrepreneurship on an "Entrepreneur", who also helped me in completing my project. I came to know about many new things and I am really thankful to them.

Secondly, I would like to thank my parents as well.

Lastly, it was a group of friends who have done this project, so I would like to thank my friends - Krishnakhi Gope & Debolina Saha who have boosted me up for the project.

- Antrisha Dutta
B.Com [3rd Semester]

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Introduction To Entrepreneurship

An entrepreneur is an individual who creates a new business, bearing most of the risks or difficulties and enjoying most of the rewards. The process of setting up a business is known as Entrepreneurship. It can also be called as an activity of starting new businesses by identifying and taking risks, which do not have insurance for the losses.

Entrepreneurship is the ability of an individual of their own to achieve and create new economic opportunities, new products, new methods, etc. to introduce their ideas and thoughts.

"Schumpeter" is best known for his theories on business cycle and the development of economics, and for introducing the concept of entrepreneurship. According to Schumpter, Entrepreneurship is a combination of strong organization that includes new services, new materials and new methods of production.

Entrepreneurship in India

Entrepreneurship promotes economic growth, provides access to goods and services, and improves the overall standard of living. Many entrepreneurs also make a positive impact on their communities or societies and improve their well-being by catering to underserved areas and development environment-friendly products. Entrepreneurship can help identify market opportunities and allocate resources in the most effective way possible.

Few entrepreneurs in India are –

(a) Dhirubhai Ambani – Reliance

(b) Jehangir Ratanji Dadabhoy Tata – TATA

(c) Nagavara Ramarao Narayana Murthy – Infosys

(d) Ardeshir Godrej – Godrej

Introduction of the Entrepreneur

"Mrs. Mithu Singh."

Mithu Singh, a 40 years old woman from Tezpur is an building entrepreneur. When we visited her she was very kind in her behaviour. She has a bakery in Tezpur, where different types of sweets, patties, cakes, biscuits, bread etc are baked.

Varieties of sweets and cakes are baked in her bakery. The behaviour and the language style of the lady towards the customers was very kind, polite and understandable.

Name - Mrs. Mithu Singh

Date of Birth - 1983 (40 years)

Sex - Female

Permanent Address - Kabarkhana Road,
Tezpur, Assam.

Source = With Entrepreneur Mithu Singh

Information About the Enterprise

Owner Of the Enterprise : Mrs. Mithu Singh

Type Of the Enterprise : Sole Proprietorship

Name Of the Enterprise : Dibakar Bakery

Nature Of the Enterprise : Bakery

Location Of the Enterprise : G.D. Road, Chaok Bazar, Tezpur, Assam

Establishment Year : 2014

Employee Engaged : Depends On Demand

Supply Areas : All over Assam.

Source : Collected from field work

An Interview With Mrs. Mithu Singh

Mrs. Mithu Singh, a well-known entrepreneur of Tezpur, gives response to my questionnaire are -

Question 1 : When you started your business idea ?
Answer : 2014

Question 2 : What is the location of your firm ?
Answer : G.D. Road, Chowk Bazar, Tezpur, Assam.

Question 3 : Is it a family business or entrepreneurial venture
Answer : It is a family business

Question 4 : What is the form of your business organisation?

i) Sole Proprietorship ☑
ii) Partnership ☐
iii) Company form ☐
iv) Any other ☐

Question 5: What is the nature of your business?

i) Construction business ☐
ii) Manufacturing concern ☑
iii) Service Marketing ☐
iv) Distribution Outlet ☐
v) Any Other ☐

Question 6: What motivated you to start your own business?

i) Self-interest/desire ☑
ii) Support from friend/family ☐
iii) Support from govt scheme ☐
iv) Advertisements ☐

Question 7: How is the demand for product/service from customers?

i) High ☑ iii) Low ☐
ii) Moderate ☐ iv) Very Low ☐

Question 8: How many employees you have in your unit/establishment?

i) Less than 5 ☐
ii) Less than 10 ☐
iii) Less than 15 ☑
iv) Less than 20 ☐

Question 9: What is the source of your finance ?

i) Owners' equity ☑
ii) Loans from financial institute ☐
iii) Private moneylenders ☐
iv) Government funded ☐

Question 10: Is the location of your business an owned property ?

i) Yes, own property ☐
ii) A rented premise ☑
iii) On lease ☐

Question 11: Have you received any government support in setting up your concern ?

i) Yes ☐
ii) No ☑

Question 12: What kind of advertising strategies you adopt to market your goods.

i) Electronic Media ☐
ii) Outdoor Media ☑
iii) Print Media or direct media ☐
iv) Social Media ☐

Question 13: Are you using any technology to provide superior service/product to your customers?

i) Yes ☐
ii) No ☑

Question 14: Are you facing competition in the market?

i) Yes ☑
ii) No ☐

Question 15: How you perceive the commercial viability of Tezpur market for doing business?

i) Very High ☐
ii) Satisfactory ☑
iii) Average ☐
iv) Poor ☐

Question 16: What is your average monthly income?

i) Less than 20,000 ☐
ii) 20,001 to 40,000 ☐
iii) 40,001 to 60,000 ☐
iv) 60,001 to above ☑

Question 17: What are the resources available at the store/company/store ?

Answer : Bakeries require a lot of equipments when compared with other restaurant business. The resources/equipments required like sugar, eggs, wheat flour, Ovens, Ranges, Grills, Ventilation, microwaves, freezers & refrigerators, knives, mixing bowls, cutting boards, Gloves, Aprons, Blenders, Utensils etc.

Resources like Freeze baking Machine is also available to ensure freshness and help to prevent the formation of mold, especially for fully-baked goods that often emerge from ovens in a warm state and are quickly stored in plastic bags.

Question 18: Resources not available but can be created.

Answer : The equipments/resources which are not available may be of different types. Every industry and business has its own set of problems & difficulties, some may be large or some may be small.

The resource not available in Bibekar Bakery was Automatic biscuit making machine which cut or give the desired shapes and sizes to the biscuits or cookies. It is also known as biscuit wire cutter machine.

Question 19: Any social responsibility discharged by the company to its customers

Answer : The owner of the enterprise has the responsibility to fulfill the customers desires. Minimizing the food waste is good for the environment. If there is left unsold baked products, its the responsibility of the entrepreneur to donate them in charities, nursing homes and health care centers rather than throwing them.

The social behaviour of the entrepreneur was very sweet, kind, polite and understandable and she was very friendly with the customers.

Source = Collected from Field Work.

Question 20: Any Innovation

INNOVATION

Product innovation has involved the use of new ingredients, using seeds and grains to boost fibre and nutrient levels, adding flavours and variety

To make a bakery unique, we should go with a classic design, Use graphics, choose or create and solid Brand image and voice, use Easy to Read the Font, etc.

They should innovative the bakery by more technology. One of technology name is -

Automatic Making (biscuit) Machine or
Biscuit wire cutter Machine

Biscuit Wire Cutter Machine is a type of industrial equipment used in the baking industry to cut biscuits or cookies into desired shapes & sizes, the machine consists

of a conveyor bell that carries the dough to wire cutting section. The wire cutting section is equipped with multiple thin wires that move across the dough, cutting it into individual biscuits. The machine ensures uniformity in the size and shape of the biscuits, increasing production efficiency in large-scale biscuit manufacturing

Few examples to innovate in future are

(a) Reduce Sugar Trends

(b) Frozen Bakery Products.

(c) Enhanced Nutrients

(d) Hybrid baked Products

...CONCLUSION...

Baking, the process of cooking by dry heat, especially in some kind of oven. It is probably the oldest cooking method. There is a scope for bakery products as means of improving micronutrients.

- This project was an opportunity for the team members to utilize the skills they had acquired.
- It also gave us the opportunity to challenge ourselves to go outside of our knowledge to learn new programming things.
- The end result of the bakery topic inventory system was an overall team success!

Source = Collected from field work

FIELD VISIT TO SHILLONG

DEPT. OF HISTORY

DARRANG COLLEGE

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GU Roll no – UA-211-225-0286
College UID – 21AD0616
Paper name – Historical Tourism in North East India
Paper code – HIS-SE-3014

Introduction

Field studies are learning experiences outside of the classroom. Ful Field Studies allow students to gather their own (Primary) data provide opportunities to extend classroom learning through direct observation and experience, and allow for scientific research through field experiments.

37 students of B.A. 3rd sem. History Honours CBCS undertook a Study Tour to Shillong, Meghalaya from 15th to 17th November 2022. Faculty members were also join us to this trip. This tour was led by a faculty member and a student of B.A. 3rd sem.

Meghalaya is a beautiful state in the northeastern part of India and one of the Seven sisters, its name literacy means the 'abode of clouds'.

In the morning of 15 November, 7:00 am. Our We all students and faculties clicked some

group photos and then started our journey from Bauranag College to Shillong, Meghalaya. At 10:00 a.m. we steped eat our breakfast once in a restaurant near Sonapur and around 10:45 a.m. we crossed Jorabat and enter the Shillong road. Slowly, Slowly we saw big mown mountains and beautiful churches. At 1:45 pm we reached Shillong ISBT and we all had a light lunch. At 5:00 pm we reached our destination, Shillong. Then we reached our hotel named Shubham Hotel, we stayed there for two night.

Objective

The objective of our field study is, we have a Skill paper named "Historical Tourism in North-East India". So we all choose Shillong for our field visit, which was compulsory for all.

And to improve our excursion experience and field experiments. To Know about

the historical Significance of the place.
To Know the liferstyle of the hilly areas people. Meghalaya, Shillong also called 'The Scot-land of the East'.

Procedure

On 15 November, we are going to Shilling then we drove past hamlets, small eateries, schools, churches and a beautiful water body, named 'Umiam lake' commonly Known as Barapani lake. It's not a natural lake but a dam. It is indeed a reservoire and an artificial lake and was created by damming the Umiam river and covers about 220 square Km. This is first hydro-power project in this part of the country. Barapani is a major tourist attraction. The distance between Shillong and Umiam lake about 15 Km. The surrounding Sylvan Hills and green Khasi pines add to the majesty

of this vast lake. It was initially established as a dam on a reservoir. It is also known for water sports and adventure facilities such as Kayaking, water cycling, scooting and boating.

On the same day, we all explore the famous market of Shillong, that is Police Bazar. Our In around 6:00 p.m. we are going to explore the Police Bazar. Police Bazar is a major market of Shillong, and a popular shopping haunt for locals and tourists alike. Police Bazar, also known as Khyndailad is the prime shopping hub in Shillong and the ideal place to book a hotel, and so we book our hotel at Police Bazar. This market is the heart-point of Shillong. The markets are well laid out in a form of a huge circle (chowk) right in the middle of a police Bazar with plants and trees, surrounded by 7 roads going away from the circle to the different

points in the city. Then we eat some local food. The shopkeepers are closed their shops in around 9:00 p.m and the whole Police Bazar was closed and deserted by 9:30 p.m. Then we had our dinner in Police Bazar and we all returned to the hotel and ~~excited~~ excited for the next day.

The next morning i.e. 16 November at 9:00 a.m we all had our breakfast and going to our next destination which was "ELEPHANT FALLS". This was a popular tourist attraction near Shillong. Elephant falls is a combination of 3 rivers. The Original Khasi name for the falls is "Ka Kshaid Lai Pateng Khohsiew', which translates to "the three-step waterfall". This name is still used locally. However the modern name is explained by a signboard near the waterfall — 'When the Britishers came and found the wall water falls then they renamed it 'Elephant Falls' because on the

left side of the falls there was a rock resembling an Elephant. But this rock was destroyed by the earthquake in the year 1897.

Elephant falls is situated at a the outskirts of the main city of Shillong in the East Khasi Hills District, Upper Shillong.

~~The f~~

There are three falls in the Elephant falls. The first fall of Elephant Falls is an example of a horsetail-punchbowl water-fall. The first fall is very broad and is hidden among trees. The second fall however, is quite domesticated and in the winters looks inconsequential. The third fall is the tallest and comes to view suddenly and looks most spectacular with crystal clear water falling over sharp rocks of myriad shapes. There are 150 steps in the Elephant Falls. The Elephant Falls is very picturesque.

"Then our next destination is MAWSMAI CAVE". This cave is situated in Cherrapunji popular as one of the most notable landmarks in Cherrapunji in Mawsmai cave. The striking natural cave is flocked by visitors in great numbers. On the way to Cherrapunji we saw canyon, high mountains and villages. In the cave boasts of a wide and amazing entrance with dark and magical buffs and experience seekers, mystery inside. We saw the constant dripping of water from cave roofs and the formation of stalactites and stalagmites inside the cave. Some cave openings are quite large, but some are so small that one must kneel and bend ~~their~~ our head. This cave is very scared inside and adventureous too. It is a stunning limestone cave and the local name of Mawsmai cave is "Krem Pubon" This cave is also famous for its fossils, outside of the cave we ~~saw~~ also saw some monolith. Outside the cave there are many shops including hotels and we all had our light lunch there.

At 2:00 pm. We reached our next destination "Seven Sisters Waterfall" which is also known as "Nohsngithiang Falls". On the way we saw East Khasi Hill, a stone abstract from the rocks and some concrete factory. Now-a-days Cherrapunji also known as 'Sohra'. Located in the wettest place on Earth, Cherrapunji. Seven Sisters Waterfall, is a seven segmented waterfall that cascades down from a height of 315 m. The falls plunges over the top of limestone cliffs of the Khasi Hills only during the rainy seasons. The seven segments of the waterfalls symbolize the seven sister states in northest. Then we saw Shillong NIT from our bus which was situated nearby Seven Sister Waterfall at the distance about 1 km. Then we returned at the hotel. When we returned we saw a magnificent view of the fog

was just amazing and I have no words describe how beautiful the moment is!. And all just amazed to saw a view like this. reached hotel our hotel around 5:00 pm. again we went to explore the Shillong town i.e. Police Bazar and had our dinner at 9:00 pm.

The next day i.e. 17 November, last day of Shillong trip. We in the morning at 9:00 am we had our breakfast and we packed our luggage and check out of the hotel. Then we visit "Don Bosco Centre for Indigenous Cultures". This Museum situated in 'Mawlai Phudmawri', Shillong. This museum opened in the year 2000 and it is one of the crown jewels of Shillong. Don Bosco Museum in Shillong is a major tourist spot providing a glimpse of the rich and multi-cultural lifestyle of the indigenous peoples of not only Meghalaya

the whole North East India. The museum displays a wide collection of artwork, ornamentation, regional attires, weapons, handicrafts, and photographs. The seven-floor museum offers the visitor an historic experience of the Northeast by means of over 14 aesthetically amusing, pleasing and informative galleries. The newly added sky walk is breath-taking that flaunts the visitors a 360° view of the beautiful Queen City of the North East, Shillong. All the galleries in the Don Bosco Museum are provided with Multimedia Presentations.

The Don Bosco Museum contains 17 galleries displaying cultural artifacts and paintings. The museum displays the unique characteristics of each State in terms of population geography and natural resources with anthropological aspects. It also shows the

cultural dimensions of civilization like dance and music, arts and crafts.

In this museum it advertises the neighbouring neighbouring countries surrounding the North East of India: Bhutan, Nepal, China, Bangladesh and Myanmar.

Another section of the museum is the Pre history gallery where we know about the evolution of mankind and shows some kind of primates like Australopithecus, Homo Habilis, Homo Erectus and Neanderthal. The tools used by the early man of Meghalaya also shows there. The Pre-historic tool in Meghalaya was - chopper, chopping tool, cleaver, disc, blades, burins etc.

The Mesolithic tool - Pebble flaked tools, short axes, etc.

Neolithic tools - Tangedon, shaul ferced celts, wedges, axes, adzes, etc.

The next gallery is the cultivate, Sohiong, Khasi village, Meghalaya cultivable field surrounded by hillocks on way to Sonapahar Meghalaya. Laitkyngew coaliary in Cherrapunji and Rangshken, a valley for cultivation Meghalaya Jhum field garo hills.

The next gallery is Fishing, Hunting and Gathering, this age depicts old livelihood strategies of mankind. There are fishing trap and the local name of this trap is 'Ruh pad pahdoh' and used by Khasi tribe. Fishing basket and the local name of this basket is 'Chok' dong' and used by garo peoples. Valve fishing trap, local name 'Khonam' and used by 'bhoi Khasi' tribe. Circular tray like fishing basket, local name "Kyrejah' and used by bhoi Khasi. Large fishing trap, local name 'Polo' used by 'marram Khasi' tribe.

basket for keeping dry fish, local name 'Puh doh' and used by 'bhoi Khasi' tribe.

The next gallery is agriculture, agriculture is the livelihood of a large number of people in North-East. Scratcher for ploughed field, local name 'nangulli' and used by garo tribe.

The next gallery is Pottery. Earthen globe type pitcher, local name 'Kumdiang' and used by Jaintia tribe.

Earthen pot, local name 'Kakasi' used by garo tribe. Pot with two horn like projection, local name 'bhoat' used by Jaintia. Globular type earthen pitcher, local name 'Khra' used by Jaintia tribe.

Then the museum had a Weaving, blacksmith, goldsmith, wood carving, leather making, rice beare making, pottery making and cane making.

The next gallery is musical instrumen-
ts gallery. Long drum local name, 'Kram' and
used by garo. Buffalo horn horn bulge, local
name 'mohing'. Drum local name 'Ka Ksing'
used by Khasi tribe. Stringed Bamboo guiter
local name 'chigring' used by garo tribe.

The next gallery is weapons, Garo
warriors sword, local name 'millam'.

The next gallery is Traditional
attires. The Jaintia people wearing, man wears
dhoti, sleeveless coat, called 'Jymphong' and
'pirran' and pagri and women put on home woven
saris. Another piece of cloth called 'Ka jaonkup'.

Then we all clicks some group
photos and get in the bus and returned back
to Tezpur. On the way to we eat our lunch
and back to home.

Conclusion

Most of the society are predominantly patrilineal. The opposite of a patriarchy is a society in which the female member of the society hold positions of power, known as a matriarchy. The most remarkable institiution among the Khasis is the matrilineal system. Meghalaya is the only state which follows this system in North-East India.

Earlier Shillong was the capital of Assam, but now it shifted to Dispur.

The best part of the trip was getting to see the people, their customs and the wonderful places. The experience of our trip was wonderful.

UMIAM LAKE

ELEPHANT FALLS

MAWSMAI CAVE

SEVEN SISTERS FALL

MONOLITHS

INDO-CHINA WAR AND IT'S IMPACT ON PEOPLE

DEPT. OF HISTORY

DARRANG COLLEGE

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Paper Code — HIS-SE-4014

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Abstract :

In 1962 Sino-Indian conflict stemmed from a Himalayan border dispute, with China asserting rights over Aksai China area and also claimed Tibet. After the 1959 Tibetan uprising, Dalai Lama's asylum in India sparked tension. In 1959, the Dalai Lama's flight to Tezpur triggered Chinese advances towards the city, affecting it's plains. Chinese forces reached Bhalukpong en route to Tezpur, causing evacuation. During the 1962 war, Tezpur underwent transformation into a ghost town. Among its victim was Winghing Tham, representing the Chinese families in Assam who endured considerable suffering during the conflict. Many of these families faced arrest and were detained in camps in Delhi, leading to the tragic separation of Chinese individuals from their families. This article sheds light on the impact of the war on Tezpur, it's populace highlighting the plight of the Chinese community and the resulting familial separations.

Keywords:

Sino-Indian war, border dispute, Tibetan uprising, Chinese advance, evacuation.

Introduction:

India and China are civilizational nations. The two nations share more than 5000 year of unbroken history, cultural and economic exchanges over millions, and have been among the main sources of world's heritage and culture. Separated by the Himalayas, they share a 3488 kilometres long border with Bhutan and Nepal.

India established diplomatic relation with China in April 1950s, since then there has always been disputes between the two nations. The war that started in the year 1962 or still defines the international relation between the two nations.

The Sino- Indian war also known as the Indo- China war of 1962 or Sino-Indian war of 1962, was a military conflict between China and India that took place from October to November 1962.

The Sino-Indian war of 1962, which occurred between China and India, was driven by a disputed Himalayan border. China claimed sovereignty over India's regions of Aksai Chin , and Arunchal Pradesh, igniting the conflict. Aksai Chin, an extension of the Tibetan plateau located in ladakh, was contested between the nations. China considered it part of its Xinjiang region, while India regarded it's as a component of its Leh district within the Ladakh union territory. The conflict followed a series of violent border skirmishes after the 1959 Tibetan uprising, during which India granted asylum of the Dalai Lama.

In 1959, the Dalai Lama escaped Tibet, traversing Bomdila to reach Tezpur. This event prompted a forceful Chinese advance towards Tezpur, Assam. Among Assam's cities

with plain terrain, Tezpur suffered the most. The Chinese military arrived at Bhalukpong en route to occupying Tezpur, leading to the evacuation of the local population. This article investigates the impact of these events in the existing circumstances, their repercussions in Tezpur's populace, and the preparations made for evacuation to gain insights, we conduct two case studies:

- Interview of Winghing Tham (of Chinese origin)
- Interview of Meenakshi Bhuyan (of Indian origin)

Methodology:

- The study relies primarily in primary date and some secondary data. To collect primary data, direct personal interview was made with the Respondence. The secondary data was obtained via the internet.
- The survey was carried out in Dekargaon, where there is still a Chinese family and in Porua Chariali, where Meenakshi Bhuyan lives.

Objectives:

- To know about the Indo-Chinese war of 1962.
- To know about the history of Chinese origin residing in Tezpur

Case Study 1-Interview of Winghing Tham (family of Chinese origin)

In order to know about the Chinese origin and the Sino-Indian war of 1962, we went to interview Winghing Tham on May 2. He provided us with lot of information. He described his family's voyage to India, including why they arrived, their plans for settling there and any challenges they encountered, their traditions, cultures and customs. He explains to us that beginning in 1830, British colonists send trained Chinese labourers to India, where some of them worked as tea planters and others in various business or in carpentry, one of them was his father, who immigrated to India in 1940s as a labourer from China(Kunzhou a village from Hongkong) and ultimately worked in the tea sector in Assam. After working for a long time in the Dikom tea estate in Dibrugarh district his father committed suicide on 16 September 1959. Winghing Tham was born in 1946 in Dikom. He is the 2nd generation of his family. He has three sons, all of whom are well settled. He said that his family and he had never visited their home town. When his father passed away his uncle took him to Calcutta and trained him as an advance carpenter and came back to Assam in 1961 to work with a private contractor in Makum. We questioned him about some of their customs, beliefs, theirs traditions and practises. He said that they practice Buddhism(Mahayana), honour the four father, offer them wine. He added that the follow local Assamese customs and ritual as well . He claimed that during his wife's final death rite they followed the local Assamese customs and rituals. He also added that he was one of the victims of the 1962 Sino-Indian conflict. At the time of the conflict between the two countries, at least 2000 people from China settled in Assam's Makum. In October and November 1962, the Government of India arrested all Chinese citizens living in Assam. But he was not arrested for any special reason. Many Chinese were detained in the Deuli Camp in distant Rajasthan for about 3-4 years by the Indian Government and many of them got separated from their family. He said that after many hardship, he worked in Chaina Tea Estate in 1965 and married Ahum Tham, daughter of Ithakola, Jamugurihat. He was promoted in 1982 and joined Naduar Tea Estate as factory officers tretired from Kynung Tea estate, Tinisukia till 2006 and currently residing in Tezpur after the war about 5 families settled in Tezpur. They were Wetsung Tham, Kinkin Tham, Bahai Kwan, Hegraj Kwan and Lt. Bunkung Kwan. He said that after a long period of deprivation of citizenship, in1985, the Dibrugarh District Administration considered their citizenship application and granted Indian citizenship and their names were included in the voter list. He also stated that some of the few Chinese family during 1962 war changed their title to Das and Bhailung out of fear for the people. However, he was one of the few who maintained their identity and did not change their title. He also said that Assam is name to more than 100 Chinese families. He said that many young people from the new generation of the Chinese community have joined in SSB, Army, Air force and has served mother India in various capacities in the medical department. In the business and industrial sectors more than 30 Chinese families in Assam are earning their living through hard work and have also provided employment to many local youths. They have formed All Assam Chinese Welfare Society to provide various assistance to the families of neighbouring citizens during various disasters in the state. Winghing Tham is the adviser

of All Assam Chinese Welfare Society. These Chinese community members who once come to India for work determined India as the true place of life and death. He said that, he feel that they will always be committed to the service of the Motherland.

Case Study 2- Interview of Meenakshi Bhuyan of Indian origin.

Meenakshi Bhuyan gave a summary of the Indo- Chinese war. A history buff, she said that Tezpur was the first town in Assam that felt the impact of the invasion. How the huge Chinese armies marched towards NorthEast India. Tezpur was the first town in Assam the Chinese could take if they reached the plains. She said that now the 1962 India China war changed her small town forever. She claimed that the Chinese war had an impact on her. She told us that she was in Banaras at the time of the Evacuation. She obtained information from Ajay Shukla who was expert in military history. As her father's younger brother was very old to interview, Ajay Shukla visited her. Along with taking him to numerous sources, she also obtained further information, such as the doctor who had gone to take prisoners of war . Ajar Shukla was introduced by her to Dr Ananda Sharma and Chakravarty . Told us about Promila Boruah, a conscious citizen wearing pant and was guarding at the time of the evacuation told us about Pushpa and Nina Dutta. Meenakshi Bhuyan recalls, Things started unravelling three years before the war when the whole town woke up to welcome the Dalai Lama's entourage in 1959. A huge crowd gathered at the Darrang college ground to see him. As the head of the Municipal corporation, her father was the one who welcomed him with a Khada(a scarf given to honour visitors). She also explained how the battle began with China claiming Tawang as their part of territory. And how the Tibetans were housed in a refugee camp at Misamari , some 45 minutes drive from Tezpur used to living in the high mountains, they were not prepared for the heat. Bundles of cotton cloth were sent to the Tezpur Mahika Samiti to make clothes for them. Her mother was the secretary of the Mahika Samiti, and her friends stitched bakhus(the traditional dress of Tibetan women) for the refugees. The

children's worked as volunteers to put together food packets. She was then 20. Years later she was to step into her mother's shoes and become the secretary of the same samiti. She said that she was not at the time of evacuation as after her matriculation she went to Darjeeling for her intermediate and then to the Banaras Hindu University for her BA. Each time she came back during her holidays, she heard disheartening news. There was a series of border skirmishes between India and China in early 1960-61 after the Dalai Lama got asylum in India . That was to have far- reaching effects on Tezpur. There was a whole lot of talk of security. Then her mother and friends enrolled to be trained bye the home gaurd for Civil defence duties. They were trained to march and handle guns by a lady named Mrs. Manekji, who had been especially sent by Nehru. She said that soon there after, people in Tezpur began noticing the growing presence of the army and the air force. There were men in uniform everywhere. By October 20, the war started she said that they didn't know what war really happening on the border. Their house became the centre frenetic activities. Her mother and friends were told to knit woollen socks, gloves and sweaters as there was shortage of warm clothing for their soldiers. They worked day and night. People talked animatedly at street corners. They heard Bomdila had fallen. Tezpur was given evacuation orders. There was panic everywhere. Those days there was no Kaliabhumura Bridge nor gad the Saraighat bridge been built. As the 1962 war took place in winter, it was bitterly cold on the open ghats where people leaving Tezpur gathered to be transported at night, waiting families set up hundreds of camp fires in the river banks. Among these fleeing families was that Akashu Barua Das. She told us about Kumar Saikia who was told to requisition vehicles for the army to carry them to border areas and jeeps and jongas would come daily from Dibrugarh, Jorhat. Everyday they would commander 25 vehicles and send them to the army also had to ensure they had enough petrol to reach Misamari where the troops were stationed. A cease fire was declared on November 21,1962 and people vegan returning saikua then had to requisition jeeps for film stars who travelled around Tezpur entertaining wounded soldiers. She added that Tezpur was called ghost town at the time of war , she talks about the town residents who had fled in fear of the Chinese army. Almost the whole of the Tezpur had fled, some to Shillong and others to Guwahati and Nagaon. On November 20, Bomdila in Tawang, Arunchal Pradesh, the last Indian resistance in the path of the Chinese fell just about 150km southwards, Tezpur was transformed into a ghost town.

Meenakshi Bhuyan regrets that all this is new history, in a few more years the generation who witnessed the 1962 war will be no more. Some of her friends from that era also remember those turbulent times. People like Akashu Das Baruah and Prasab Kumar Saikia vividly bring the past alive with their memories. They recall now, as the war progressed, fresh rumours swept through Tezpur everyday.

Conclusion

The study was conducted to understand the impact of Indo war(1962). In order to know, two case studies were taken out. One from family of Chinese origin(Winghing Tham) and other is from family of Indian origin(Meenakshi Bhuyan). Tezpur was the most affected place among the Assam cities and towns. The populace was compelled to evacuate Meenakshi Bhuyan said that the 1962 war changed her small town forever. Tezpur was transformed into ghost town in the time of war. One of the victims of the 1962 was Winghing Tham. It is know where they originally came from the Chinese family in Assam suffered a lot in the war of 1962, got arrested, many Chinese were detained in the Delhi camp and got separated from their family.

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