

စာပေသင်္ကေတ

ကြူကြူ

စာတမ်းအကျဉ်း

စာပေသင်္ကေတတို့သည် မြန်မာစာပေအတွက် အတိုင်းအတာတစ်ခုထိ ထိရောက်နိုင်ပါသည်။ ရသစာပေများရေးဖွဲ့ကြရာတွင် အလင်္ကာ၊ နိမိတ်ပုံ၊ သင်္ကေတတို့သည် စာပေအတွက် အလှတရားများဟု ဆိုရပေမည်။ ထိုစာပေအလှတရားများကို ရသစာပေများတွင် ထည့်သွင်းအသုံးပြုခြင်းဖြင့် စာပေ၏အာနိသင်များပို၍ ထိရောက်နိုင်ပါသည်။ အသံသာယာလာနိုင်ပါသည်။ အနက်အဓိပ္ပာယ်နားလည်လွယ်လာနိုင်ပါသည်။ ဤစာတမ်းတွင် စာပေသင်္ကေတတို့၏ အစွမ်း ထက်မြက်ပုံကို လေ့လာတင်ပြပါမည်။

သော့ချက်စကားလုံး- အလင်္ကာ၊ နိမိတ်ပုံ၊ သင်္ကေတ၊ ရသစာပေ၊ စကားပြေ၊ ကဗျာ၊ အသံ၊

အနက်၊ အတွေး၊ စိတ်ကူး၊ ခံစားမှု

နိဒါန်း

လူတို့သည် နေ့စဉ်စားဝတ်နေရေးအတွက် လှုပ်ရှားရုန်းကန်နေကြရသည်။ စားရန်၊ ဝတ်ရန်၊ နေရန်သည် အရေးကြီးသောအချက်(၃)ချက်ဖြစ်သည်။ ထိုစားဝတ်နေရေး(၃)မျိုးထဲတွင် လူတို့ဘာကြောင့်အဝတ်ဝတ်ကြသနည်း။ ရာသီဥတုဒဏ်ကိုခံနိုင်ရည်ရှိရန်၊ အရှက်ကိုကာကွယ်ရန်နှင့် မိမိတို့ပင်ကိုအလှကိုပိုမိုလှပစေရန် အားဖြည့်ပေးမှုတစ်ခုဖြစ်သော အဆင်တန်ဆာတစ်မျိုးအဖြစ် အဝတ်ကိုဝတ်ကြသည်။ မိန်းကလေးများဆိုလျှင် ပို၍သိသာသည်ဟုပင်ဆိုရမည်။ မိန်းကလေးများ အဝတ်အစားဝတ်တတ်ခြင်းသည် မိမိအလှကိုပို၍ပေါ်လွင်စေပါသည်။

ထို့အတူပင် ရသစာပေတွင်လည်းရိုးရိုးဖြောင့်ဖြောင့်ရေးပြသည်ထက် အဆင်တန်ဆာတို့ဖြင့်ရေးပါက စာဟန်ကိုပိုမိုပေါ်လွင်စေသည်။ အကြောင်းအရာကို ပို၍သိသာထင်ရှားစေသည်။ ရသစာပေတွင် စကားပြေထက်ကဗျာတွင် တန်ဆာဆင်ရေးဖွဲ့ပါက ကဗျာပါအကြောင်းအရာကို ပို၍သိသာထင်ရှားစေသည်။ ကဗျာသည်တန်ဆာဆင်ရေးဖွဲ့ရန် ပိုမိုကောင်းမွန်သော စာပေတစ်ရပ်ပင်ဖြစ်သည်။ ထိုသို့တန်ဆာဆင်ရေးဖွဲ့လျှင် ပို၍ကောင်းမွန်စေသောကြောင့် ရသစာပေတွင်ကဗျာကို မိန်းကလေးများ၏အလှနှင့်တူ၍ စကားပြေကိုယောက်ျားလေးများ၏အလှနှင့်တူသည်ဟု ပညာရှင်တို့ကဆိုခဲ့ကြသည်။ စကားပြေသည်အားကောင်းသွက်လက်ရမည်။ ကဗျာမှာမူအလင်္ကာ၊ အဆင်တန်ဆာတို့ဖြင့် တန်ဆာဆင်ရေးဖွဲ့မှသာ ပို၍ရုပ်လုံးကြွလာနိုင်ပါသည်။

ထို့ကြောင့် စာရေးသူတို့သည်ရသစာပေတို့ကိုရေးဖွဲ့လျှင်အလင်္ကာ၊ နိမိတ်ပုံ၊ သင်္ကေတတို့ဖြင့် တန်ဆာဆင်ရေးဖွဲ့တတ်ကြသည်။ မိမိသိစေလိုသောအချက်များ၊ ရည်ရွယ်ချက်များကို သာမန်ရေးခြင်းထက် နိမိတ်ပုံပြစကားလုံးတို့ဖြင့်ထည့်သွင်းရေးဖွဲ့ခြင်း၊ အလင်္ကာတို့ဖြင့် တန်ဆာဆင်ရေးဖွဲ့ခြင်း၊ သင်္ကေတများသုံး၍ရေးဖွဲ့ခြင်းတို့ကို စာပေလက်နက်တစ်ခုအဖြစ် အသုံးပြု လာကြသည်။ ထိုအလင်္ကာ၊ နိမိတ်ပုံ၊ သင်္ကေတတို့ဖြင့်ရေးဖွဲ့ခြင်းသည် ယခုခေတ်မှသာမဟုတ် ရသစာပေပုံသဏ္ဌာန်စတင်ပေါ်ပေါက်ချိန်ကပင် သန္ဓေတည်လာခဲ့သည်ဟု ဆိုရပေမည်။

^၁ ကြူကြူ၊ ဒေါက်တာ၊ တွဲဖက်ပါမောက္ခ၊ မြန်မာစာဌာန၊ ပုသိမ်တက္ကသိုလ်။

ရသစာပေတွင် အဘယ်ကြောင့်သင်္ကေတများသုံး၍ရေးဖွဲ့ခဲ့ကြသနည်း၊ လူတို့၏စားဝတ် နေရေးတွင် အဝတ်ဝတ်ခြင်းသည်သာမန်ထက်ပိုမိုလှပစေရန် တန်ဆာဆင်ခြင်းတစ်မျိုး ဖြစ်သကဲ့သို့ ရသစာပေ၌လည်း သင်္ကေတပြုရေးဖွဲ့လိုက်ခြင်းဖြင့် အကြောင်းအရာများ၊ စာဟန်များကိုပိုမို သွက်လက် လေးနက်လာစေသည်။ ပို၍လှပလာစေနိုင်ပါသည်။ ထို့ကြောင့်သင်္ကေတပြုရေးဖွဲ့ခြင်း သည် ရသစာပေတွင်အရေးပါသော ကဏ္ဍတစ်ခုအဖြစ်ပါဝင်လာပါသည်။

၁။ အလင်္ကာ၊ နိမိတ်ပုံနှင့် သင်္ကေတ

ရသစာပေတွင် အလင်္ကာ၊ နိမိတ်ပုံ၊ သင်္ကေတတို့သည် အရေးပါသည့်အခန်းကဏ္ဍများမှာ ရပ်တည်နေပါသည်။ အလင်္ကာ၊ နိမိတ်ပုံ၊ သင်္ကေတတို့ကိုပညာရှင်တို့ကအမျိုးမျိုး ဖွင့်ဆို ထားပါသည်။ အလင်္ကာ ဟူသည်ကို ဆရာပါရဂူက

“အလင်္ကာသည် ကဗျာအဖွဲ့အပြင်ပန်းကို တင့်တယ်လှပစေသော ကဗျာအဆင်တန်ဆာ ဖြစ်သည်”^၁

ဟူ၍ ဆိုထားပါသည်။ အရှင်ကုမာရ၏ အလင်္ကာပန်းကုံးစာအုပ်တွင်လည်း

“အလင်္ကာဟူသည် သဒ္ဒါ၊ အနက်တို့၌သာ ဖြစ်၏။ ထို့ကြောင့် သဒ္ဒါလင်္ကာရ၊ အတ္ထာလင်္ကာရ တို့ကိုသာ မုချအားဖြင့် ‘အလင်္ကာ’ ဟုခေါ်ရပေသည်”^၂

ဟူ၍ ဖော်ပြထားပါသည်။

ထို့ကြောင့် အလင်္ကာဆိုသည်မှာ အသံသာယာအောင်၊ အနက်ဆန်းကြယ် နှစ်သက်ဖွယ် ဖြစ်အောင်သုံးသော အဖွဲ့အနွဲ့ အဆင်တန်ဆာ တစ်မျိုးဖြစ်သည်ဟု ဆိုရပေမည်။

နိမိတ်ပုံကို ဆရာမြဇင်က

“နိမိတ်ပုံဆိုတာ စာဖြင့်ဖွဲ့ထားသော ရုပ်ပုံကလေးတစ်ခုဖြစ်သည်”^၃

ဟုဆိုထားသည်။ ဆရာဇော်ဂျီက

“နိမိတ်ပုံဟူသည် ဆွေးစရာဖြစ်နေစေကာမူ ပရိသတ်၌ဆွေးလျက် ရသနှစ်သက်ခြင်း ပေါ်အောင် ပြုပေးနိုင်သော အစွမ်းဖြစ်သည်”^၄

ဟူ၍ ရှင်းပြထားသည်။

ထို့ကြောင့် နိမိတ်ပုံဟူသည် စာရေးသူကစာဖတ်သူပရိသတ်ကို ခံစားမှုဖြစ်စေရန် ရုပ်လုံး ဖော်ပေးသော စာပေတစ်မျိုးဖြစ်သည်ဟုဆိုရပေမည်။

သင်္ကေတ ကမူတစ်စုံတစ်ခုကို ကိုယ်စားပြုရည်ညွှန်းထားသော အမှတ်အသားတစ်မျိုးပင် ဖြစ်သည်ဟု ဆိုနိုင်ပါသည်။ စာပေသင်္ကေတကို အတ္ထဗေဒနိဒါန်းတွင်

“သင်္ကေတဟူသည် အကြောင်းအရာတစ်ခုခုကို ကိုယ်စားပြုသော၊ ရည်ညွှန်းသော အမှတ်အသားဖြစ်သည်”^၅

ဟူ၍လည်းကောင်း၊ “ခပ်သိမ်းကလျာရှုဖွယ်သာတည့်” စာအုပ်တွင်

^၁ ကောဝိဒ၊ လယ်တီ၊ ၉၊ ၁၉၇၃၊ ၇။

^၂ ကုမာရ၊ အရှင်၊ ၁၉၉၅၊ ၂၁။

^၃ မြဇင်၊ ၁၉၉၈၊ ၁၁၉။

^၄ ဇော်ဂျီ၊ ၂၀၀၄၊ ၃၀၁။

^၅ ခင်အေး၊ ဒေါက်တာ၊ ၂၀၀၄၊ ၃၄။

“သင်္ကေတ၊ နိမိတ်ပုံသဘောက အပြည့်အဝတူအောင် လုပ်ပြခြင်း၊ ဆောင်ပြခြင်း ဖြစ်သည်”^၁

ဟူ၍ဆိုထားသည်။

ထို့ကြောင့် အလင်္ကာနှင့် နိမိတ်ပုံ နှစ်မျိုးကိုကြည့်လျှင် စာပေ၌အသံ၊ အနက်တို့ လေးနက်စေရန်၊ စာဖတ်သူခံစားမှုဖြစ်စေရန် ရုပ်လုံးဖော်သော၊ ပုံဖော်သော စာပေအဆင့်တန်ဆာ တစ်မျိုးဖြစ်သည်။ ရသစာပေတွင်သုံးသောသင်္ကေတဟူသည် အကြောင်းအရာတစ်ခုကို ပေါ်လွင် စေရန် အခြားတစ်ခုနှင့်ရည်ညွှန်းထားခြင်းဖြစ်သည်။ စာပေသင်္ကေတတွင် အနက်နှစ်လွှာရှိသည်။ တိုက်ရိုက်အနက်နှင့် သင်္ကေတအနက် (ဥပစာအနက်) တို့ဖြစ်သည်။

၂။ စာပေသင်္ကေတ

စာပေသင်္ကေတများသည် သင်္ကေတ၏ရှိရင်းစွဲအနက်အဓိပ္ပာယ် ဂုဏ်အရည်အသွေးများကို အရှိအတိုင်းထင်မြင်လာစေခြင်းမဟုတ်ဘဲ ထိုသင်္ကေတကိုအသုံးပြုသော ထိုသင်္ကေတရပ်တည်ပါဝင် ရသော အခန်းကဏ္ဍအပေါ်အခြေခံ၍ သင်္ကေတ၏အနက်ကို ဖော်ထုတ်ရခြင်းဖြစ်ပါသည်။

စာဆိုအမည်မသိသော ‘မိဘမဲ့ကဗျာ’ တစ်ပုဒ်ဖြစ်သည့် ‘စပယ်ငုံ’ ကဗျာတွင် ဘုရားရှင်တို့ ပွင့်တော်မူကြခြင်းကို စပယ်ပွင့်ခြင်းနှင့် သင်္ကေတပြုခဲ့ပါသည်။ ဘုရားလေးဆူပွင့်တော်မူပြီး သော်လည်း မဖူးထိုက်၍မဖူးလိုက်ရသည့်သူများကို

“စပယ်တဲ့လေးရဲ့

မလေးကွယ်မပန်ထိုက်

ပန်းပြတ်ခိုက်ကြ”^၂

ဟူ၍ဆိုထားပါသည်။ ဘုရားလေးဆူပွင့်တော်မူပြီးသော်လည်း နောင်ပွင့်မည့်ဘုရားတစ်ဆူကျန်သေး ကြောင်းကို

“အပွင့်ရယ်ကုန်

တစ်ငုံကျန်ပါသေးရဲ့

ပန်ချင်သ ညိုနွဲ့နှောင်းရယ်

ခေါင်းဖြိုးခဲ့လေး”^၃

ဟူ၍ နောင်ပွင့်မည့်ဘုရားကို ပန်းအငုံနှင့်သင်္ကေတပြုခဲ့ပါသည်။

ဤကဗျာကိုသာမန်အားဖြင့်ကြည့်လျှင် ပန်းကြိုက်တတ်သည့်၊ ပန်းပန်ချင်သည့် မိန်းကလေး တို့၏သဘာဝကိုဖွဲ့ဆိုထားသည်ဟုထင်ရပါသည်။ထိုသို့ မိန်းကလေးများဦးခေါင်းတွင် အမြတ်တနိုး ပန်ဆင်သောစပယ်ပန်းကို ဗုဒ္ဓဘာသာဝင်များအမြတ်တနိုးကိုးကွယ်သောဘုရားရှင်နှင့် သင်္ကေတပြု ထားပါသည်။

ရေးသူအမည်မသိသောကဗျာတစ်ပုဒ်တွင်လည်းလူ့စရိုက်သဘာဝကို မဲလေ၊ တမာပင်တို့နှင့် သင်္ကေတပြုရေးဖွဲ့ထားသည်ကို တွေ့ရသည်။

“မဲလေပင်ပျိုအောက်

^၁ ဘုန်းနိုင်၊ တက္ကသိုလ်၊ ၂၀၁၄၊ ဒုကြိမ်၊ ၁၈၃။

^၂ သန်းထွတ်၊ ဦး၊ ၂၀၀၂၊ ၈။

^၃ သန်းထွတ်၊ ဦး၊ ၂၀၀၂၊ ၉။

ပေါက်လာတဲ့ရွှေတမာ
ခါးချက်ကနာ။
ရေစီးရယ်တစ်ခါ
ရေသာရယ်တစ်လှည့်
သူများလိုတို့မရိုင်းတယ်
တိုင်းသိပါရဲ့”^၁

ထိုကဗျာတွင် လူတို့၏ခါးသီးသော စိတ်နှလုံးပုံရိပ်များအဖြစ် ပြင်းထန်သောအတ္တဗြူစရိုက်များအဖြစ် နှစ်ဆင့်ခံအခါးအရသာနှင့်သင်္ကေတပြုထားသည်။ ထိုသို့ ခါးသီးဖွယ်စရိုက်ဆိုးတို့ထင်ရှားရှိလျက် နှင့်ခွင့်လွှတ်ခြင်းသည်မြင့်မြတ်သောသဘောဖြစ်ကြောင်းကို အတုံ့အလှည့်သဘော မထားတတ်မှု နှင့်ဖော်ပြထားသည်။

တက္ကသိုလ်ဘုန်းနိုင်၏ ‘သူငယ်ချင်းလိုပဲ ဆက်၍ခေါ်မည်ခိုင်’ ဝတ္ထုထဲတွင်

“ခိုင်နှင့်ကျွန်တော့်ဘဝမှာမူ...

နှစ်လွှာပေါင်းမှတစ်ရွက်ဖြစ်ရမည့်စွယ်တော်ရွက်ပမာသာ

ဖြစ်ခဲ့ရသည်။ တစ်လွှာကြွေခဲ့လေပြီမင်း ...

တစ်ရွက်မမည်လေတော့သော အထီးကျန်ဤဘဝဝယ်...”^၂

ဟူ၍ စာရေးသူသင်္ကေတပြုထားသောစွယ်တော်ရွက်သည် တကယ့်သစ်ရွက်ဖြစ်သည်ဟူသော တိုက်ရိုက်အနက်ရှိသကဲ့သို့ ချစ်သူနှစ်ဦးတို့၏ အချစ်သင်္ကေတအဖြစ် ကိုယ်စားပြုထားသော သင်္ကေတအဓိပ္ပာယ်ကိုလည်းတွေ့ရသည်။ စာရေးသူ၏သင်္ကေတပြုမှု ပေါ်လွင်သောကြောင့် စွယ်တော်ရွက်သင်္ကေတသည် ယခုထိ ချစ်သူတို့သင်္ကေတအဖြစ် အမှတ်ထင်ထင် ကျန်ရစ်ခဲ့သည်။ ဆရာဇော်ဂျီ၏ ‘ဗေဒါလမ်းကဗျာ’ များသည်လည်း စာဖတ်သူတို့ကို နှစ်သက် စေသောကဗျာများဖြစ်သည်။ ထိုကဗျာများထဲတွင်ပါသော မြစ်ချောင်းတစ်လျှောက် စုန်ဆန်မောပါ နေသော ဗေဒါပင်ကလေးများကို လူတိုင်းသတိထားမိကြမည်ထင်သည်။ သို့သော် စာရေးသူတို့ ကဲ့သို့ဆက်စပ်၍မစဉ်းစားမိတတ်ကြပေ။ ဆရာဇော်ဂျီသင်္ကေတပြုထားသောဗေဒါလမ်း ကဗျာများကို ဖတ်ကြည့်လျှင် စာဆိုအဓိကဆိုလိုချင်သော ရည်ရွယ်ချက်ဖြစ်သည့် လူတို့လောကဓံ တရား ရင်ဆိုင်ရပုံကို ရေးဖွဲ့ထားကြောင်း စာဖတ်သူချက်ချင်းသိနိုင်သည်။

‘ဗေဒါလမ်းကဗျာစု’တွင်ပါသော ‘ပန်းပန်လျက်ပဲ’ကဗျာတွင်လည်း ဗေဒါစုန်ဆန်လမ်း တစ်လျှောက်မောပါပုံများ၊ စုန်ဆန်လမ်းတွင်ကြုံတွေ့ခဲ့ရသော အဖြစ်အပျက်များကို ရေးဖွဲ့ပြသည်။ သို့သော်ဝါကျအဆုံးသတ်၌ ‘ဗေဒါပျံ့အံ့ကိုခဲပန်းပန်လျက်ပဲ’^၃ဟု သူဆီချင်သောအရာကို ညွှန်းပြခဲ့သည်။ အံ့ခဲခြင်း၊ ပန်းပန်ခြင်းတို့သည် သက်ရှိလူတို့သာပြုလုပ်တတ်သောအရာများ ဖြစ်သည်။ သက်မဲ့ကိုသက်ရှိသင်္ကေတနှင့် ကိုယ်စားပြုလိုက်ခြင်းဖြစ်သည်။ ဆရာဇော်ဂျီ၏ သင်္ကေတပြုမှုအားကောင်းသောကြောင့် မြစ်ကြောင်းတစ်လျှောက်စုန်ဆန်မောနေသော ဗေဒါကလေး များကို ဗေဒါလမ်းကဗျာချစ်သူတိုင်း၊ကဗျာဖတ်မိသူတိုင်းသတိထားကြည့်မိတတ်ကြသည်။ စာရေးသူ

^၁ နတ်ရှင်၊ ဒဂုန်၊ ၁၉၆၇၊ ၆၂။

^၂ ဘုန်းနိုင်၊ တက္ကသိုလ်၊ ၂၀၀၆၊ ၄၄၃။

^၃ ဇော်ဂျီ၊ ၁၉၉၈၊ ၁၇၀။

ရေးဖွဲ့သော စာပေသုံးသင်္ကေတ အားကောင်းသောကြောင့် သက်မဲ့ဗေဒါပင်ကလေးများကို သက်ရှိတို့ကဲ့သို့ သနားစိတ်များ ဖြစ်ပေါ်နိုင်ပါသည်။

သင်္ကေတသည်တိုက်ရိုက်သဘောလည်းပါ၍ တင်စားသည့်သဘောလည်းပါဝင်သည့် ကဗျာ ပရိယာယ်တစ်မျိုးဖြစ်သည်။ ‘လှိုင်းကလေးသင်’ကဗျာတွင်စာဆိုသည်လှိုင်းကလေး၏ ပင်ကိုသဘာဝ အတိုင်း ပင်လယ်မှကမ်းခြေဆီသို့ ကမ်းဆီမှပင်လယ်ဆီသို့ သွားချည်လာချည် ခရီးကိုဖွဲ့ဆိုသည်။ လူ့ဘဝခရီးတွင်လည်းသွားချည်လာချည် စုန်ချည်ဆန်ချည်ဖြင့်အမျိုးမျိုး ရင်ဆိုင်ကြုံတွေ့နေရသည်။ ဤသို့ကြုံတွေ့နေရသော်လည်း အကူအညီပေးတတ်သည့်သူတို့ကို ဤကဗျာတွင်

“သင်လာစဉ် ပင်လယ်လမ်းမှာဖြင့်
မုန်တိုင်းလေ လှိုင်းရေကြမ်းသော်ကြောင့်
ပန်းခဲသူ ဇင်ရော်ငှက်ကိုလ
ကျောထက်ဝယ် ဆောင်ယူသယ်၍
ဖောင်သဖွယ် သင်ကူမတယ်လို့
တွေးဆကာ သည်အလွမ်းရယ်နဲ့
ဝမ်းမြောက်တယ်လေး”^၁

ဟုဖွဲ့ခဲ့သည်။လှိုင်းများကသယ်ဆောင်လာသော ဇင်ရော်ငှက်ကလေးများသည် လှိုင်းတို့၏ အကူအညီဖြင့် ကမ်းခြေသို့ရောက်ရှိလာခြင်းဖြစ်သည်။ထိုကဗျာတွင် လှိုင်းကလေးကို ဘဝခရီး၌ ကြုံကြိုက်လျှင်ကြုံကြိုက်သလို အကူအညီပေးတတ်သည့် လူတို့၏သဘာဝနှင့်သင်္ကေတပြုထားသည်။ဇင်ရော်ငှက်ကလေးများကိုခြေကုန်လက်ပန်းကျ၍ သူတစ်ပါးကိုသာအားကိုးရသည့် လူသားတို့၏ဘဝနှင့်သင်္ကေတပြုထားသည်။ စာရေးသူသည်လူ့လောကလူ့ဘဝ၌ဒုက္ခနှင့် မကင်းသူတို့အတွက် အကူအညီလိုတတ်သည့်သဘော၊ မိမိတတ်စွမ်းသမျှကူညီတတ်သူတို့၏သဘောကို ဇင်ရော်ငှက်၊ လှိုင်းကလေးတို့နှင့်သင်္ကေတပြုထားသည်။ လူ့ဘဝခရီးလမ်းကိုလျှောက်လမ်းရာ၌ တစ်ဦးကိုတစ်ဦး အမှီပြု၍ ဘဝ၌အဆင်ပြေချောမွေ့အောင် နေထိုင်နိုင်သည်ဟူသောလောကအမြင်ကိုရရှိစေပါသည်။

ရေးမြန်မာကဗျာများတွင်ဇင်ရော်၊ဟင်္သာစသည့်ငှက်များကိုအမျိုးမျိုးဖွဲ့သော်လည်း ဝမ်းဘဲငှက်ကိုမူအရေးတယူဖွဲ့ဆိုမှုနည်းပါးသည်။ စာဆိုသည် ဝမ်းဘဲကဲ့သို့စိတ်ကူးယဉ်ဖွယ်ရာ နည်းပါးသော ငှက်တစ်ကောင်၏အမူအရာ၊အသံတို့ကို အနီးကပ်အမြင်ဖြင့်ရှုမြင်ပြီးလျှင် သင်္ကေတပြုခဲ့သည်။ ဝမ်းဘဲ၏အသံနှင့်အမူအရာကို

“နှုတ်မလပ်သည်၊ ဃပ်ဃပ်ညိုးညံ
သူ့ရွတ်သံတည့်။
တက်သက်လေသည်၊ ရေတိမ်ကမ်းစပ်
သူ့ချောင်ရပ်တည့်။
မခုန်မပျံ၊သူ့ဟန်ပန်တည့်”^၂

^၁ ဇော်ကျီ၊ ၁၉၉၈၊ ၃၆။

^၂ -ယင်း-၊ ၄၄။

ဟူ၍ဖွဲ့ဆိုထားသည်။ဝမ်းဘဲ၏အသံသင်္ကေတသည် လူ့လောကတွင် နေရာတကာ၌ပါဝင်ချင်ပြီး အသံကြီးအသံကောင်းများဟစ်နေသော်လည်းအကျိုးရှိရှိစွမ်းဆောင်နိုင်စွမ်းမရှိသည့်သူများကို ညွှန်းဆိုနေသည်။

ဝမ်းဘဲ၏အမူအရာသည် သွားချည်လာချည်နှင့် နေရာတကာတွင်ပါဝင်လှုပ်ရှားလေဟန် ပြသော်လည်း အကျိုးရှိမဆောင်ရွက်နိုင်သည့် လူ့စရိုက်လူ့အမူအရာကိုသင်္ကေတပြုထားသည်။

“တောင်ပံနှစ်ဖက်၊ ရှိပါလျက်တည့်

မတက်တိမ်ခွင်၊ နေသာဝင်၍

လေတွင်မလွှား၊ နေ့သာပါးသည်

ရေနားကုန်းမှာသာတကား”^၁

ထိုကဗျာတွင် ဝမ်းဘဲငှက်သည်တောင်ပံနှစ်ဖက်ရှိသော်လည်း အခြားငှက်များကဲ့သို့ မိုးတိမ်ယံ တက်ရန်မစွမ်းနိုင်၊ လေတွင်မပျံနိုင်၊ နားငြီးလောက်အောင်သာ အသံမြည်နေသော်လည်း

ရေတိမ်ကမ်းစပ်၌သာအချိန်ကုန်နေသည်။ ထိုသို့ အခြားသူများနည်းတူမိမိ၌ ဘဝအခြေအနေ အခွင့်အရေးများရှိသော်လည်း ထွန်းထွန်းပေါက်ပေါက်ဖြစ်အောင်မစွမ်းဆောင်နိုင်ဘဲ အရေးမပါသည့် အရာများတွင် ဟိုစပ်စပ်သည်စပ်စပ်လုပ်၍အချိန်ကုန်နေတတ်သည့် လူညံ့တို့၏စရိုက်နှင့် သင်္ကေတ ပြုထားပါသည်။

ဆရာမင်းသုဝဏ်၏ ကဗျာများထဲတွင်လည်း သင်္ကေတအသုံးများကိုတွေ့ရသည်။ မြန်မာ့ လွတ်လပ်ရေးကြိုးပမ်းမှုအချိန်တွင် မြန်မာတစ်မျိုးသားလုံး အားတက်စေရန် ရေးသားခဲ့သော သပြေညိုကဗျာမှ သပြေညိုသင်္ကေတကို တွေ့နိုင်သည်။ သပြေပန်းကို အောင်ပန်းအဖြစ် ရှေးပဒေသရာဇ်ခေတ်ကပင် လက်ခံယုံကြည်ခဲ့ကြသည်။ ထိုသို့လက်ခံပြီးသော သင်္ကေတ သပြေပန်းကိုစာဆိုက လွတ်လပ်ရေးအတွက် တပ်လှန့်ရာတွင် ထပ်မံအသုံးပြုခဲ့သည်။ ကဗျာ အဆုံးသတ်တွင်

“သပြေညို၊ ရွှေဘိုပန်းရယ်နဲ့

လှမ်းကြစို့လေး”^၂

ဟု ရေးသား၍ အောင်ပန်းအဖြစ် သင်္ကေတပြုခဲ့သည်။ စာဆို၏သင်္ကေတပြုရေးသားသည့် အကြောင်းအရာ လေးနက်သည့်အလျောက်၊ စာဆို၏စေတနာထက်သန်မှုအလျောက် သပြေညိုပန်း ကို အောင်မြင်မှု သင်္ကေတအဖြစ် သတိရလာစေနိုင်ပါသည်။

‘နှင်းဆီပွင့်’ ကဗျာသည်လည်း စိတ်လှုပ်ရှားခံစားမှုကို သင်္ကေတများနှင့် ဖွဲ့ဆိုထားသည်။ စာဖတ်သူ၏စိတ်ကူးကို လူတိုင်းသိသောသင်္ကေတများနှင့် သိမ်မွေ့စွာရေးဖွဲ့ထားသည်ကို တွေ့ရပါသည်။

“လယ်တောကပြန်

ပန်ချင်တယ် ခရေဖူးဆိုလို့

မောင်ခူးကာပေး။

မနက်တုန်းဆီက

^၁ -ယင်း-။

^၂ မင်းသုဝဏ်၊ ၁၉၉၇၊ ၄၃။

ကြောဆုံးကို မောင်မြင်တော့
သူ့ဆံပင် နှင်းဆီပွင့်တွေနဲ့
ဂုဏ်တင့်တယ်လေး”^၁

ဟူ၍ ခရေဖူးနှင့် နှင်းဆီပွင့်က သင်္ကေတအဖြစ်ထည့်သွင်းရေးဖွဲ့ထားသည်။ လူတို့သည် ဂုဏ်မြင့်သည်ကိုသာ တန်ဖိုးထားကြသော မိမိတို့လိုအပ်သည့်အရာကိုမရမီ၌ စိတ်ဖြေသိမ့်စရာ အဖြစ်တစ်စုံတစ်ခုနှင့်အစားထိုးလေ့ရှိသော လူ့သဘာဝစရိုက်များကို သိမ်မွေ့လှပသော ကဗျာ ပရိယာယ်ဖြင့်ရေးဖွဲ့ထားခြင်းဖြစ်သည်။ ဂုဏ်နိမ့်သကို ခရေပန်းဖြင့်သင်္ကေတပြုပြီး ဂုဏ်မြင့်သူကို နှင်းဆီဖြင့်ကိုယ်စားပြုထားသည်။

မိမိဘဝအတွက်လိုချင်သည့်အချစ်ကိုမရခင်၌ ရသည့်အချစ်ဖြင့်အစားထိုး၍ စိတ်ကိုဖြေသိမ့်ခြင်း၊ မိမိရည်မှန်းသည့်အရာကို ရရှိသွားသောအခါ အချစ်ကိုပြောင်းရွှေ့နှင်းအပ်ခြင်းဆိုသည့် စိတ်အမူအရာနှစ်ရပ်ကို လှပစွာရေးဖွဲ့ထားသည်။ ချစ်ခြင်းမေတ္တာကိုအလေးအနက်ထားတတ်သော၊ လက်သာရာသို့ရွှေ့ပြောင်းတတ်သောလူ့သဘာဝ၏စက်ဆုပ်ဖွယ်၊ ရင်နှင့်ဖွယ်ကောင်းပုံ၊ ရိုးသားဖြူစင်သောမေတ္တာရှင်တို့၏ ခွင့်လွှတ်သည်းခံတတ်သောအချစ်၊ မုဒိတာတရားပွားများနိုင်ပုံတို့ကို ကွဲပြားခြားနားသောသင်္ကေတများဖြင့်ရေးဖွဲ့ပြခဲ့သည်။ သင်္ကေတများ၏စွမ်းအားကြောင့် စာဖတ်သူတို့၏ရင်ထဲသို့ စာနာသောခံစားမှုနှင့်အတူ လူ့သဘာဝဆိုင်ရာအသိကိုပါ စွဲမြဲရရှိစေပါသည်။

ပညာကိုလည်း အများအားဖြင့်ဆီမီးတိုင်နှင့်သင်္ကေတပြု ရေးဖွဲ့တတ်ကြပါသည်။ ပညာဆိုသည်မှာ အခြားသူကိုဝေမျှပေးသော်လည်းယုတ်လျော့သွားသည်ဟူ၍မရှိနိုင်ပေ။ ထို့အတူ ဆီမီးတိုင်မှာလည်း အလင်းရောင်ရချင်၍ အခြားဆီမီးတိုင်များက လာရောက်ထွန်းညှိသော်လည်း အလင်းရောင်မှာ ယုတ်လျော့သွားသည်ဟူ၍မရှိပေ။ မိမိဆီမီးထွန်းညှိသွားသော အလင်းရောင်တို့ကြောင့် ပိုမို၍ပင်လင်းထိန်လာစေနိုင်ပါသည်။ ထို့ကြောင့် အစွမ်းသတ္တိတူသည့်ပညာကို ဆီမီးတိုင်နှင့် သင်္ကေတပြု ရေးဖွဲ့လေ့ရှိကြပါသည်။ မမြင်သာသောအရာကို မြင်သာသောအရာနှင့် သင်္ကေတပြုရေးဖွဲ့ပြလိုက်သဖြင့် ပို၍အဓိပ္ပာယ်ကိုလေးနက်စေ၊ အကျိုးအာနိသင်ကို သိသာလာစေပါသည်။ စာဆိုငွေတာရီ၏ ‘ဤမီးတိုင်’ ကဗျာတွင်

“သူ့အလျှံမှာ
တစ်ဖန်ကူးဘိ
သူငါညှိလည်း
မသိလျော့ရာ
ထိန်မြီသာတည့်”^၂

ဟူ၍ ရေးဖွဲ့ထားပါသည်။ ကဗျာတွင်ဆီမီးတိုင်၏အစွမ်းသတ္တိကိုသာ ဖော်ပြထားပါသည်။ သို့သော် စာဆိုရည်ရွယ်ချက်မှာ ပညာရှင်တို့သည် မိမိတို့ပညာကို ဖြန့်ဝေပေးသော်လည်း ပညာယုတ်လျော့သွားခြင်းမရှိပုံကို ဆီမီးတိုင်နှင့်သင်္ကေတပြု ရေးဖွဲ့ပြခြင်းဖြစ်ပါသည်။

‘မင်းလှည့်နံ့ကြူး’၏ ‘ဘိုးဘိုးအောင်ဈေး’ကဗျာတွင် ကုန်ဈေးနှုန်းများတက်လာခြင်းကို ဘိုးဘိုးအောင်မစခြင်းနှင့်သင်္ကေတပြုခဲ့ပါသည်။ ထိုကဗျာတွင်ဝယ်သမျှပစ္စည်းများအားလုံးဈေးတက်နေသည်။ ဈေးကြီးပေးဝယ်ရသည်ကို

^၁ -ယင်း-၊ ၄၉။

^၂ ငွေတာရီ၊ ၂၀၁၅၊ ဒုကြိမ်၊ ၅၂၄။

“ဈေးကွက်ထဲမှာ၊ ဆိုင်ပေါ်မှာ
ကုန်ပစ္စည်းမှာ၊ ဈေးနှုန်းမှာ
တွေ့လာဘိုးဘိုးအောင်ကိုတည်း”^၁

ဟူ၍ဆိုခဲ့ပါသည်။ ဈေးထဲတွင်ကုန်ပစ္စည်းဈေးနှုန်းများ ဘိုးဘိုးအောင်နှင့်တွေ့နေသည်ဟုသင်္ကေတ
ပြုထားပါသည်။ ဘိုးဘိုးအောင်ကိုမြန်မာလူမျိုးတို့က နှစ်ဆတိုးအောင်မစသည်ဟုအယူရှိကြသည်။
ဈေးထဲမှာမြင်မြင်သမျှဘိုးဘိုးအောင်မစထားပြီဖြစ်၍ ဈေးမှပြန်လာသောအိမ်သူက အိမ်၌လည်း
ဘိုးဘိုးအောင်များတွေ့လေအုံးမလားဟုရှာမိပုံကို

“ဈေးပြန်အလာ
မောင့်လစာကို၊ ရေကာတွက်ကာ
သူ့ကိုရှာသည်၊ စကြာတို့အဖိုး
မြေကလျှိုးသလား
မိုးကပျံသလော”^၂

ဟူ၍အဆုံးသတ်ထားသည်။ ကုန်ဈေးနှုန်းလစာတို့ကိုဘိုးဘိုးအောင်မစပုံ၊ ပျောက်နေပုံနှင့် သင်္ကေတ
ပြုထားပါသည်။ ကဗျာထဲရှိဘိုးဘိုးအောင်မှာ ခေတ်ကိုထင်ဟပ်ပြသောကုန်ဈေးနှုန်းကို ကိုယ်စားပြု
ထားသောသင်္ကေတပင်ဖြစ်ပါသည်။

ထိုသို့ကျွန်ုပ်တို့၏ ပတ်ဝန်းကျင်တွင် အကြောင်းအရာတစ်ခုကို ပေါ်လွင်ထင်ရှားအောင်
ဖော်ပြလိုလျှင် သင်္ကေတဖြင့်ဖော်ပြတတ်ကြသည်။ ပူလောင်သောစိတ်သဘာဝကို နေ၊ မီး၊
အေးချမ်းသော၊ မျက်နှာဝိုင်းသောမိန်းကလေးကို လ၊ မိဘမေတ္တာကိုမြင့်မိုရ်တောင်၊ မစတတ်သူကို
ဘိုးဘိုးအောင်၊ ဒေါသကြီးသူကို မြေ၊ သတ္တိရှိသူကို ခြင်္သေ့စသည်ဖြင့်တင်စားကာ သင်္ကေတ
ပြုတတ်ကြသည်။

ထို့ကြောင့် သင်္ကေတများသည် စာရေးသူတို့၏အတွေးစိတ်ကူးတို့ကို မြင်အောင်
ကြားအောင်ပုံဖော်မှုများဖြစ်သည်။ ရသခံစားစေရန်နှင့် ဘဝအသိကိုရရှိစေရန် အထောက်အပံ့
ပြုပေးသော စာရေးသူ၏ပရိယာယ်လည်းဖြစ်သည်ဟုဆိုချင်ပါသည်။

ခြုံငုံသုံးသပ်ချက်

စာရေးသူတို့သည် ရသစာပေများဖန်တီးရာတွင် စာပေပုံသဏ္ဌာန်တစ်ရပ်ဖြင့် ဖန်တီး တင်ပြကြသကဲ့သို့၊
ထိုစာပေပုံသဏ္ဌာန်တို့တွင်ထည့်သင်းရေးဖွဲ့သည့် အသံသဘော၊ အနက်သဘော တို့ကိုလေးနက်စေရန်
သင်္ကေတတို့ဖြင့်ပုံဖော်တတ်ကြသည်။ စာပေများရေးသားရာတွင် တိုက်ရိုက် ရေးခြင်းထက်စာပေနည်းပရိယာယ်
တစ်မျိုးဖြစ်သော သင်္ကေတပြုရေးသားခြင်းကို စာပေလက်နက် အဖြစ်ကိုင်ဆွဲလာကြသည်။ ထို့ကြောင့်
ရသစာပေများကို ဖန်တီးရာတွင်သင်္ကေတပြု ရေးဖွဲ့ခြင်းသည် ရသစာပေဖန်တီးမှုစွမ်းရည်တစ်ရပ်ဟုဆိုရပေမည်။
ထိုမှတစ်ဆင့် စာဖတ်သူကို ခံစားမှုနှင့်ယှဉ်၍ ဘဝအသိများပင်ရရှိစေနိုင်ပါသည်။

နိဂုံး

ဤစာတမ်းတွင် ရသစာပေတို့၌ သင်္ကေတ၏အသုံးကဏ္ဍများကိုရွေးချယ်တင်ပြထားပါ သည်။
သင်္ကေတများပြု၍ရေးဖွဲ့ခြင်းဖြင့် ရသစာပေများ၏အာနိသင် ပိုမိုအစွမ်းထက်လာကြောင်း သိသာစေပါသည်။
ရသစာပေကိုလည်းအမှတ်ရစေ၊ သင်္ကေတများကိုလည်းအမှတ်ထင်ထင် သိမြင် စေပါသည်။ ထို့ကြောင့်
ရသစာပေဖွံ့ဖြိုးတိုးတက်မှုတွင် သင်္ကေတပြုမှုသည် အရေးပါကြောင်း ဗဟုသုတရစေပါသည်။

^၁ မင်းလှညွန့်ကြူး ၁၉၆၉၊ ၇။

^၂ -ယင်း-။

ထိုပြင်ရသစာပေထဲတွင် သင်္ကေတ၏အခန်းကဏ္ဍသည် ထိရောက်မှုရှိပြီး ဆက်လက်လေ့လာမည့်သူတို့အတွက် အထောက်အကူပြုနိုင်လိမ့်မည်ဟု မျှော်လင့်မိပါသည်။

ကျမ်းကိုးစာရင်း

- ကုမာရ၊ အရှင်။ (၁၉၉၅)။ *အလင်္ကာပန်းကုံး၊ ဆဋ္ဌမအကြိမ်*။ ရန်ကုန်၊ ပါရမီစာပေ။
- ကောဝိဒ၊ ဦး၊ လယ်တီ။ (၁၉၇၃)။ *ကာဗျဘာရတီကျမ်း*။ ရန်ကုန်၊ ဇွဲစာပုံတိုက်။
- ခင်အေး၊ ဒေါက်တာ။ (၂၀၀၄)။ *အတ္ထပေဒနိဒါန်း*။ ရန်ကုန်၊ ပညာတန်ဆောင်ပုံနှိပ်တိုက်။
- ငွေတာရီ။ (၂၀၁၅)။ *ငွေတာရီကဗျာပေါင်းချုပ်၊ ဒုတိယအကြိမ်*။ ရန်ကုန်၊ စိတ်ကူးချိုချိုစာပေ။
- ဇော်ဂျီ။ (၁၉၉၈)။ *ဇော်ဂျီကဗျာပေါင်းချုပ်*။ ရန်ကုန်၊ စာပေလောကစာအုပ်တိုက်။
- ဇော်ဂျီ။ (၂၀၀၄)။ *ရသစာပေအဖွင့်နှင့်နိဒါန်း၊ ဒုတိယအကြိမ်*။ ရန်ကုန်၊ အင်ကြင်းဦးပုံနှိပ်တိုက်။
- ဘုန်းနိုင်၊ တက္ကသိုလ်။ (၂၀၀၆)။ *သူငယ်ချင်းလှိုင်းဆက်၍ခေါ်မည်ခိုင်*၊ ဧကဒသမအကြိမ်။
- ရန်ကုန်၊ ကံ့ကော်ဝတ်ရည်စာပေ။
- ဘုန်းနိုင်၊ တက္ကသိုလ်။ (၂၀၁၄)။ *ခပ်သိမ်းကဗျာရှုဖွယ်သာတည်း၊ ဒုတိယအကြိမ်*။ ရန်ကုန်၊
- ကံ့ကော်ဝတ်ရည်စာပေ။
- မင်းလှညွန့်ကြူး။ (၁၉၆၉)။ *ရှုမဝမဂ္ဂဇင်း*။ ရန်ကုန်၊ ရှုမဝပုံနှိပ်တိုက်။
- မင်းသုဝဏ်၊ (၁၉၉၇)။ *မင်းသုဝဏ်ကဗျာပေါင်းချုပ်*။ ရန်ကုန်၊ စာပေလောကစာအုပ်တိုက်။
- မြဇင်။ (၁၉၉၈)။ *ကဗျာနုရီနှင့်နိမိတ်ပုံ*။ ရန်ကုန်၊ အသိုင်းအဝိုင်းစာပေ။

Spatial Distribution Patterns of Basic Education Schools in Pathein City

Tin Tin Mya¹, May Oo Nyo²

Abstract

Pathein City is located in Pathein Township, western part of Ayeyarwady Region. The study area is included fifteen wards. This paper emphasizes on the spatial distribution patterns of these schools are analyzed by using appropriate data analysis methods. This study is divided into two types of schools, they are governmental schools and nongovernmental schools. Qualitative and quantitative methods are used to express the spatial distribution patterns of Basic Education Schools in Pathein City. Primary data are obtained from field surveys, informal interview, and open type interview. Secondary data are collected from the offices and departments concerned. Detailed facts are obtained from local authorities and experience persons by open type interview.

Key words: spatial distribution patterns, education, schools, primary data, secondary data

Introduction

The study area, Pathein City is situated in the Ayeyarwady Region. The study focuses only on the unevenness of spatial distribution patterns of basic education schools in Pathein City. This paper focuses on not only the distribution of governmental schools but also the distribution of nongovernmental schools. Because Boarder schools were established in 2000 and Monastic education schools and private schools were established in 2007. This study is divided into two types of schools, they are governmental schools and nongovernmental schools. Emphasis is put on the spatial distribution patterns of basic education schools by types, wards and based on population concentration and transportation.

Aim

-To analyze the spatial distribution patterns of basic education schools in Pathein City.

Objectives

-To study the saturation of basic education schools.

-To examine the Teacher-Student Ratio in different levels of basic Schools.

-To assess the relationship between number of population and schools.

Sources of Data and Methodology

First, many field observations have been made to understand the current basic education schools distribution patterns. And the gathering and referring to the books and various departments and several field observations are done within Pathein City.

In this study, data are mainly used population data, and others are received from Township Administration Department, General Administration Office, Land Record Department.

Primary data are obtained from field observation, informal interview and open type interview. Open type interview and in depth interview are conducted focusing on authorities persons, experience persons, local people, parents and students. Secondary data such as number of schools, students and teachers are obtained from Department of Basic Education Pathein District. This paper emphasizes on the spatial distribution patterns of Basic Education

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Schools are analyzed by using appropriate data analysis methods. Mapping data linkage and analysis are done by using Geographic Information System technique.

Study Area

Pathein City is located in the eastern part of the Pathein Township, Ayeyarwaddy Region. It is situated between $16^{\circ} 44'N$ and $16^{\circ} 51' N$ Latitude and $94^{\circ} 42'E$ and $94^{\circ}48' E$ Longitude. Pathein City lies on both banks of Pathein (Ngawan) River. But the greater part of the area lies on eastern banks. The study area is situated about 120 miles away the west of Yangon and about 75 miles away from the Andaman sea. And it is one of the leading seaports of Myanmar as well as the seat of the Region Government of Ayeyarwady Region. Pathein city also serves as headquarter for south west Military Command, Shown in Figure (1).

In 1874, Pathein Municipal Area of just under 30.72 square kilometer (12 sq miles). In 1976 the area increased to 40.78 square kilometer (15.91 sq miles). In 2014 ,Pathein City with 15 wards are 66.1 square kilometer (25.75 square miles) due to extension of ward No.12 (1990), ward No- 14(1989) and ward No-15 (2002) .

According to its location, the shape of the study area is rather elongated along the banks and narrowed in the east-west direction. In eastern bank of the river, the city extends about 4 miles toward the easterly direction but in the western bank, the area occupies about half miles along the bank.

Pathein City is bounded on the north by Mayangaung ,Zinbyungon and koku Village Tracts, on the east by Myochaung , Pyingadogon and Paukon Village Tracts, on the south by Payachaung and Yemanebingaing Village Tracts, on the southwest by linwungyi and Thitpokkon Village Tracts and on the northwest by kanni Village Tracts.

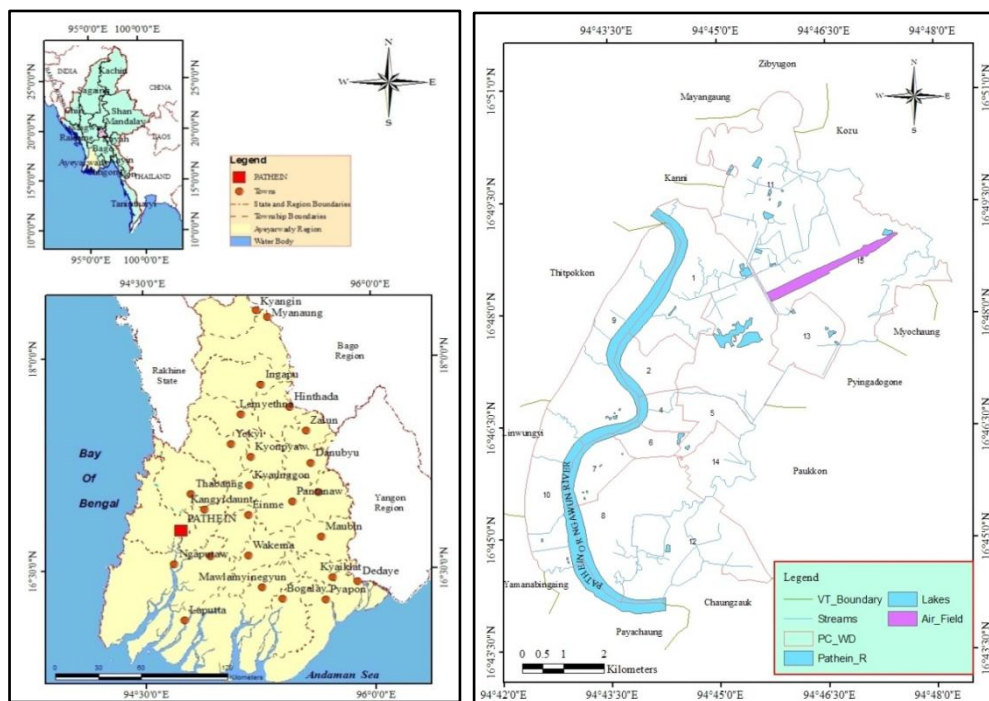


Figure (1) Location Map of Pathein City in Ayeyarwady Region

Source :Land Record Department in Pathein Township.

Result and Findings

Spatial Distribution of Basic Education Schools in Pathein City

Pathein City Comprises 15 wards separated by the Pathein River, thus the wards are located on both sides of the river. They are adjoining with village tracts of the several area. The number of students on the eastern bank of the urban area is much greater due to the presence of downtown, high accessibility and high population concentration. There are 13 out of 15 wards on the eastern bank, including ward No.1,2,3,4,5,6,7,8,11,12,13,14 and 15 of which Ward No. 3 has the largest number of basic education schools, followed by Ward No.1,2,5 and 8, where ward No.14 has the least. Ward No.9 and 10 are located on the other side of Pathein River and have one high school, one middle school, and 4 primary schools to which the students from the nearby areas attend for education pursuit.

Distribution of Basic Education Schools by Wards

There are one middle school and 6 primary schools in ward No.1, 1 middle school (Bch) and 3 primary schools in ward No.2, 3 high schools and 5 primary schools in ward No.3, one high school, one middle school and 3 primary schools in ward No.4, 6 primary schools in ward No.5, one middle school and 4 primary school in ward No.6, one high school and 5 primary school in ward No.8, one high school, and 2 primary schools in ward No.9, one middle school and 2 primary schools in ward No.10, one high school and 3 primary schools in ward No.11, 3 primary schools in ward No.12, each middle school and primary school in ward No.13, one primary school in ward No.14, and 2 primary schools in ward No.15.

Among the 15 wards, ward No.3 ranks first in the number of basic education schools with 8, followed by ward No.1 and 2 with 7 schools each, and by ward No.5 and 8 with 6 schools each, ward No.14 has the least, with only one basic school Figure (2).

There are one pre-school and one private school in ward No.1, one pre-school and 6 boarder in ward No.2, one pre-school, one tuition and 7 boarder in ward No.3, one boarder in ward No.4, one pre-school, one private school and 2 boarders in ward No.5, one boarder in ward No.6, one pre-school, one tuition and one boarder school in ward No.7, one Monastic school and 2 boarders in ward No.8, one pre-school in ward No.10, one pre-school in ward No.13 and one private school in ward No.15.

Among the 15 wards, ward No.3 ranks first in the number of nongovernmental schools with 9, followed by ward No.2 with 7 schools, ward No.5 with 4 schools, ward No.4,10,13 and 15 have the least with only one school. Plate (1,2,3,4).

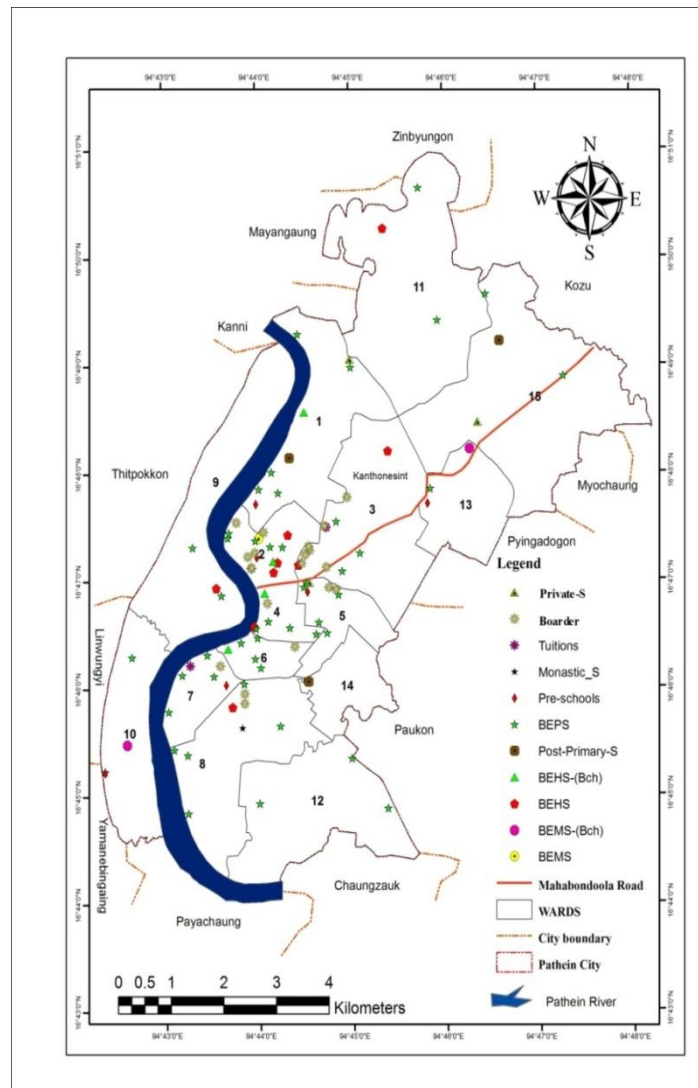


Figure (2) Distribution of Basic Education Schools by Wards
Source : Based on Field Observation, December ,2015



Plate (1&2) Basic Education High Schools in Pathein City



Plate(3&4) Private school and Boarder School in Pathein City

Teacher-Student Ratio (TSR)

The teacher-student ratio refers to the relative number of students to a teacher teaching at a given class or level or school.

Average Teacher-Student Ratios in Different Basic Education Levels

There are 9 high schools in Pathein City at which 13573 students are learning, taught by 470 teachers and thus the teacher-student ratio in this level is 1: 29. This ratio is fairly good for effective teaching. Among the 9 high schools 5 are below the average ratio. Pathein City has 4 branch high schools in which 129 teachers are teaching to 2892 students, thus resulting in an average teacher-student ratio of 1:22 which is better than the high schools average. The ratios of two branch high schools are lower than the average. In the middle school level, there is only one school and it needs no average. For two branch middle schools the average teacher-students ratio is 1:30, moderately good for teaching and learning.

The study area has 3 post-primary schools and with 33 teachers and 103 students and the average teacher-student ratio is 1:31 which is also moderately good. Two out of three schools have lower ratio than the average. The total teachers and students in the 47 primary schools are 437 and 9183 respectively and so the teacher-student ratio is 1:21. Among the 47 schools 26 have the ratio below the average.

Teacher-Student Ratios of Non Governmental Schools

There are 2 private high schools in Pathein City at which 451 students are learning, taught by 55 teachers and thus the teacher- students ratio in this level is 1:8. This ratio is good for effective teaching. There are 1 monastic schools in Pathein City where 326 students are learning taught by 10 teachers and thus the teacher-students ration in this level is 1:33. This ratio is fairly good for effective teaching . There are 1 private middle schools in Pathein City where 182 students are learning taught by 70 teachers and thus the teacher-students ratio in this level is 1:3. This ratio is very good for effective teaching. There are 2 tuition schools in Pathein City at which 45 students are learning , taught by 10 teachers and thus the teacher-students ratio in this level is 1:5. This ratio is good for effective teaching. There are 20 boarders schools in Pathein City where 920 students are learning, taught by 170 teachers and thus the teacher-students ratio in this level is 1:5. This ratio is good for effective teaching. There are 5 pre schools in Pathein City at which 172 students are learning, taught by 18 teachers and thus the teacher-students ratio in this level is 1:10. This ratio is fairly good for effective teaching.

Analysis of Spatial Distribution Patterns of Basic Education Schools Physical Factor

Pathein Town lies astride on the both banks of Pathein River which flows across the city from north to south. The larger and more developed part with downtown and commercial activities occupies the eastern bank, comprising Ward No.1, 2, 3, 4 ,5 ,6,7 ,8,1 1, 12, 13, 14 and 15. On the western bank are Ward No.9 and 10 which are relatively less developed.

Dictated by the high population concentration, more basic education schools are located in the eastern part. Although it is put of the river valley, the land is slightly undulating. The wards close to the banks usually witness flooding every year in July and August. As a result, the basin schools that occupy the low lying and depressed area have to suspend classes for some days during floods. Usually 26 schools suffer from the negative effect of flooding and these are the schools located in ward No.1, 2, 3, 5, 6, 7, 8, 9, 10 and 12. The schools that encounter flooding are Sakawar BEPS, Kunchan BEPS and Akaukseik BEPS in Ward No.1, Patali BEPS and Huthtakay BEPS in Ward No.2, Tatseik BEPS in Ward No.3 Papawadi and Taunggone BEPS in Ward No.5, branch high school (No.6 BEPS) in Ward No.6, Ramanya, Marta, Wedauk and Kyankngu BEPS in Ward No.7, Bogyikone, Wliluwun and Marta kwethit BEPS in Ward No.8, Yekyaw and Thinbawkyin BEPS in ward No.9, Tarkaing branch middle, Padaukchaung and Yeosin BEPS is Ward No.10, Kyakhatkone and Paukkone BEPS in Ward No.12, and Shwewuthmon BEPS in Ward No.13. As these schools are suspended for some days during flood the teachers have to take more time in teaching to catch up the lessons prescribed.

The distribution patterns of basic education schools on the western part somewhat bears the elongated of shape, while that of Ward No.2,3 and 4 on the eastern part appears as clustered form. The basic education schools in the peripheral area of the city have dispersed pattern.

Transportation Factor

Ward No.2, 3 and 4 are located beside MahaBandoola road and No.1 and 3 BEHSs are on this road and No.2 BEHS on Zizawar road. The schools located on MahaBandoola road are highly accessible. No.4 BEHS is located on Tagaung Pagoda road and No.5 BEHS on Yoodayarkone road. The former is in the peripheral area and latter in the interior, resulting in fairly low accessibility. No.6 BEHS is also located on Tagaung Pagoda road, but it is easily accessible. Its pass percentage is highest among the high schools. No.7 BEHS is located in the area belong to the army and thus its location is peripheral. No.8 BEHS is attended by students living in the respective ward and nearby village tracts. BEHS (University) is located within the campus of Pathein University and it is easily accessible. Some students living on the west bank attend the schools locating on the east bank crossing the river by boats. Among the basic high schools, No1, 2 and 3 BEHSs are relatively most accessible with short distances between homes and the schools. The concentration of schools in the eastern part of the city is due to high population concentration, high accessibility with different modes of transportation, including car, three-wheel car and motorcycle and good road condition. Accessibility is relatively low and it takes more time to get to Tayokekone, Alekoune, Kyakhatkone, Paukkone, Yekyioo, Yeosin and Padaukchaung BEPSs locating in the outer part of the city Figure (3).



Population Factor

(A). Correlation between Population and Number of Primary Schools in Pathein City

Table (1) Population and Number of Primary Schools in Pathein City (2014)

Ward No	Population(2014)	Number of Schools
1	21601	5
2	13612	3
3	13904	5
4	9193	3
5	9044	6
6	15965	4
7	14500	4
8	12262	5
9	9436	2
10	5545	2
11	12037	3
12	4321	3
13	5580	1
14	8087	0
15	3085	1
Total	158172	47

source: Field Observation

The relationship between number of population and number of primary schools is analyzed by Separman's Rank Correlation Method. The resultant value ('r' value) is +0.7. Therefore, there is a high positive relationship between the two variables . The total numbers of population 'X' and the numbers of schools 'Y' are used and find out their correlation. Table(1).

The highest population density in ward No. 4 and the second population density in ward No.6. In the most concentration BEPS schools in ward No.5 and the second concentration is ward No.1, 3 and 8. These wards are close together with each other.

(B). Correlation between Number of Primary Students and Number of Primary School in Pathein City

Table (2). Number of Primary Students and Number of Primary Schools in Pathein City (2014)

Ward No	Numbers Students	of Number of Schools
1	797	5
2	542	3
3	1222	5
4	928	3
5	1235	6
6	854	4
7	816	4
8	883	5
9	537	2
10	346	2
11	365	3
12	385	3
13	230	1
14	-	-
15	43	1
Total	9183	47

source: Field Observation

The relationship between number of students and number of primary schools is analyzed by Separman's Rank Correlation Method. The resultant value ('r' value) is +0.9. Therefore , there is higher positive relationship between the two variables . The total numbers of students 'X' and the numbers of schools 'Y' are used and find out their correlation, Table(2).

Analysis of Deviational Ellipse of Some Basic Education Schools

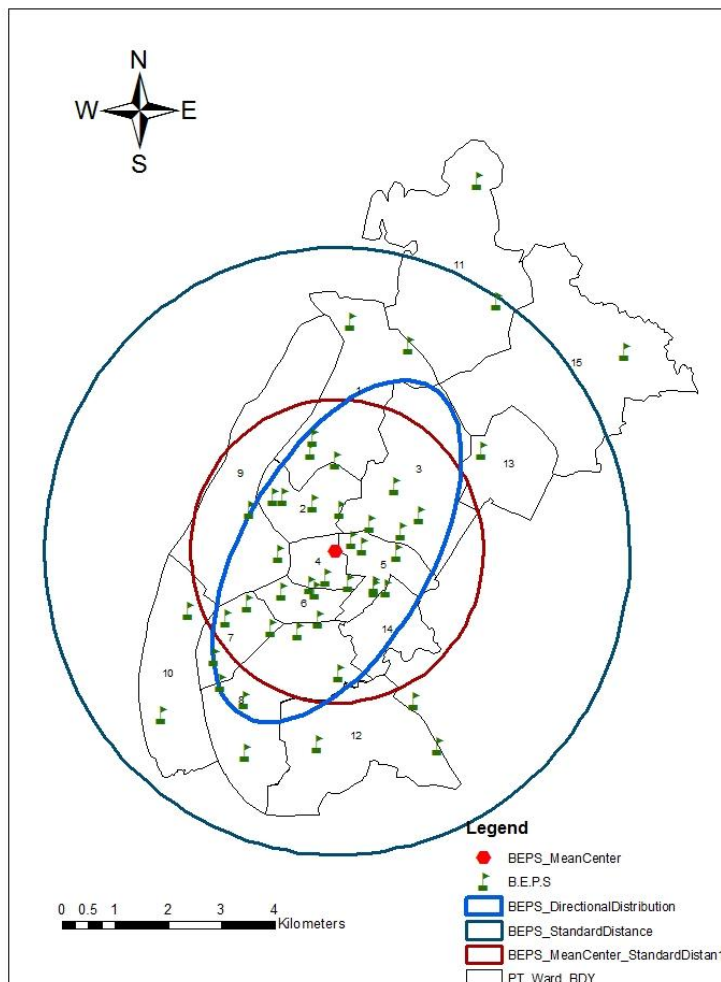
For statistical analysis, latitude and longitude coordinate points are calculate in Arc map table. In this paper, script languages in Arc Map GIS. 10.1 are used to solve the statistical analysis. Mean Center, Weighted Mean Center and Standard Distance are used for Standard Deviational Ellipse. A Mean Center gives the average location of a set of points. Weighted Mean Center provides a better description of the central tendency. Standard Distance indicates how points in distribution deviated from the Mean Center, and expressed in distance units.

The more disperse of a set of point is around a Mean Center, the longer the standard distance and larger the standard ellipse

In Map (4) Mean Center of Basic Education Primary Schools lie center of the town. Generally, the orientation of Basic Primary Education Schools are 'NNE' Direction. The standard distance of Basic Primary Education Schools are 2.75 kilometers from Mean Center to one Standard Deviation, and 5.51 kilometers from Mean Center to two Standard Deviation. On the other hand, Ward No.2,3,4,5,6 are included in within one Standard Deviation. These wards are densely populated wards in Pathein City. The 68percent of Primary schools are exist in these wards.

In Map (5) Mean Centers of Basic Education High Schools and Boarders lie center of the town. Generally, orientation of Basic Education High Schools are 'NNE' Direction and also Boarders are 'NNE' Direction. The most of Boarders exist near the Basic Education High Schools.

The trends of the Boarder deviational ellipse and Basic Education High Schools deviational ellipse are leading to same direction. Privates and Tuitions lie near the governmental schools. So, the distribution of non- governmental schools are found is near the governmental schools.



Figure(4). Mean Center ,Standard Distance and Deviational Ellipse of Primary Schools of Pathein City

Source : Based on Field Observation, December ,2015

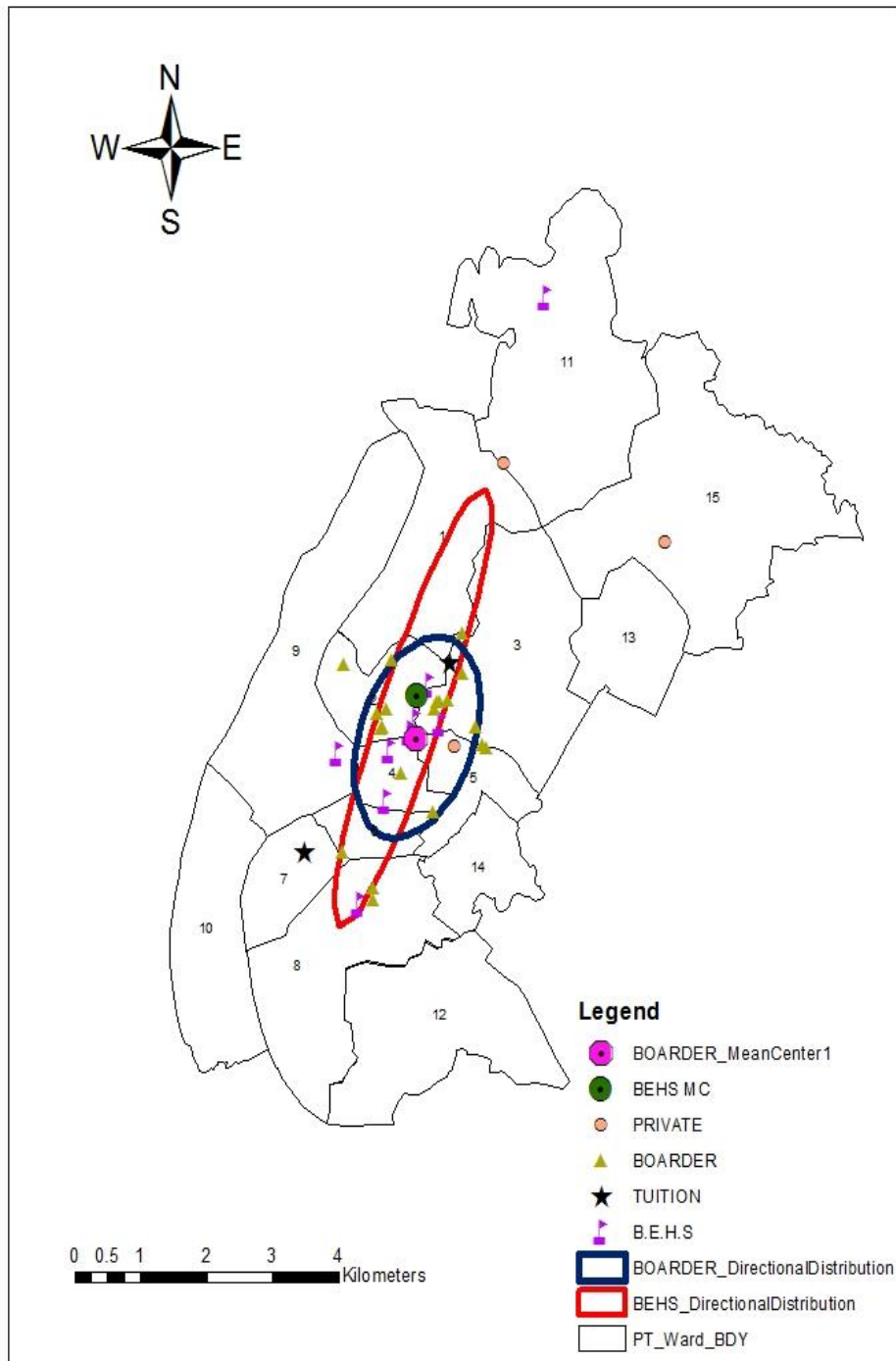


Figure (5). Mean Center, and Deviational Ellipse of Basic Education High Schools and Boarders of Pathein City

Source : Based on Field Observation, December ,2015

Findings and Suggestions

The basic education in Pathein City includes different basic levels schools, private schools, boarder schools , tuition services , pre - kindergarten schools and monastic schools. The government controlled basic education schools and private schools are more concentration in Ward No.2,3 and 4 , largely due to high population density , high accessibility and government policy , whereas the basic education schools are dispersed in peripheral areas of the city due to low population density and small number of students. However, there are no private schools in the central part of the city mainly on account of high land value and in availability of spacious land plot. On the other hand, boarder schools , are found mostly in Ward No. 3 and 4 where more basic education schools are located , probably to attract more students . The increasing number of boarder schools somehow helps improve the education standard of the city. The study area, has a few number of tuition classes , these are formally registered .All wards in the study area have at least one basic primary school. There are disparities in teacher - student ratios among the basic schools. More teachers should be appointed, particularly in the basic primary schools with unfavorable teacher - student ratio .

In the knowledge age, education plays the most important role in nation building tasks. Therefore, the government should provide such facilities as playgrounds, computers and computer rooms , laboratories and teaching staffs where it is deemed necessary .

There are plans to materialize 'education for all' at different levels from ward / tract to national levels. The success of the plan depends largely on the improvement in the basic education levels. 'Education for all' planning includes the following procedures.

- (a) Creation of school environment for school children to be qualified and happy
- (b) Child care service for infants to aged 5 years
- (c) Creation of extra - curriculum activity and uninterrupted education
- (d) Upgrading of education management and information

In Myanmar, education began at monastery since early Bagan Dynasty . Monasteries had been the seat of national schools in the pre - independent days. Literacy rate of Myanmar is high due to the presence of monastic education.

As the Pathein River separates the area of PatheinCity. The distribution of basic education schools are highly uneven. It is the effect of physical factors . Some students living on the western bank have to attend the schools located on the eastern bank . As they have to cross the river , their safety is very much uncertain . It would be convenient for all the residents , particularly students , if a bridge is constructed across the river straight to Maha Bandoola road .

Some basic education schools are located in the low-lying area of ward No.8, 9 and 10. These wards witness flooding every year in the rainy season .Therefore, schools should be placed at relatively higher and elevated sites. The students who have to attend the schools located by the river bank, main roads and rainy station are susceptible to accident, with the increasing number of vehicles .

There are only a few kindergarten schools in the study area, of which some are on the main road where a large number of vehicles are passing at high speed. Therefore, kindergarten schools should be placed at more safety places. Some kindergarten schools have no playground. The young school children should have a chance to play in spacious

playground. It would be better if the personal concerned can arrange ferry bus for the children.

To be able to upgrade the quality of teaching staff and the students concerned all basic education high schools should have separate rooms for computer aided instruction , audio system , video system , overhead projector ,reading corner and display media .

All the lessons for middle schools and high schools levels should be recorded with CD / DVD writers to be able to learn repeatedly.

By supplementing all the necessary facilities and teaching aids, if would be able to achieve all - around development in education and compulsory education for all the children at the basic primary level. The success of nation - building tasks depend largely on the quality of human resources which can be upgraded only through proper training in the basic education school levels.

Conclusion

. Pathein City lies on astride on the both banks of Pathein (Ngawun) River. They are adjoining with village tracts of the several area. But the greater part of the area lies on eastern banks. Most of the population is concentration in ward No.1, ward No.2, ward No.3, ward No.6 and ward No.7, due to the main business areas, services center and administrative offices, of the City, ward No. 4 with the highest population density, is located in the heart of the City and followed by ward No.6, ward No.2, ward No.7 and ward No.5. In 2014, ward No.1, 2, 3, 6, 7, 8, 11 are wards with total number more than 10000 people. Except ward No.15, the remaining wards have population between 4000 and 9000 persons. Ward No.15 has total population of 3085 persons, the lowest in population number. The total population of 138272 persons in Pathein City. The ward No. 15, is periphery of city is related with some village tracts. The number of students on the eastern bank of the urban area is much greater due to the presence of downtown, high accessibility and high population concentration. There are 13 out of 15 wards on the eastern bank, including ward No.1,2,3,4,5,6,7,8,11,12,13,14 and 15 of which ward No.3 has the largest number of basic education schools, followed by ward No.1,2,5 and 8, where ward No.14 has the least. Ward No.9 and 10 are located on the other side of Pathein river and have one high school, one middle school, and 4 Primary schools to which the students from the nearby areas attend for education pursuit. In this paper divided into two group , Governmental schools and Non-Governmental schools. Dictated by the high population concentration, more basic education schools are locating in the eastern part. Although it is put of the river valleys, the land is slightly undulating. The ward close to the bank usually witness flooding every year in July and August. As a result, the basic schools that occupy the low-lying and depressed area have to suspend classes for some days during floods. Usually 26 schools suffer from the negative effect of flooding and these are the schools located in ward No.1,2,3,5,6,7,8,9,10 and 12. As these schools are suspended for some days during flood the teachers have to take more time in teaching to catch up the lessons prescribed. Ward No.2,3 and 4 are located beside MahaBandoola road and No.1 and 3 BEHSs are on this road and No.2 BEHS on Zizawar road. Some students living on the west bank attend the schools locating on the east bank crossing the river by boats. Among the basic high schools, No.1,2 and 3 BEHSs are relatively most accessible with short distances between homes and the schools. The concentration of schools in the eastern part of the city is due to high population concentration, high accessibility with different modes of transportation, including car, three-wheel car and motorcycle and good road condition. By supplementing all the necessary facilities and teaching aids , if would be able to achieve all - around development in education and compulsory education for all the children at the basic primary level .

Acknowledgement

I wish to express my most grateful appreciation to Rector Dr. Nyunt Phay, Pro-Rector Dr. Wai Wai Nyunt and Pro-rector Dr. Mi Mi Gyi in Pathein University, Professor and head Dr. May Myat Thu, and Professor Dr. Mar Mar Khin ,Department of Geography , Pathein University for their kindness in giving me permission to do this research .I also thank to officers and staffs in Department of Basic Education, PatheinTownship, for giving useful information and data on my research.

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မြဝင်း (1999) : ပုသိမ်မြို့ပြကြီးထွားဖွံ့ဖြိုးလာခြင်း ပထဝီဝင် ဘာသာရပ်သင်ကြားခြင်း၊

စိန်ရတု စာတမ်းဖတ်ပွဲ၊ ရန်ကုန်တက္ကသိုလ်

ပညာရေးဝန်ကြီးဌာန : အခြေခံပညာရေးကဏ္ဍ/အမျိုးသားပညာရည်မြင့်မားရေး အထူးလေးနှစ် စီမံကိန်း
အကောင်အထည်ဖော်ဆောင်ရွက်မှုအစီရင်ခံစာ (ပညာရေးကော်လိပ်)

ပညာရေးဝန်ကြီးဌာန : အခြေခံပညာရေးကဏ္ဍ/ အမျိုးသားပညာရည်မြင့်မားရေး နှီးနှောဖလှယ်ပွဲ
သို့တင်ပြသည့်စာတမ်း(2003) (ပညာရေးကော်လိပ်)

ပညာရေးဝန်ကြီးဌာန: အခြေခံပညာရေးကဏ္ဍ/ပညာရေးမြှင့်တင်မှုအစီအစဉ် (တတိယအဆင့်) ဆွေးနွေးပွဲသို့
တင်ပြသည့်စာတမ်းများ (2000) (ပညာရေးကော်လိပ်)

Land Use Patterns of Selected Wards in Patheingyi City

Aung Swe¹ and Hnin Yu Khaing²

Abstract

This paper is the land use patterns of selected wards in Patheingyi City. The city has 15 wards of which 3 wards (Wards No.3, and 4 are located on the eastern bank and Ward No.9 on the western bank of the Patheingyi or Ngawun River) are selected for the detailed study. The objective of this paper is to assess the land utilization and land use patterns of selected wards in Patheingyi City. The data relating to the land use of the selected wards were acquired from field surveys conducted during the period from 15.10.2015 to 20.11.2015. In this paper, Average Nearest Neighbour Analysis has explained for the area pattern analysis such as clustered, random and dispersed patterns of distinct land use type of selected wards in Patheingyi City.

Key words: Patheingyi City, selected wards, land use types, clustered, random and dispersed patterns

Introduction

This paper is the “land use patterns of selected wards in Patheingyi City”. Patheingyi City has 15 wards and out of them, 3 wards (ward no. 3, 4 and 9) are selected for the detailed study. Ward No. 3 is located on Patheingyi-Yangon Highway and adjoined with Ward No.4 which is the economic hub of the city. Ward No.4 is located on the main road and adjoined with waterway with ports and is an economically well-developed area. Ward No.9 is located on the western bank of Ngawun River and accessible toward the west by Patheingyi-Chaungtha, Patheingyi-Ngwesaung, and Patheingyi-Talakwa main roads. It has a mixed morphology between urban and rural characteristics as shown in figure 1(a) and 1(b).

Objectives

The objective of this paper is to assess the land utilization and land use patterns of selected wards in Patheingyi City.

Land Use Types of Selected Wards in Patheingyi City

Land Use Types of Ward No.3

Types of Residential Land Use

Ward No.3 has 1578 houses including rick, semi-brick, wooden, bamboo and dhani houses. Brick houses range between one-story and six-story, comprising 227 one-story houses, 373 two-story houses, 10 three-story houses, 7 four-story houses, 2 five-story houses and only one six-story house. The ward has 10 one-story semi-brick houses and 189 two-story semi-brick houses. Brick and semi-brick houses are mostly found on Maha Bandoola, Zayattan, Koosukyaung, Hnithyathitsa, Tarwathinta, Sagawa, Obotan, Aungmyitha, AungZaya and Theindawgyi roads. Wooden houses are most common in this ward having one or two-story houses. There are 71 bamboo houses, 3 wood-bamboo houses and 15 dhani hats which are located mostly on Tawakyaung road Bokanaung road, Koothin eastward, Kantharyar ward, and Myainghaymar ward.

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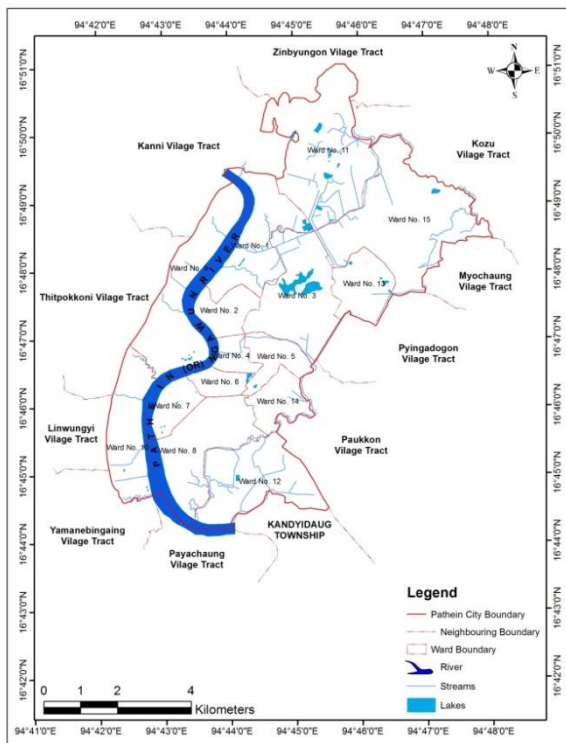


Figure 1(a) Location of Pathein City and fifteen wards
Source: Land Record Department, Pathein

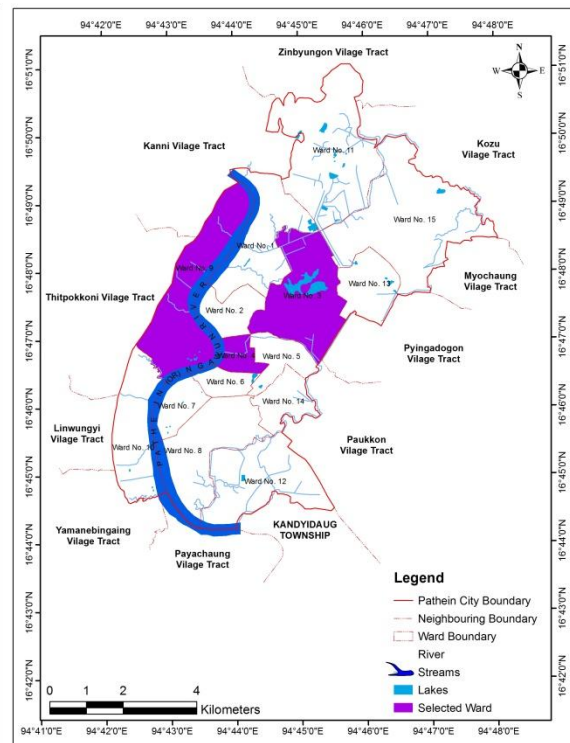


Figure 1(b) Location of Pathein City and three selected wards
Source: Land Record Department, Pathein

Types of Industrial Land Use

Industrial Land use in Ward No.3 includes rice mill, saw mill, furniture mart, printing and home industries. A rice mill is located on Tetseik road and a saw-mill on Mindon road. Furniture making industry is found on Obotan road and printing on Maha-Bandoola road. The ward also has 7 Patheinunbralla producing houses, one coconut-husk rope industry and one medals making industry which are located on Tawyakyaung, Minyattan, Thayetpin maunghnama and Koosukyaung road.

Types of Commerical Land Use

There are two markets, one is located beside Shinpinphonepwint and Theindawgyi road and another is Amyothameekone Market. A number of houses are those ground floor for commercial purpose. These are 150 shops in road Ward No. 3, mostly selling dry goods and personal use goods located on Shinpinphonepwint, Sagawa, Kanthaya, and Yoodayarkone road, and a few or other road. Food stall, are most common which number 120, selling rice, noodle, tea, cold drink. The majority are located in Anawrahta, Shinpinphonepwint, Sagawar, Kanpat and Theindawgyi road. Others are hardware shops and shops catering for other goods. Hardwares include building materials, farm implements, vehicle and parts and others. The ward has 11 hardware shops. There are 38 shops catering other goods including clothing, household goods, electrical goods, medicine, jewelries and others in Ward No.3.

Types of Land Used for Services

The area of land occupied by services activity is largest among different types. Services include financial institutions (banks, insurance), professional service, skilled services, repairs, shops clearing for lending services and lodgings. The Ward has 7 financial institutions located on MahaBandoola and Shinpinphonepwint roads. Professional services include medical professional services and training schools, located mostly on Sagawa, Tarwateintha, and MahaBandoola roads. The ward has 64 skilled services and 19 repairs. Skilled services include beauty parlour, photo studio and tailoring shops and repairs include mostly bicycle and cycle repairs. These services activities are located mostly on Anawrahta, Kanthaya, Sagawa, Shinpinphonepwint road and a few or other roads. Lodging services are the most important and the ward has 81 lodging services, located mostly on Tawyakyang, Anawrahta, Kantharyar, Kanpat and Maha Bandoola roads. Day nursery is found on Tadagyi road.

Types of Land Used for Public and Government Departments

The ward has 11 government departments located on MahaBandoola, Offices Avenue, Gangawtaw and Theindawgyi roads. Police station is on Theindawgyi road. There are 9 schools, 39 religious institutions, one home for the aged and one cemetery. Home for aged is located near Sattawyar Pagoda and cemetery on Thayetpinmaunghnama.

Types of Recreational Land Use

Ward No.3 has 3 recreational sites and these are golf club, Kantharyar Park and Maha Bandoola Park. Kantharyar Park is well known for public recreation and it is located near Pathein University. Golf club is in Maha Bandoola road near Pathein Hotel.

Land Use Types of Ward No.4

Types of Residential Land Use

Ward No.4 is located on the eastern bank of the Ngwun River and it has 458 residential units. The ward has only 6 bamboo houses and 3 dhani huts.

Types of Industrial Land Use

The Ward has several types of home industries including that related to producing candles, furniture and printed materials, located respectively on Bali, Bo Ba Htay, Shwezayti, Mingyi and TagaungPagda roads.

Types of Commerical Land Use

The ward has two markets-Myoma Market and Shwepyitha Market located close to the bank of Ngawun River. Selling activities are mostly carried at the ground floor of the houses. There are 163 miscellaneous shops, 82 food stalls, 69 hardware shops and 213 shops catering for a variety of goods including firm clothing to lottery ticket. All roads in the ward have more or less commercial activities.

Types of Land Used for Services

Ward No.4 has 17 financial institution, 25 professional services, 84 skilled services, 17 repairs, 3 shops catering for lending services, 17 lodging services and 6 other services. Financial institution are mostly located on Konsone, Zaychaung, Shwezayti and Ohmardanti roads, professional services on Mingalar, Htaungkone, Mingyi and Konthe roads, skilled services on Konthe, Mingalar and Mingyi, Htaunggone, and other roads, and lodging services and others on Mingyi, Konthe, MahaBandoola, Zaychaung, Aungyatanar and Htaungkone roads.

Types of Land Used for Public Government Department

This type of land use in the ward includes one telegraph and post-office, one military area, one police station, one fire station, 25 government department, 20 religious institution and home for aged. Telegraph and post-office is located on Maha-Bandoola road, police station on Kanna road, government departments on Konthe, Maha Bandoola, Shwezayti, Kannar and Myaynu roads, schools, museum and library on Konthe, Maha Bandoola, Tagaung pagoda and Ohmardanti road, religious institution on Kanna, Ohmardanti, Konthe, Bali, local health center and home for the aged on Maha Bandoola and Mingyi roads.

Land Use Types of Ward No.9

Types of Residential Land Use

Ward No.9 occupies part of the western bank of Ngawun River, having 1620 house unit of which majority are made of wood, followed by bamboo-dhani houses with a few brick and semi-brick building. There are 903 wooden houses, 370 bamboo- dhani houses, 28 brick house and 35 wood- brick houses are scattering along the main road, while bamboo-dhani and wood-bamboo are found mostly in Bogyokekwethit, on Kalarsu road, and in Yekyaw extension and Myawady extension.

Types of Land Used for Primary Production

Ward No.9 is relatively less developed and it still has land for primary production. Particularly for the production of paddy, garden crops and chicken raising. Gardening and brick-baking activities are found on Kalarsu main road, pig raising on Ohntaw road and chicken raising on Bogyokekwethit.

Types of Industrial Land Use

Ward No.9 has rice mill, saw mill, salt mill, ice factory and other types of home industries including production of stove, rope and cheroots. There are 3 rice mills, 3 saw mill, one salt mill and one ice factory, 5 stove producer, 7 cheroot rolling and 3 rope producers. Rice mill and ice factory take place on the river bank and Bogone main roads, rice mill at Htinponseik. Stoves are produced on Myawady and Kokkotan roads, rope on Kalarsu road and cheroots on Htantaw and Thuhtaykwethit roads.

Types of Commercial Land Use

Ward No.9 has two markets. These are 90 shops, 24 food stalls, 6 hardware shops and 21 shops catering others goods. Daily-use goods and personal-use goods are mostly on main roads, food stalls on Seinyatanar and Kwintan roads, other goods shops on Seinyatanar, Kankone and Shwehninsi roads.

Types of Land Used for Services

Services in Ward No.9 are that related to banks and pawn-shops, located on the other side of No.8 BEHS. The ward has 4 professional services, 13 skilled services, 15 repairs, 2 shops catering for lending and 2 other services. Professional services are found on Seinyatanar road, Bogone main road and Shwemyinmo road, whereas skilled services shops take place mostly on Kwintan, Bogone, Shwehninsi and Seinyatanar roads, repairs services on the same roads.

Types of Land Used for Public and Government Departments

Concerning this type of land use, Ward No.9 has one post-office, one military and police station each, 3 other government department, 5 schools, one library, 9 religious institution and one cemetery. Post-office, military area and police station are located on

Kwintan road, other government departments on Seinyatanar road, School on Seinyatanar. Academy, Yekyaw, Kalarsu and Htinponeseik roads, library in front of No.8 BEHS, religious institutions on Kwintan, Bogone, Kangone, Ohndaw, Kalarsu, and Htinponeseik roads and cemetery on Kalarsu road.

Occupied Areas of Land by Different Land Use Types

Occupied area of Land Use in Ward No.3

Ward No.3 has an area of 7.2 sq km, of which 1.29 sq km(17.92%) are occupied by residential land use, 1.71 sq km(23.75%) by land use for primary production, 0.01 sq km (0.14%) by industrial land use, 0.07sqkm(0.97%) by commercial land use, 0.08 sq km(1.11%) by land used for services, 2.17 sq km(30.14%) by land used for public and government department, 1.52 sq km(21.11%) by recreational land use, 0.32 sq km(4.44%) by transportation land use, and 0.08 sq km(0.42%) by unused land. In Ward No.3 residential land use shares 17.98 % of the ward area and land used for public and government department 30.14% and thus these two types are the most dominant in terms of area. Some plots of lands are used for primary production and the ward also has a small area of unused land which is not found in Ward No.4. (Table 1 and Figure 2)

Occupied area of Land Use in Ward No.4

There are 7 types of land use in Ward No.4 of which residential land and occupies the largest area with 0.27 sq km which account for(33.75%) of the ward area, followed by land use for public and government department with 0.25 sq km(31.25%). Commercial land uses 0.15 sq km (12.5%). Industrial land use for occupies 0.01 sq km (1.25%), recreational land use 0.01 sq km (1.25%), land use for services 0.02 sq km(2.5%) and transportation land use 0.14 sq km (17.5%). Ward No. 4 has no unused land. (Table 2 and Figure 3)

Table 1 Occupied Area of Land Use in Ward No.3

No.	Land Use Types	Area	Percentage
1	Residential Land Use	1.29	17.92
2	Land Used for Primary Production	1.71	23.75
3	Industrial Land Use	0.01	0.14
4	Commercial Land Use	0.07	0.97
5	Land Used for Services	0.08	1.11
6	Land Used for Public and Government Department	2.17	30.14
7	Recreational Land Use	1.52	21.11
8	Transportation Land Use	0.32	4.44
9	Unused land	0.03	0.42
	Total	7.2	100.00

Table 2 Occupied Area of Land Use in Ward No.4

No	Land Use Types	Area	Percentage
1	Residential Land Use	0.27	33.75
2	Industrial Land Use	0.01	1.25
3	Commercial Land Use	0.1	12.5
4	Land Used for Services	0.02	2.5
5	Land Used for Public and Government Department	0.25	31.25
6	Recreational Land Use	0.01	1.25
7	Transportation Land Use	0.14	17.5
	Total	0.8	100

Occupied area of Land Use in Ward No.9

The area of Ward No.9 is 6.7 sq km, the second largest among the three wards. The area occupied by land use for primary production tops the list with 3.40 sq km, representing 50.75% of the ward area.

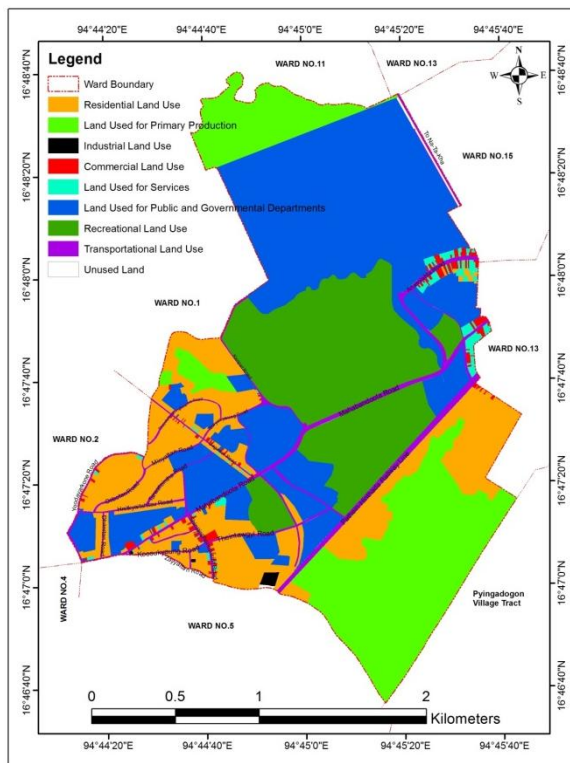


Figure 2 Occupied Area of Urban Land Use in Ward No.3

Source: Field Survey

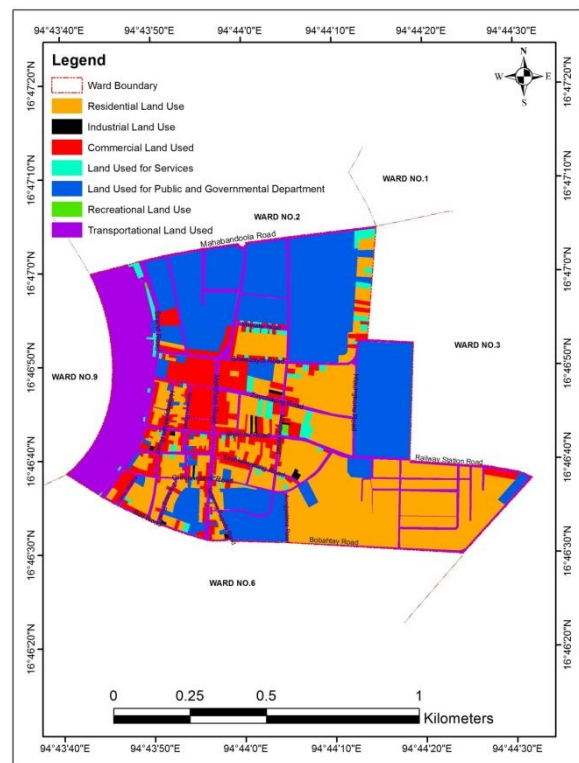


Figure 3 Occupied Area of Urban Land Use in Ward No.4

Source: Field Survey

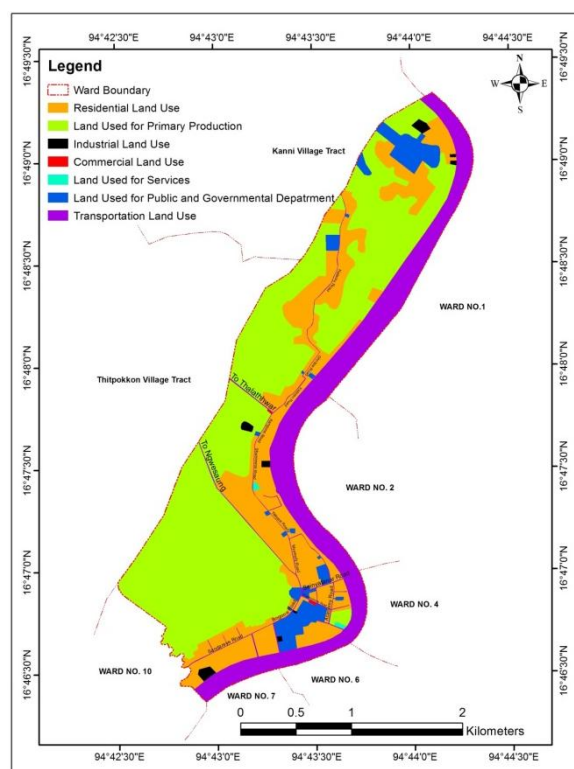


Figure 4 Occupied Area of Urban Land Use in Ward No.9

Source: Field Survey

The land area used by transportation land use is also large, compared with that of Ward No.3 and 4. In Ward No.9, there is no unused land and recreational land. Residential land use by occupies 1.56 sq km (23.28%), industrial land use 0.06 sq km(0.9%),commercial land use 0.01 sq km (0.15%)and land used for public and government departments 0.34 sq km (5.07%). (Table 3 and Figure 4)

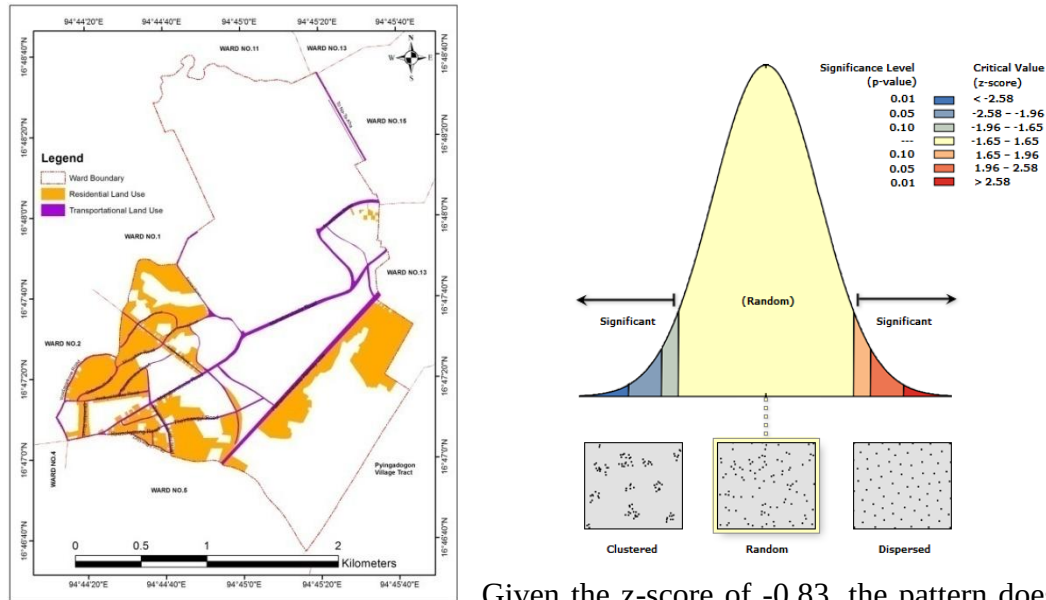
Table 3Occupied Area of Land Use in Ward No.9

No.	Land Use Types	Area	Percentage
1	Residential Land Use	1.56	23.28
2	Land Used for Primary Production	3.4	50.75
3	Industrial Land Use	0.06	0.9
4	Commercial Land Use	0.01	0.15
5	Land Used for Services	0.02	0.3
6	Land Used for Public and Government Department	0.34	5.07
7	Transportation land Use	1.31	19.55
	Total	6.7	100

Area Pattern Analysis of Selected Wards in Pathein City

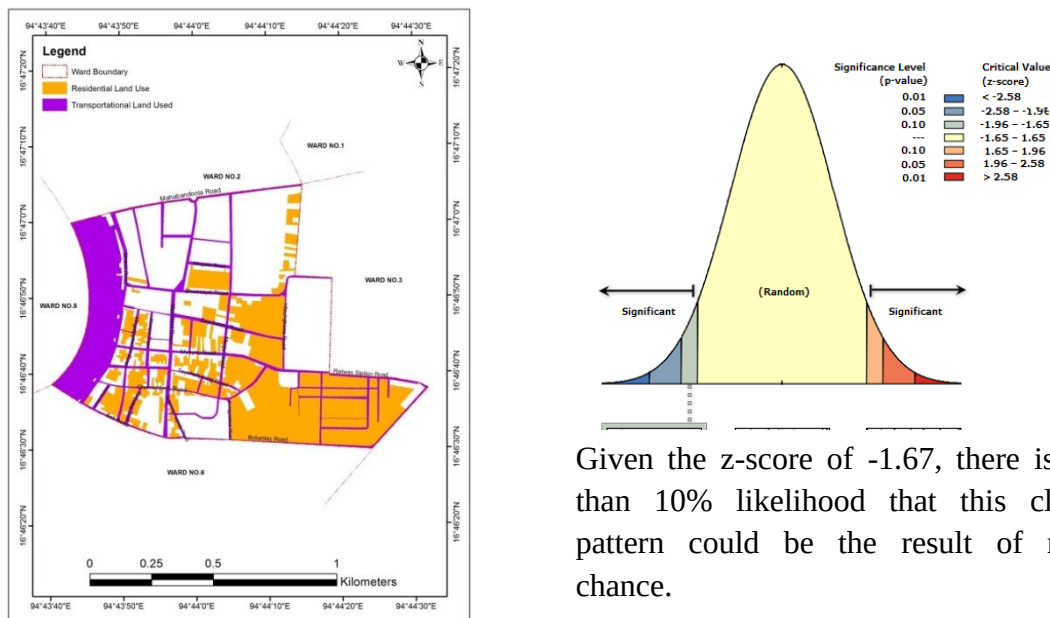
Area Pattern of Residential Land Use in Selected Wards

Area patterns of residential land use, commercial land use, and land used for public and government department are worked out by Average Nearest Neighbour Analysis. Based on the result, residential land use in Ward No.3 has random pattern, Ward No.4 clustered pattern and Ward No.9 random pattern as shown in Figure 5 (a), 5 (b) and 5 (c).



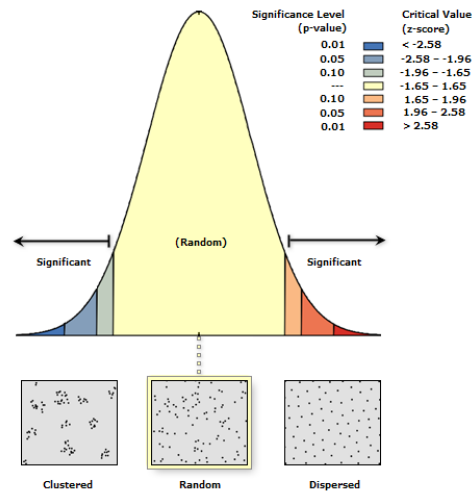
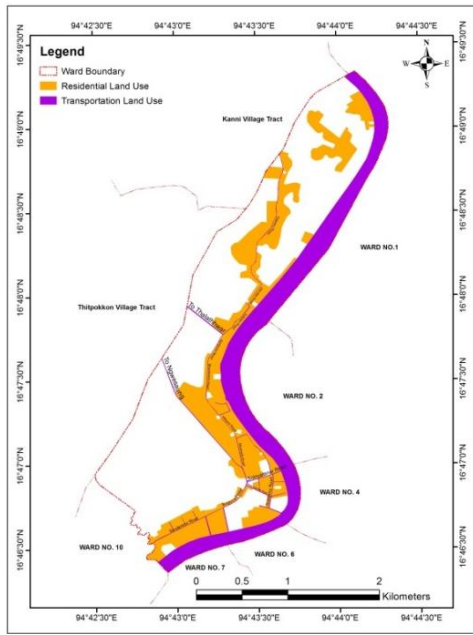
Given the z-score of -0.83, the pattern does not appear to be significantly different than random.

Figure 5 (a) Average NearestNeighbour Analysis of Residential Land Use Area in Ward No.3
Source: Based on Figure 2



Given the z-score of -1.67, there is a less than 10% likelihood that this clustered pattern could be the result of random chance.

Figure 5 (b) Average NearestNeighbour Analysis of Residential Land Use Area in Ward No.4
Source: Based on Figure 3

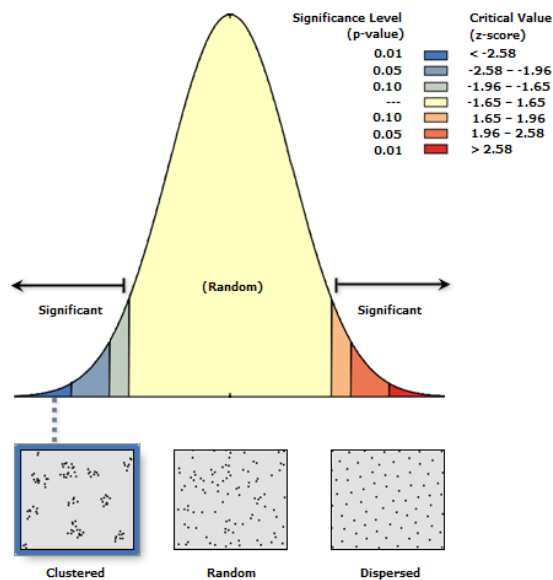
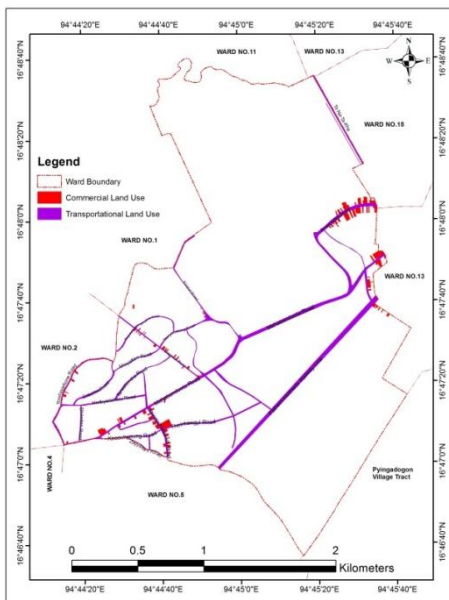


Given the z-score of 0.92, the pattern does not appear to be significantly different than random.

Figure 5 (c) Average NearestNeighbour Analysis of Residential Land Use Area in Ward No.9
Source: Based on Figure 4

Area Pattern of Commercial Land Use in Selected Wards

The pattern of commercial land use is clustered in Ward No.3 and 4, but dispersed in Ward No.9 as shown in Figure 6 (a), 6 (b) and 6 (c).



Given the z-score of -16.41, there is a less than 1% likelihood that this clustered pattern could

Figure 6 (a) Average NearestNeighbour Analysis of Commercial Land Use Area in Ward No.3
Source: Based on Figure 2

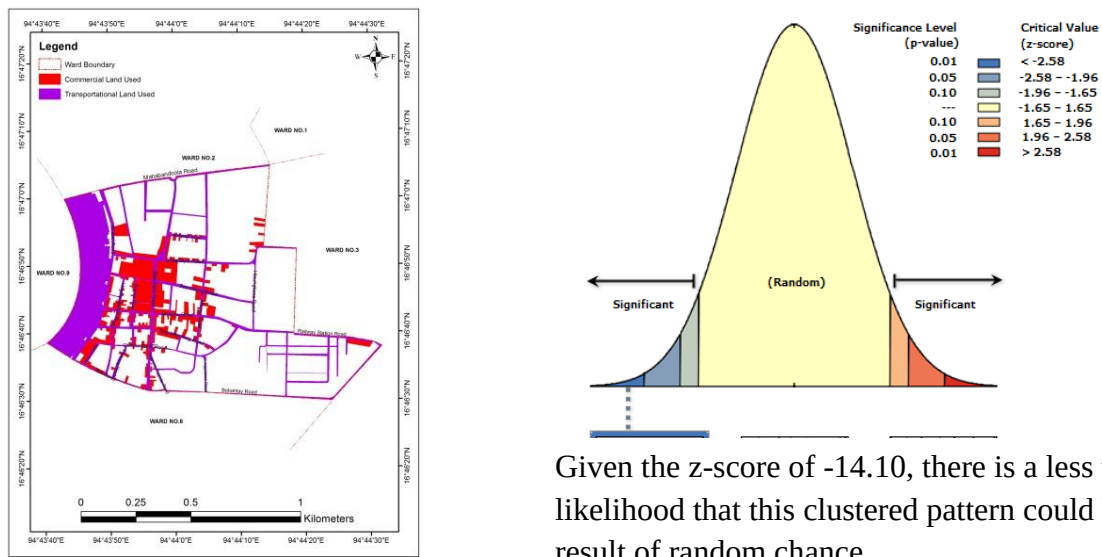


Figure 6 (b) Average NearestNeighbour Analysis of Commercial Land Use Area in Ward No.4
Source: Based on Figure 3

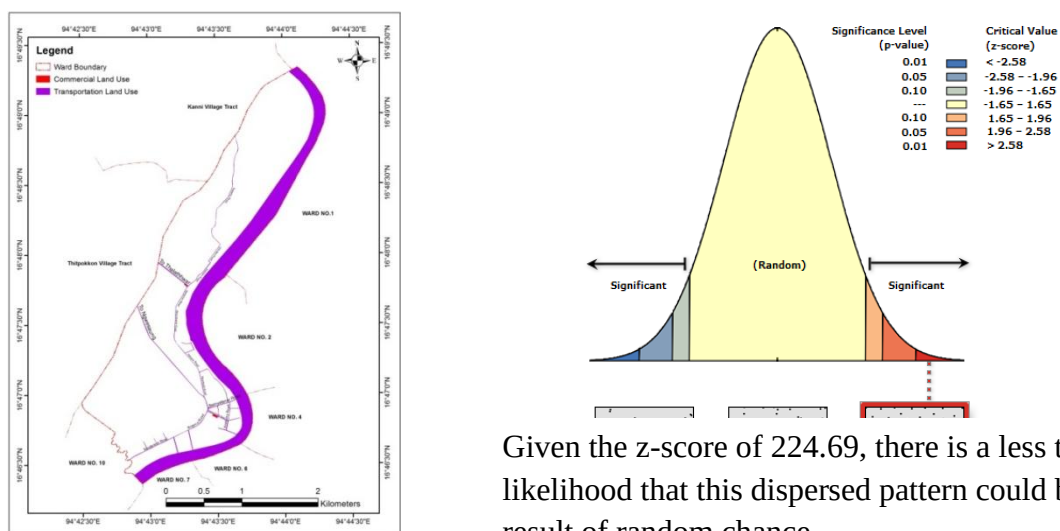
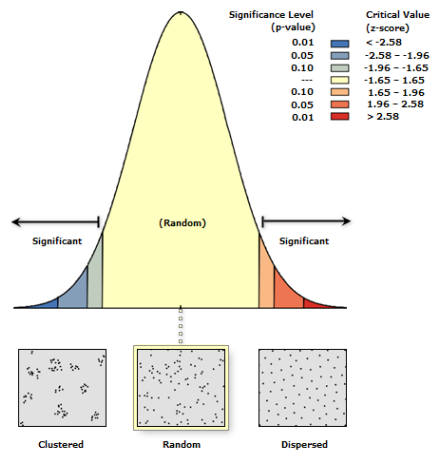
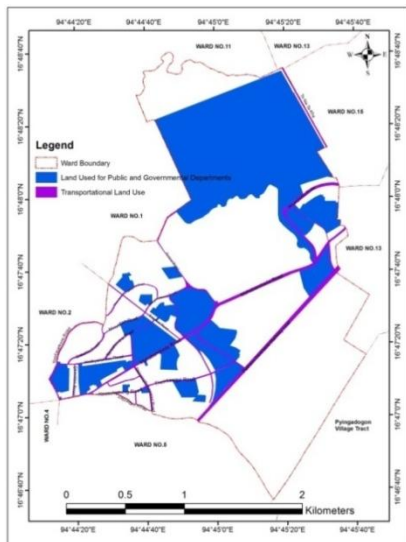


Figure 6 (c) Average Nearest Neighbour Analysis of Commercial Land Use Area in Ward No.9
Source: Based on Figure 4

Area Pattern of Land Used for Public and Government Department in Selected Wards

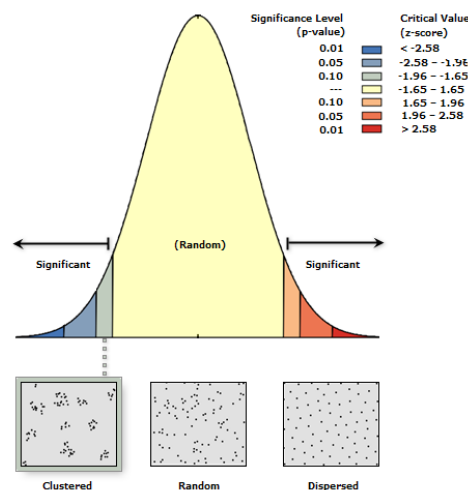
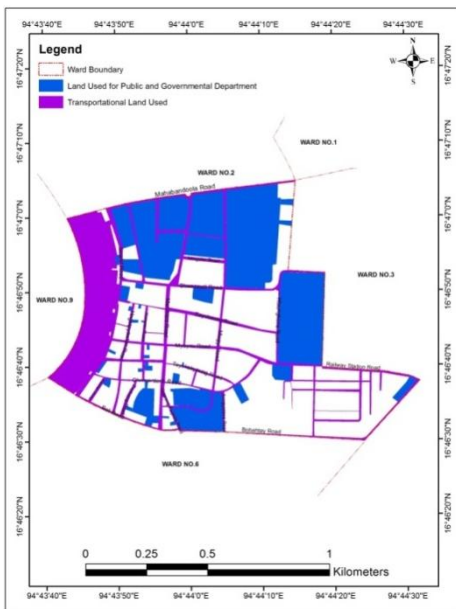
As regard with land use for public and government department, the area pattern is random in Ward No.3, dispersed in Ward No.4 and clustered in Ward No.9 as shown in Figure 7 (a), 7 (b) and 7 (c).



Given the z-score of 0.83, the pattern does not appear to be significantly different than random.

Figure 7(a) Average NearestNeighbour Analysis of Land Used for Public and Government Department Area in Ward No.3

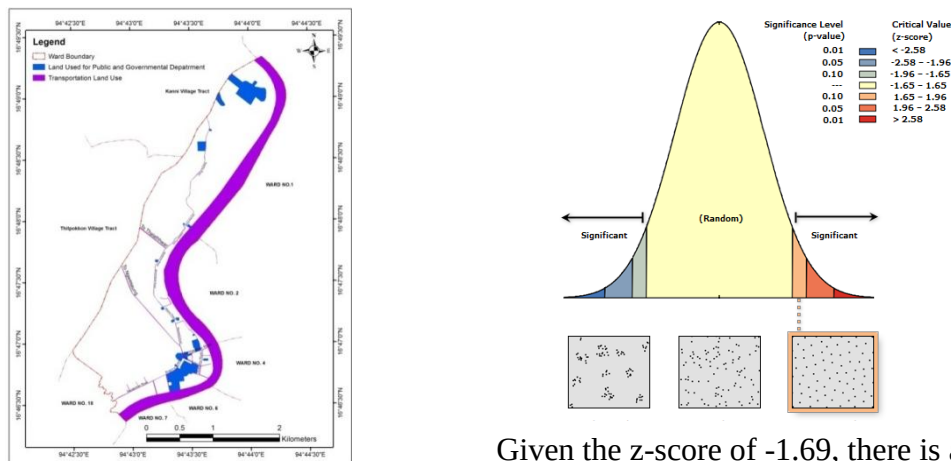
Source: Based on Figure 2



Given the z-score of 1.68, there is a less than 10% likelihood that this dispersed pattern could be the result of random chance.

Figure 7 (b) Average NearestNeighbour Analysis of Land Used for Public and Government Department Area in Ward No.4

Source: Based on Figure 3



Given the z-score of -1.69, there is a less than 10% likelihood that this clustered pattern could be the result of random chance.

Figure 7 (c) Average NearestNeighbour Analysis of Land Used for Public and Government Department Area in Ward No.9

Source: Based on Figure 4

Conclusion

Pathein is the capital city of Ayeyarwady Region and located in the southwestern part of the Region. It is about 120 miles from Yangon and 75 miles from the sea. Pathein is the third largest port-city of Myanmar. It comprises 15 wards of which selected Wards No.3, and 4 are located on the eastern bank and Ward No.9 on the western bank of the Pathein or Ngawun River. For comparison, Ward No.3,4 and 9 are selected. Area patterns of residential land use, commercial land use, and land used for public and government department are worked out by Average Nearest Neighbour Analysis. Based on the result, residential land use in Ward No.3 has random pattern, Ward No.4 clustered pattern and Ward No.9 random pattern. The pattern of commercial land use is clustered in Ward No.3 and 4, but dispersed in Ward No.9. As regard with land used for public and government department, the area pattern is random in Ward No.3, dispersed in Ward No.4 and clustered in Ward No.9.

Acknowledgement

I would like to express thanks to Ma Hnin Yu Khaing, Master Student, Geography Specialization, Pathein University for her detail field data collection.

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An Artistic Evaluation of Myanmar Lacquerware

Ah Mar¹

Abstract

Lacquerware making is one of the Ten Myanmar Traditional Arts which have long been existing in the country. It is called in Myanmar "**Pan Yan**". There are isolated references to the lacquerware in ancient epigraphs. In the lithic inscription of Pawdawmu pagoda and also that of Shinpin Bodhi pagoda at Bagan there are mentions of alms- bowls dedicated to monks. Alms bowls are made of mostly lacquer, bamboo and wood. In the Tayar chin song of minister Padethayeza of the Nyanung Yan period of Myanmar history, during the reign of king Anaukphetlun, the envoys from the Mughul Emperor Akkbar and those from the Maha Rujah of Achin came to his court and in the receptions accorded to them the pickled tea was served on a fine lacquered kalat and the credential letters were placed on an exquisitely gift lacquered kalat. In the list of royal gifts sent with diplomatic missions dispatched missions dispatched to the rulers of neighbouring countries of priority. Lacquer is considered a minor art in most countries but for the last three-centuries lacquerwares were found to be articles in has been one of the show industries of Burma. The Burmese kings often presented gifts of silk precious stones, and lacquerware to foreign envoys. There are, however, many more epigraphic and historical evidence of Myanmar lacquerware we can glean from old records.

Keyword: Traditional Culture , Lacquerware

Introduction

Lacquerware itself is a name with loose meaning. Any article or object covered with a hard bright and smooth varnish called lacquer which is a vegetable product is called lacquerware, because this varnish can be applied to plain or carved surface of paper, bamboo, wood brick, terracotta, stone, fibric, even metal. Recently we have produced glazed objects covered with lacquer. This extremely adhesive quality of lacquer varnish with lacquer varnish with a gloss sheen makes it a general term for coloured and frequently opaque varnishes applied to all materials including metal. In Myanmar, there are two types of lac the resin lac or lacquer which is thitsi or the sap of a thitsi tree which is native to South East Asia, and the shellac, a much demanded forest product of Myanmar in the 15th to 17th century foreign-market. Shellac or cheik in Myanmar is the gummy deposit of an insect which Myanmar forest Department today culturing for export. It is the resin lac or lacquer (thitsi) and not shellac (cheik) which is used in the making of lacquerware in Myanmar. The tree from which lacquer is tapped in China and Japan is a different species *Rhus vernicifera*. It is cultivated in Japan. In western countries, lacquerware is sometimes called Japanned ware and the process of applying the lacquer to articles of wood is known as Japanning.

Artistic evaluation of Myanmar Lacquerware

To evaluate the art of Myanmar Lacquerware both traditional and modern, one needs to take an excursion to museums, temples, monasteries shops and centers of this craft and examine lacquer objects by oneself it will only be a sketch to write an aesthetic assessment in a research paper. I may briefly describe the 6 different types of Myanmar lacquerware as follows:

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- **Plain lacquerware (kyauk Ka ware)**
- **Incised lacquerware (Yun ware)**
- **Gilt lacquerware (Shwezawa ware)**
- **Relief moulded lacquerware (Tha - yo)**
- **Glass Mosaic and gilt lacquerware (Hmansi Shwecha) and**
- **Dry lacquerware (Man or Manpaya)**



Plain lacquerware (kyauk Ka ware)

Plain lacquerware or Kyauk Ka ware is an indigenous product made of either bamboo , or wood , or both for the framework and thitsi (resin) which is Myanmar native lacquer from a Thitsi tree for coating and painted with black and red colours produced from natural materials. Such kind of lacquerware is found at the houses of village folks , monasteries and shrines in remote areas. Common objects of such kind are domestic utensils- trays, goblets, cups, rice receptacles, boxes, circular tablets, betel boxes, containers for pickled tea, medicine, and tobacco or cheroots, pillows, votive objects and monastic utensils such as flower vases, pots, fans, containers for offertories, chests to store sacred books, spittoons etc. These objects are made either by craftsmen or by amateurs in the villages. Those made by the amateurs are valued as Myanmar folk art objects. They are collectors' hot item. Plain Lacquerwares are noted for their lightness, utility, durability, artistic simplicity and genuine tradition.

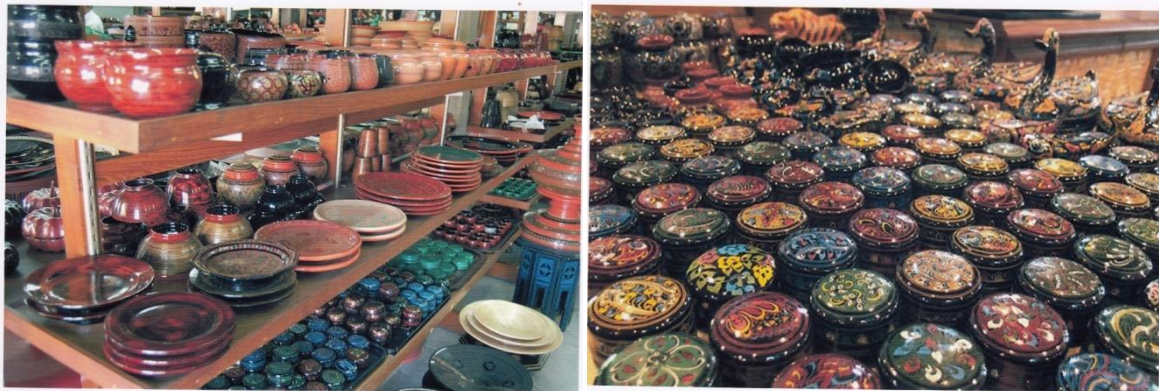
Incised lacquerware (Yun ware)

Incised Lacquerware is Yunware. The framework is made of the same materials as in plain lacquerware. But bamboo strips are fine and are oven or coiled to form the frame. The design and decoration are sophisticated and exquisite. The Yun technique is more advanced. With a fine iron style , decorative motifs or designs are incised on the surface of the object and the incised areas are filled with pigments. Colours are red, yellow, orange, blue , green, white and black. The lacquerwares of this type are mostly meant for ornamental, decorative and votive purposes. Folding screens and folding tables, chests, flower pots, caskets for sacred relics, plaques to decorate, plates for inscribing scripture, napkin rings, bangles, and several souvenir pieces.

Gilt lacquerware (Shwezawa ware)

Gilt lacquerware is called Shwezawa . The designs or figures are incised on the surface of the object coated many times with black or red lacquer. Gold foils are applied to the incised areas. The result is extremely regal and beautiful. In the days of Myanmar Kings,

Shwezawa wares were exclusively for religions and royal use. Today Shwezawa is most costly lacquerware because of the ever soaring price of gold. Some old temples and monasteries in the Shan State have their walls and ceiling covered with panels of Shwezawa work.



Relief moulded lacquerware (Tha - yo)

Relief moulded lacquerware is called Tha-yo. Tha-yo means animal bone. A fine sticky plaster is concocted out of ashes of animal bones, paddy husks, and sawdust of teakwood. This pliable plaster (Tha-yo) mixed with lacquer is folded into long threads of required thickness. By means of an iron or wooden stylus these threads are stuck on a smoothed lacquercoated surface of the object to form a relief design which is already sketched on the surface. But experienced craftsmen can create any design or figure freehand. When the Tha-yos dry up and stick firmly on the surface, many coatings with lacquer are done on them. After colouring or gilding the whole Thayo object looks like a finely carved piece. Mandalay, Kyauk Ka, and Leigya in the Southern Shan State are the centres for this craft.

Glass Mosaic and gilt lacquerware (Hmansi Shwecha)

Glass mosaic and gilt lacquerware is called Hman-si Shwe-Cha Yun. Pieces of mirror or coloured glass are cut into different geometrical shapes. They are inlaid on the surface of the Thayo lacquerware by using special lacquer as adhesive. After gilding the whole surface, it is washed with water so that gold foils on the glasses are cleaned off while those on the Thayo remain stuck up. This type of lacquerware is much more costly than the Shwezawa lacquerware not only because of gold and glasses but also of the skill and amount of labour involved. Many fine pieces of this type are found as couches, chests, betel boxes, caskets, containers, covers of folding manuscript and palm leaf manuscript.

Dry lacquerware (Man or Manpaya)

Dry lacquerware is called Man or Manphaya because most dry lacquer works are Buddha images. Man means to cover with a pasty substance. Manphaya is a lacquered wickerwork image of Buddha. Well kneaded clay is shaped into a rough form of an image. A plaster of straw ash and water is smeared over the clay image. A piece of cloth, usually the monk's robe, or scarf of turban of the aged in the family is soaked in lacquer and wound over the lacquer smeared clay image. A Thayo plaster is applied over it up to a thickness of half an inch or more. Details of the image are executed with an iron implement called Than-let. When the image is dried and hardened the clay is removed by washing and cutting. The opening is sealed by lacquer. More coating of the image with lacquer mixed with a paste of straw ash follows. When the image is hardened it undergoes finishing touches- smoothening,

rewashing, polishing and varnishing. Then any kind of decoration or ornamentation can be executed on it, painting, gilding, or glass mosaic and gilding. Since Man images are hollow they are light. Some Man images have wooden or bamboo wicker as framework. The largest Man Buddha image in a seating posture is at Sale town. It measures about 20 feet high. It has a bamboo wicker frame, hollow and so light that one person can lift it. Another one with a bamboo framework is found in the Dharmmayone in downtown Taung Gyi in Southern Shan State. In some Man images in the Eastern Shan State, Maing Kaing paper instead of cloth, soaked in lacquer is used for covering the framework.

Decoration and Ornamentation of Lacquerware

Design and motif used in Myanmar Lacquerwares form a subject by itself which art historians or art connoisseur are better qualified to assess.

Publically speaking they do not differ much from those used in other Myanmar art forms such as fresco, sculpture, carving etc. Designs are geometrical, achiik or wavy pattern, floral, scroll or arabesque.



Four main basic styles of Myanmar traditional drawing are applied in lacquerware decoration. They are:

- Kanou' (2) Kapi (3) Gaza and (4) Na-ri. All are Pali words.
- Kanou' is the traditional art style of depicting convoluted lotus stems, buds, blossoms, or scroll work with floral motif, or floral arabesque. Any beautiful floral drawing or intricate design can be called Kanou.
- Kapi is the traditional art style of depicting apes, monkeys and the life, and action and movement depicted can be called kapi.
- Gaza is the traditional art style of depicting elephant, horses, cattle or any massive objects such as mountain, rock, tree trunk.

- Na-ri is the traditional art style of depicting the female figure or all human figures.

No perspective is applicable in Myanmar ancient art. The required effect achieved by lines and colours. The artist has freehand to express his concept⁶.

Motifs are lotus, orchid, mythical animals, demons and devas. Symbols of nine planets and twelve signs of Zodiac are the artists favorite. Scenes and episodes from Jatakas stories, wellknown folk tales and fables. Pagoda legends and Nat (spirit) stories are depicted in panels. Enough Space is left on the object for inscribing the artist's name and the date or for any letter the buyer may wish to have it inscribed.

Conclusion

I have given you a brief outline of Myanmar lacquerware in historical and cultural perspectives. As to the origin of lacquerware art and how and where it spreads to they are the questions that will never be answered satisfactorily. We should therefore leave them in the domain of research and let scholars go on with their academic discussion. But we should bear in mind that culture knows no frontier. No culture is absolutely isolated. Despite natural or artificial barriers between nations, there goes on a continuous process of reciprocal cultural flows between nations since times immemorial. History has proved us that this process has brought about identical forms and experience of a culture in more than one country. That is why we find in some aspects of one country's culture similarities with those of another, especially neighbouring country.

Acknowledgements

I would like to express my deep gratitude to Dr. Nyunt Phay, Rector, University of Pathein and Dr. Wai Wai Nyunt and Dr. Mi Mi Gyi, Pro-Rectors of Pathein University, for allowing me to do this research paper. I am also grateful to Professor Dr. Khin Aye Aye Soe, Head of Department of History, Pathein University for her encouragement and suggestion. I am also indebted to the editors of the Pathein University research journal for their assessment and understanding on academic publication.

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Safety of Navigation on Ayeyarwaddy River

Nge Nge Aung¹

Abstract

Before the British annexation, Myanmar was poorly endowed with roads. Bullock carts tracks were usable only in dry season. Most of the population relied on river communication. As the steamers using the Ayeyarwaddy River increased in number by 1852, the necessity for river conservancy became urgent. The Irrawaddy Flotilla (IF) Company, the only organized transport operation on the river had to take this responsibility until 1942. The river conservancy work commenced with sounding the depth of river channels by country boats with sand ballast. Later country boats were replaced by buoying launches. Channel buoys positioned along the river for safe navigation. Clearing of snags and wrecks were carried out by cranes installed on launches. The river conservancy was carried out by Mercantile Marine Department under Transport Ministry after 1948. A fleet of 44 vessels consisting, buoying launches, Rock Pounder Snag lifter and dredgers continue to carry this service. Finally the river conservancy was reestablished as a separate Directorate under the ministry of Transport.

Key words: safely navigation, river conservancy, river channel

Introduction

This paper is the study on efforts to achieve the safety of steamers that plied on Ayeyarwaddy River. There are many factors which influence the safety of navigation. One of them is the peculiarities of the river itself. The others are river conservancy work, usage of modern steamers and skilful steamer operators.

The peculiarities of the river, such as obstruction of fairways by shoals and sand bars, rocks, snags and wrecks can be overcome by river conservancy services. The sudden rise and fall of river levels, great different in height of river level between low and high water seasons yearly is far from present day's effort and ingenuity.

This paper is handicapped by some references. Some accurate firsthand accounts by persons who served on the I.W.T Flotilla for some years are embodied. The statistics are obtained from Government's official papers and publications.

UNIFORM-SYSTEM OF BUOYAGE AND SHORE MARKS FOR THE INLAND WATERWAYS

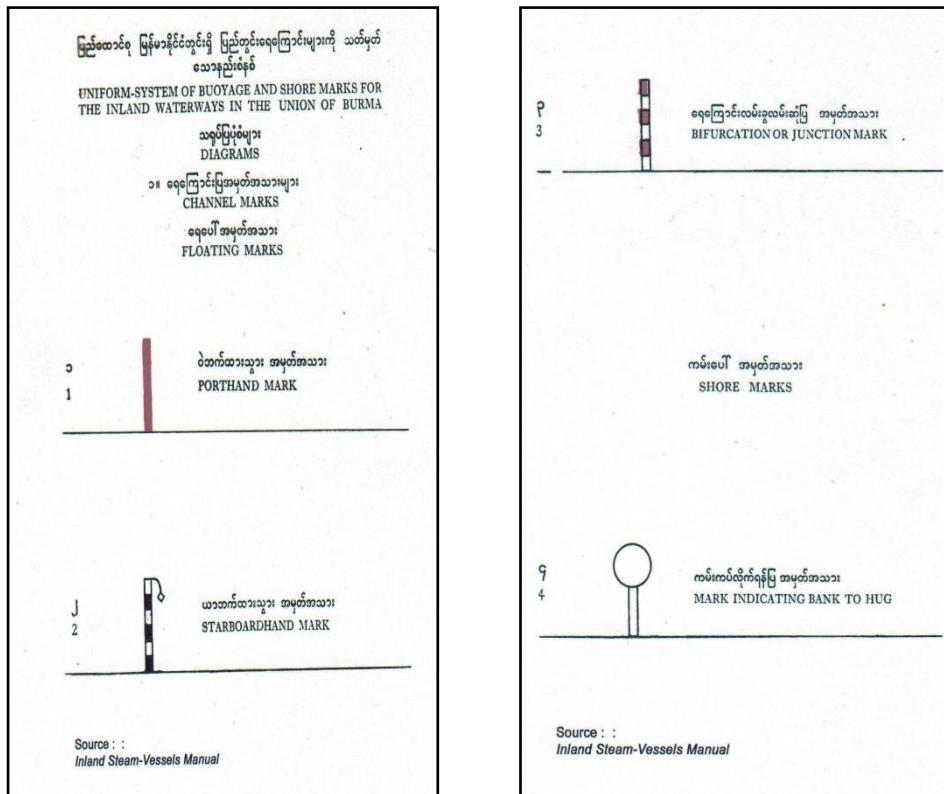
Prior to the formation of the *Irrawaddy Flotilla and Burmese Navigation Company Limited* in 1st January 1865, there was no established steamer service apart from small traffic of country boats on Ayeyarwaddy River. ² Countless river side pagodas had to be memorized as related land marks for navigation. But it was not with a precise position for a steamer in an ever changing river. In those early days it was customary for upward and downward bound ships to meet each other and exchange up to date channel information of the changing conditions.

The earliest record of marker buoys used by Irrawaddy Flotilla was in 1852 to warn the steamers of some dangerous places on Ayeyarwaddy River. Two buoying launches were introduced in 1870. The purpose is to search for deep water channels by sounding and placing

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² **Report to the Public**, The Revolutionary Govt. of the Union of Burma, 1866-67, P.49

of marker buoys. By 1880, the buoying fleet grown to seven numbers and by 1920, it had grown to fifteen.¹



(fig-1-2) Uniform-System of Buoyage and shore mark

Source: Inland Steam- Vessel Manual

Marker buoys are made of bamboo poles each eighteen feet long moored with a sand bag at one end.² The port buoy looking from seaward is painted red. The starboard buoy is painted white with black top.³ In addition the starboard buoy carried a tin sheet at the top so that the captains of the steamers were able to identify the buoy with the tin sheet glittering in day light or in the rays of the search light during the night navigation. There are three other types of buoys, a black buoy to indicate snags and rocks, a red and white striped buoy for junction of channels, a red buoy to mark wrecks.⁴

The buoyage system is installed during low water reason. Buoys are either removed or submerged in high water season. For succeeding year in low water season, new buoys have to reside for new channels.⁵ The buoyage system is used between Hinthada and Bhamaw. Below Hinthada is the delta region. The Ayeyarwaddy River breaks into many tributaries. Unlike Ayeyarwaddy River the creeks in delta are under the influence of tidal effect from the

¹ Mc CRA'E and PRENTICE, *IRRAWADDY FLOTILLA*, LONDON, JAMES PATON LIMITED, P. 149, (Hereafter this words will be referred to as Mc CRA'E and PRENTICE, *IF*).

² PERCY MAUNG MAUNG, "THE AYEYARWADDY RIVER TRANSPORT SYSTEM"

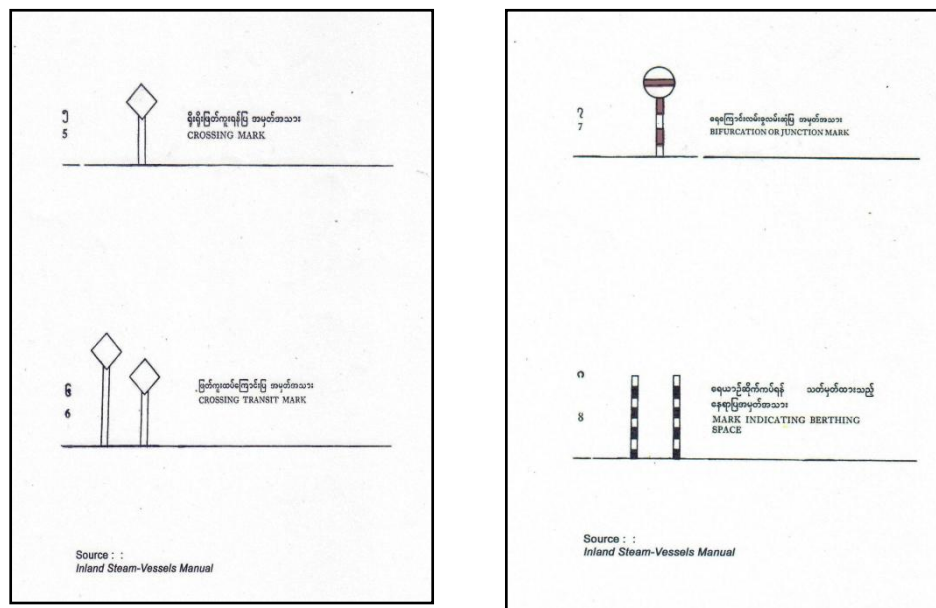
အလုံသင်္ဘောကျင်းနှစ်ဝဝဝဝပြည် မဂ္ဂဇင်း၊ ရန်ကုန်မြို့၊ ဧပြီလ၊ ၂၀၀၄၊ ပ-၂၅

³ *THE INLAND STEAM VESSEL MANUAL*, RANGOON, CENTRAL PRESS, 1968, P.159, (Hereafter this words will be referred to as *ISV MANUAL*)

⁴ *ISV MANUAL*, PP.160,161,162, 165,166

⁵ An interview with U Tin Myint, Retd .Dy. General Manager , (26.11.06)

Bay of Bengal which occurs twice daily. The creeks are narrow and winding but deep enough for navigation; hence the buoyage system is not necessary.¹



(fig-3-4) Uniform-System of Buoyage and shore mark

Source: Inland Steam- Vessel Manual

Land beacons (shore marks) were introduced in 1885 to indicate crossings.² Beacons were gradually used for different indications. By 1964 nine types of beacons with code of colours (Red, White and black) and for different indications were adopted.³

By 1965-66, the river conservancy fleet consists of the following vessels.

Rock pounder	1
Snag lifter	3
Buoyming launch	36
Dredger-large	3
Dredger small	1
Total	44 ⁴

The service of the dredgers is also useful for conservancy service. Sand bars and shoals around Pakoku and Sinbaungwai were cleared by dredging in 1962.⁵ The cargo loading jetty of Myanmar Cement Factory at Thayetmyo blocked by sand bar and shoals were cleared by dredging in 1963.⁶

Prior to 1886, steamer traffic is seldom practiced at night except on rare occasions on moonlight nights. After the search lights were fitted on steamers it became a standard fitment.

¹ Mc CRA'E and PRENTIC, *IF*, p.26

² (a) Where deep water channel cross one side of the bank to other.

(b)Mc CRA'E and PRENTIC, *IF*, p.149

³ *ISV MANUAL*, pp.160,161,162,165,166

⁴ THE REVOLUTIONARY GOVERNMENT OF THE UNION OF BURMA, REPORT TO THE PUBLIC, 1966-67, P.34, Table.34

⁵ *Burma National Economy*, Burma, The DIRECTOR OF INFORMATION, 1962-63, p.141.

⁶ *Ibid*, p.110

By 1932 steamer search lights became compulsory between sun set and sun rise.¹ The steamer captains had the help of Pilots who accompany the steamers over each beat in which they specialized.²

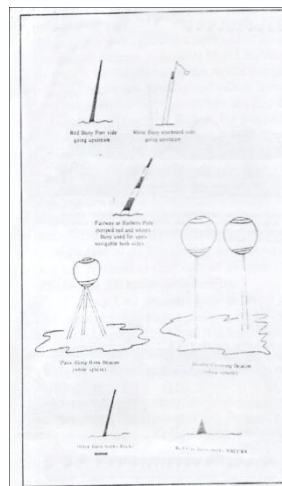
The Ayeyarwaddy River from Nyaungdong to Bamaw is divided into the thirteen sections.³ The sections are known as Pilotage Beat.⁴ The distance of each section is divided as follows:

Nyaungdong- Hinthada	61 mile
Hinthada-Myanaung	58 mile
Myaungmya-Pyay	56 mile
Pyay-Meegyaungye	87 mile
Megyaungye-Nyaungghla	60 mile
Nyaungghla- Nyaungoo	77 mile
Nyaungoo-Seemegon	61 mile
Seemegon- Mandalay	58 mile
Mandalay-Kyaukmyaung	52 mile
Kyaukmyaung- Tagaung	75 mile
Tagaung-Katha	66 mile
Katha-Shwegyu	44 mile
Shwegyu- Bamaw	40 mile ⁵

(Fig-5) Map of Myanmar and Ayeyarwaddy River



Ayeyarwaddy River Conservancy



Navigational Aids on the Ayeyarwaddy River

¹ Mc CRA'E and PRENTIC, *IF*, p.155,156

² Ibid, p.150

³ **PILOT PROJECT**, Rangoon, IWT, May 9th 1968, APPENDEX (A)

⁴ PERCY MAUNGMAUNG, "THE AYEYARWADDY RIVER TRANSPORT SYSTEM", P.251

⁵ IWT BOARD, **HAND BOOK OF SAILING AND GENERAL INFORMATION**, RANGOON, RANGOON GAZETTE LTD, 1 st April 1962, pp.127-128

The depth of river water during low water season is the factor that limits the draught of the steamer. Draught limitation of steamers and flats are limited as from 15th November to 15th May every year.

Hinthada to Pyay	-	5ft 6ins
Pyay to Mandalay	-	5ft
Mandalay to Katha	-	4ft
Katha to Bhamaw	-	3ft 9ins ¹

For the safety of steamers, the Ministry of transport is empowered to administer under the provision of the ***Inland steam vessel Act***. Provisions include issuing river worthiness certificates for steamers; Examination for steamer operator, Safety rules for navigation and risk of fire and legal proceedings.²

Conclusion

The river conservancy service is expensive. It contributes the safety of steamers. It also provides better draughts to which the steamer could load in the low water season. But the effort to achieve safety on Ayeyarwaddy is not yet ultimate. The perils on the river still exist. The safety passage though country boats and rafts that depend solely on wind and sail and ineffectiveness of oars. These are to be overcome by travellers on Ayeyarwaddy.

Acknowledgements

I would like to express our special gratitude to Dr Nyunt Phay, Rector, University of Pathein and Dr Wai Wai Nyunt and Dr Mi Mi Gyi, Pro-rectors of Pathein for allowing me to do this research work. I would like to thanks to Dr Khin Aye Aye Soe, Professor/ Head of History Department Pathein University, for suggestion and permission to research. I am also indebted to the editors of the Pathein University Research Journal for their proof reading.

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¹ MINISTRY OF TRANSPORT AND COMUNICATION, **NOTIFICATION NO, 233**, 14 NOV 1963, P.156

² **INLAND STEAM VESSELS ACT. 1917**, 1ST JUNE 1917, P.1.

An Analysis of the Concept of *Karuna* in Buddha's Teaching

Ohnmar Khaing¹

Abstract

This paper is an endeavor to search for the fact that why the concept of *Karuna* (Compassion) is really essential to apply and to make for a good society. It is for the reason that by generating *Karuna*, man will have the tender and gentle consciousness in daily life events. In four cardinal values named *Metta*, *Karuna*, *Mudita* and *Upekkha*, *Karuna* is one of all basic values that contribute towards not only the improvement of Humanism but also the development of human-heartedness for other living beings. This paper will contribute to know how the concept of *Karuna* (Compassion) is one of the cardinal things to be virtuous and good for persons and free from violence (non-violence) for society.

Keywords: *Karuna* (Compassion), Humanism, Human-heartedness, Non-violence

Introduction

In Buddha's Teaching, there is an important concept of four beautiful qualities which is the cardinal emphasis in Philosophy of Buddha. The qualities are *Metta*, *Karuna*, *Mudita* and *Upekkha* and *Karuna*. It can be revealed as a desirable mind group of necessities for societies. According to the Buddha's teaching, when man can generate, regenerate and develop these important spiritual qualities he becomes man powerful in humanistic affairs unlike other living beings.

The Four Supreme practices for monks and layman called in *Pali* are known as *Brahma-Viharas* and are also known as the celestial dwellings. The four intrinsic worth incline to raise man's level of abnormal and sub-normal consciousness to be a pleasant and respectable person and man's level of normal consciousness to be free from hate, hate speech and terrorism.

For the peace of man's living world, he will first grow its essence to replace in the discrimination of skin colors, races, genders and differentiations in nonsense human affairs etc.,. If the practice is right, the man's world will be peace in practice. In this paper this theme will be searched as a main finding from the Buddha Teachings for the advantages of living societies.

Man who has full of these beautiful minds will make us beautiful adornment as what he has and he will make experiencing more joy and lightness. This making can also be affective to others around us. In this paper, *karuna*, one of the four cardinal values is extracted and presented as one of the most beneficial mental factor.

(i) Research Problem

The problem is why the concept of *Karuna* (Compassion) is really essential to apply and to make for a good society.

(ii) Research Method

In finding the sound reason why the making of the concept of *Karuna* (Compassion) need to be wholly for a better society, evaluative method and the descriptive method will be used. In this way, the effects and the improvement of *Karuna* will be evaluated.

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The Sermon of the Buddha in the *Metta Sutta* is that a man of virtue will nurture a desire for the welfare of all beings. All things including the living and non-living creatures or organisms are interconnected and interrelated. All Myanmar Buddhists understand and accept that there is such a relationship in the ties of physical and mental processes. Although it is hard to put into practice this *Karuna*, it holds equally well for the ethics of environmental conservation and sustainable development as the socio-ethico guidance in this world.

The Buddha taught that to realize enlightenment, a person must develop two qualities: wisdom and compassion. Wisdom and compassion are sometimes compared to two wings that work together to enable flying, or two eyes that work together to see deeply.

In the West, men are taught to think of “wisdom” as something that is primarily intellectual and “compassion” as something that is primarily emotional, and that these two things are separate and even incompatible.

The Sanskrit word usually translated as “wisdom” is *prajna* (in Pali, *panna*), which can also be translated as “consciousness,” “discernment,” or “insight.” Each of the many schools of Buddhism understands *prajna* somewhat differently, but generally, it can be said that *prajna* is the understanding or discernment of the Buddha's teaching, especially the teaching of *anatta*, the principle of no self.

The word usually translated as “compassion” is *karuna*, which is understood to mean active sympathy or a willingness to bear the pain of others. In practice, *prajna* gives rise to *karuna*, and *karuna* gives rise to *prajna*. Truly, one cannot exist without the other one. They are a means to realizing enlightenment, and in themselves they are also enlightenment itself manifested. But in this paper, *Karuna* will be studied as the one side of obtaining humanitarian peace separately.

Brahma Viharas including *Karuna*

Metta is one of the Four Brahma Viharas. Brahma in this case has been translated as divine or noble. The word – as qualified in the path of purification – is meant in the sense of best and immaculate. This is because being best and immaculate is the best attitudes towards beings and those who practice it have immaculate minds.

Vihara means abiding and living. And so those who practice these are said to be abiding or living in the divine or noble way.

The Four Brahma Viharas are

1. *Metta*: loving kindness
2. *Karuna*: compassion
3. *Mudita*: sympathetic joy
4. *Upekkha*: equanimity

These four are attitudes towards other beings. They are also favorable relationships. They can also be extended towards an immeasurable scope of beings and so are called immeasurable.

In a way the first three are different shades of each other. Compassion (*karuna*) and sympathetic joy (*mudita*) can overlap with *Metta* but not with each other. Compassion sees into the suffering of beings while sympathetic joy sees into their happiness. *Metta* can be applied to both situations. Equanimity, however, differs in the sense of being a detached state. The cultivation of the first 3 into absorptions have been described as similar and is attainable

to the 4 lower *rupajhanas*, while equanimity enters only in the 5th. Hence the other three have to be cultivated before the absorption of equanimity can be reached.

The Meaning of *Karuna*

Karuna is a Sanskrit word and is used in Hinduism and Buddhism. It is translated to mean any action that is taken to diminish the suffering of others and could also be translated as “compassionate action.” When individuals experience enlightenment, they report that all beings are known as one. Therefore, it is natural to extend compassionate action or *Karuna* to everyone without distinction because we are all one. As men help others and aid them in their healing process, all beings benefit. Because of the oneness of all beings, it is understood that *Karuna* is not only extended to others out of love, but also because it is an entirely logical thing to do. It is also stated in the Buddhist literature that *Karuna* must be accompanied by *parjna* or wisdom in order to have the right effect.

Karuna is the motivating quality of all enlightened beings who are working to end suffering on Earth. They continually send an unlimited amount of healing energy and guidance to us, but not all are receptive to it. As you develop *Karuna* in yourself, not only are you helping others, but you also become more receptive to the *Karuna* that is being sent by all enlightened beings. Thus your healing is quickened as well.

The Concept of *Karuna* (Compassion)

Compassion is a practice that is well-known, yet little understood in its deepest form. One knows that it is good to be compassionate – one feels for his loved ones who suffer, for innocent victims of abuse or war, for animals that die at the hands of uncaring or unconscious humans.

Karuna Bhavana is the cultivation of compassion. In the cultivation it can be brought into concentration and absorption just like *Metta Bhavana*. The benefits of the practice are similar to the 11 benefits described for *Metta Bhavana*. In *Karuna Bhavana*, however, compassion is aroused instead of loving kindness. It is actually a more specific type of *Metta* that is applied or arises when one is able to see the suffering of another. It is an emotion that arises when men see someone suffering, then feel sorry for him and have a strong wish to relieve him of his suffering.

While *Metta* must not be mistaken for attachment, *Karuna* must be distinguished from sadness or grief. The thing that makes us sure is a strong and firm mindfulness that keeps the quaking mind strong and determined. So, one will find a heavier yet stronger emotion. And to balance it and make it lighter, one ought to remember to nurture softer and lighter tones of mental states while we are developing the concentration of *Karuna*.

The direct enemy of *Metta* is anger, and that of *Karuna* is cruelty and so the ways of removing it are similar to that for removing anger. The general steps of the cultivation can be similar, i.e.

1. contemplation of dangers of anger or cruelty
2. contemplations of benefits of compassion
3. growing compassion for a suffering being

The object of compassion is a suffering being and so men have to see the suffering of a being. For a start, it should not be anyone too close which could cause grief. It should not be a hostile one that he could even be glad about it. The opposite sex and the dead are also not suitable. Men are advised not to consider whether the person is dear, neutral or hostile. Instead they ought to choose one who can clearly see suffering.

Suffering can be in three ways.

Suffering as

1. physical and mental pain
2. suffering because of defilements
3. suffering of samsara

In a way men have to know exactly how the person feels. Sometimes one may even have to think hard and be with him and listen to him often to know him better. When compassion arises he can thus keep it flowing on and deepening the concentration in the process as described in *Metta Bhavana*.

However traditionally the aspiration is *dukkha pamuccantu* – may he be free from suffering. It is clear that the degree and quality of compassion comes with the degree of understanding of what suffering is.

When compassion and strong concentration have reached their depth and power, one would be able as in *Metta Bhavana* to enter into the first absorption. The attainments of its mastery as well as other higher absorptions are also similar to *Metta Bhavana* in approach. Then one may radiate *Metta* to the dear person, neutral person, unpleasant person and then hostile person in succession. Finally one can also proceed on to the specified and unspecified pervasion of *Karuna* in the 10 directions.

1. *Sabbe satta dukkha pamuccantu*

May all beings be free from suffering

2. *Sabbe pana dukkha pamuccantu*

May all living things be free from suffering

3. *Sabbe bhuta dukkha pamuccantu*

May all creatures be free from suffering

4. *Sabbe puggala dukkha pamuccantu*

May all individuals be free from suffering

5. *Sabbe attabhava pariyapanna dukkha pamuccantu*

May all personalities be free from suffering

6. *Sabbe itthiyo dukkha pamuccantu*

May all females be free from suffering

7. *Sabbe purisa dukkha pamuccantu*

May all males be free from suffering

8. *Sabbe deva dukkha pamuccantu*

May all deities be free from suffering

9. *Sabbe manussa dukkha pamuccantu*

May all humans be free from suffering

10. *Sabbe vinipatika dukkha pamuccantu*

May all unhappy states be free from suffering

10 Directions

In the Easterly direction may all beings be free from suffering

In the Westerly direction may all beings be free from suffering

In the Northerly direction may all beings be free from suffering

In the Southerly direction may all beings be free from suffering

In the South-Easterly direction may all beings be free from suffering

In the North-Westerly direction may all beings be free from suffering

In the North-Easterly direction may all beings be free from suffering

In the South-Westerly direction may all beings be free from suffering

In the Below direction may all beings be free from suffering

In the Above direction may all beings be free from suffering

Repeat 10 directions for all living things, all creatures, all individuals, all personalities, all female kinds, all male kinds, all nobles, all common folk, all deities, all humans and all unhappy states.

Karuna in daily life involves welfare work – ranging from old folks to spastic children, and kindness to animals to transference of merits to unhappy spirits (*petas*). It would be most applicable in hospitals and welfare services, where there are suffering beings. *Sasana* work which involves spiritual education and helps to relieve daily sufferings and *samsaric* sufferings also needs compassion. Even in educational institutions like schools compassion is applicable. However compared to *Metta* it may not be so widely applicable because one may not see any obvious suffering and people too don't like to be seen as suffering either. Therefore it does not arise as often in daily life though it may arise easier when the situation is present.

For *Bodhisattas* of aspiring Buddhas, it becomes the motivating force for supreme enlightenment. In such a case one has to develop the great compassion – *maha karuna* – through deep reflection of the beings suffering in *samsara*.

Compassion as Training

In Buddhism, the ideal of practice is to selflessly act to alleviate suffering wherever it appears.

You may argue it is impossible to eliminate suffering, yet the practice calls for us to make the effort.

What does being nice to others have to do with enlightenment? For one thing, it helps us realize that “individual me” and “individual you” are mistaken ideas. And as long as we're stuck in the idea of “what's in it for me?” we are not yet wise.

In *Being Upright: Zen Meditation and the Bodhisattva Precepts*, Soto Zen teacher Reb Anderson wrote, "Reaching the limits of practice as a separate personal activity, we are ready to receive help from the compassionate realms beyond our discriminating awareness." Reb Anderson continues:

We realize the intimate connection between the conventional truth and the ultimate truth through the practice of compassion. It is through compassion that we become thoroughly grounded in the conventional truth and thus prepared to receive the ultimate truth. Compassion brings great warmth and kindness to both perspectives. It helps us to be flexible

in our interpretation of the truth, and teaches us to give and receive help in practicing the precepts."

In *The Essence of the Heart Sutra*, His Holiness the Dalai Lama wrote,

According to Buddhism, compassion is an aspiration, a state of mind, wanting others to be free from suffering. It's not passive – it is not empathy alone – but rather an empathetic altruism that actively strives to free others from suffering. Genuine compassion must have both wisdom and loving kindness. That is to say, one must understand the nature of the suffering from which we wish to free others (this is wisdom), and one must experience deep intimacy and empathy with other sentient beings (this is loving kindness).

True compassion

True compassion has no expectation of reward or even a simple “thank you” attached to it. To expect a reward is to maintain the idea of a separate self and a separate other, which is contrary to the Buddhist goal.

The ideal of *dana paramita* — the perfection of giving — is “no giver, no receiver.” For this reason, by tradition, begging monks receive alms silently and do not express thanks. Of course, in the conventional world, there are givers and receivers, but it is important to remember that the act of giving is not possible without receiving. Thus, givers and receivers create each other, and one is not superior to the other.

That said, feeling and expressing gratitude can be a tool for chipping away at our selfishness, so unless you are a begging monk, it is certainly appropriate to say “thank you” to acts of courtesy or help.

Developing Compassion

It is already been noted that compassion arises from wisdom, just as wisdom arises from compassion. If you're feeling neither especially wise nor compassionate, you may feel the whole project is hopeless. But the nun and teacher Pema Chodron says “start where you are.” Whatever mess your life is right now is the soil from which enlightenment may grow.

In truth, although you may take one step at a time, Buddhism is not a “one step at a time” process. Each of the eight parts of the Eightfold Path supports all the other parts and should be pursued simultaneously. Every step integrates all the steps.

That said, most people begin by better understanding their own suffering, which takes us back to *prajna*— wisdom. Usually, meditation or other mindfulness is the means by which people begin to develop this understanding. As man's self-delusions dissolve, he becomes more sensitive to the suffering of others. As he is more sensitive to the suffering of others, his self-delusions dissolve further.

Compassion for Yourself

After all this talk of selflessness, it may seem odd to end with by discussion compassion for oneself. But it is important not to run away from our own suffering.

Pema Chodron said, “In order to have compassion for others, we have to have compassion for ourselves.” She writes that in Tibetan Buddhism there is a practice called tonglen, which is a kind of meditation practice for helping others connect to their own suffering and the suffering of others.

Tonglen reverses the usual logic of avoiding suffering and seeking pleasure and, in the process; men become liberated from a very ancient prison of selfishness. He begins to feel love both for himself and others and also he being to take care of himself and others. It

awakens their compassion and it also introduces them to a far larger view of reality. It introduces men to the unlimited spaciousness that Buddhists call *shunyata*. By doing the practice, he begins to connect with the open dimension of our being.

The suggested method for *tonglen* meditation varies from teacher to teacher, but it usually is a breath-based meditation in which the mediator visualizes taking in the pain and suffering of all other beings on each inhalation, and giving away man's love, compassion and joy to all suffering beings with each exhalation. When practiced with complete sincerity, it quickly becomes a profound experience, as the sensation is not one of symbolic visualization at all, but of literally transforming pain and suffering. A practitioner becomes aware of tapping into an endless well of love and compassion that is available not only to others but to ourselves. It is, therefore, a very good meditation to practice during times when ones are most vulnerable yourself. Healing others also heals self, and the boundaries between self and other are seen for what they are— non-existent.

Discussion

Certainly, it is relatively easy to be compassionate with someone one loves who is suffering. Concern naturally flows from a parent when their child is sick, for example. Yet even in those situations, men are often unclear whether they are being compassionate, or reacting from worry about their well-being.

It helps to have a better understanding of what compassion is. Rev. Michael Bernard Beckwith, new-thought minister and author, distinguishes between sympathy, empathy, and compassion in a way that brings clarity to this practice.

In essence, he says that sympathy is feeling sorry for someone. While there are times when we like receiving sympathy, it is not a very empowering attitude. It views the other as a "poor dear", a victim of circumstance. Sympathy tends to focus on the tragedy of the situation and is not always helpful to the one suffering.

Beckwith describes empathy as "I will feel for you." Men can take on the feelings of the one suffering, imagining how they do feel in their place – not necessarily how they actually feel. This tends to disturb the mind, causing them to focus on what their worries or concerns would be in their situation. If they are to maintain inner serenity in the face of someone who suffers, this is not the best path, either.

Compassion, however, truly focuses on the needs of the one who suffers, and develops in us greater awareness and inner peace. First of all, ones become fully present. Compassion allows one to be with the one suffering – even if it is his own self that is in pain – by being in the now, focused on what is, and instead of projecting himself into what may be.

Then, men share their understanding of their pain, their loss, their fear. Whatever is the cause of ailing, they attempt to understand deeply. They learn to quiet their own fears, reactions, judgments, opinions, and simply understand from their point of view.

When their mind is quiet, they can deeply, truly listen, which is healing itself. Thich Nhat Hahn states this beautifully: "So if we love someone, we should train in being able to listen. By listening with calm and understanding, we can ease the suffering of another person."

This is not the same as taking on their emotions by feeling themselves – it is being present to them and recognizing the experience another is having. Disaster workers understand this, as they would fall apart if they fully took in the pain of the people they are

helping. They must be present, listen, and share their understanding from the place of a witness in order to be truly helpful.

Lastly, Beckwith says that from compassion men extend a hand – how can I help? How can I support you? They are not able to take care of all their needs, but when they practice compassion they naturally fall into right action that supports the healing and well-being of the other. This is done from the quiet mind that is in service to all beings.

So compassion – *Karuna* – is the practice of being present to another who is suffering, deeply understanding them, and exploring in what way they can assist them. Sometimes, our way of helping is simply to be there, holding their hand, or to keep them in their thoughts and to wish their pain to be lifted. They may be able to help in a much larger way, but don't discount the small ways in which they can extend the action of compassion.

Occasionally, obstacles may arise to their ability to be compassionate. They may have judgments about the nature of the person's suffering. There may be a grudge they have towards a particular person that blocks compassion. They may cut their selves off from the situation because it feels too painful to witness it.

Yet, in all these circumstances, if men are able to step back a bit from their personal reactions and projecting their thoughts, feelings, and beliefs on the other, they may be able to overcome these obstacles. It is not their job to fix the situation. It is not their place to judge how someone arrived in that place. The person you hold something against is not who you are sitting across from, but rather a fixed idea you have kept in your mind. Being fully present, understanding, and helpful doesn't require you or the other person to admit wrongdoing.

And remember that men are deserving of compassion, too. They often have the most difficulty practicing compassion towards their selves. If you are suffering, be fully present to it. Feel what you feel in your body. Open your heart to it. Listen to yourself, and try to understand the nature of your pain deeply.

The way of compassion – *Karuna* – is a powerful healing path for all who practice it. For it not only eases the suffering of others as man cultivates *Karuna*; it brings peace to his own mind and heart. As Baba Hari Das says, "The attitude of compassion... also removes hatred. When one understands, 'others want to live happily, just as I do,' then one can feel the pain of others as his or her own pain. This fills one's heart with compassion."

Men are not truly separate from others – they all share the same longing for love, connection, and happiness which is our Divine Spirit. *Karuna* calls ones to feel their kindred spirit with all life. Their suffering is their selves. It should be realized that, the ego softens and all men feel more One with all that is *Karuna*.

Conclusion

"The second aspect of true love is *karuna*, the intention and capacity to relieve and transform suffering and lighten sorrows. *Karuna* is usually translated as "compassion," but that is not exactly correct. "Compassion" is composed of com ("together with") and passion ("to suffer"). But we do not need to suffer to remove suffering from another person. Doctors, for instance, can relieve their patients' suffering without experiencing the same disease in them. If ones suffer too much, they may be crushed and unable to help. Still, until they find a better word, they can use "compassion" to translate *karuna*.

The Lotus Sutra describes Avalokiteshvara as the bodhisattva who practices "looking with the eyes of compassion and listening deeply to the cries of the world." Compassion contains deep concern. Man knows the other person is suffering, so he sits close to her. He

looks and listens deeply to her to be able to touch her pain. Men are in deep communication, deep communion with her, and that alone brings some relief.

One compassionate word, action, or thought can reduce another person's suffering and bring him joy. One word can give comfort and confidence, destroy doubt, and help someone avoid a mistake, reconcile a conflict, or open the door to liberation. One action can save a person's life or help him take advantage of a rare opportunity. One thought can do the same, because thoughts always lead to words and actions. With compassion in our heart, every thought, word, and deed can bring about a miracle.

When a boy was a novice, he could not understand why, if the world is filled with suffering, the Buddha has such a beautiful smile. Why isn't he disturbed by all the suffering? Later he discovered that the Buddha had enough understanding, calmness, and strength. That is why the suffering does not overwhelm him. He is able to smile to suffering because he knows how to take care of it and to help transform it. All men need to be aware of the suffering, but retain our clarity, calmness, and strength so we can help transform the situation. The ocean of tears cannot drown us if *karuna* is there.

Inspired by the virtues of Buddhism, our philosophy for compassion not only cares deeply for the world within us - our bodies and our minds - but also for the world around us.

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A Study of Mental Substance and its Philosophical Implication

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Abstract

There are various notions of mental substance to be learned from western philosophers. This research is an attempt to present that the substance is not a religious concept but a philosophical concept in Buddhism. The concept of substance is the focus of a group of philosophical problems which has its origins in Greek. The research problem is whether there is a self or not and presents theories about what self is thought to be. So this paper has tried to make the best discussions of Western Philosophers on the concept of mental substance. This research will contribute to understand that the substance is nothing but a mere figment of imagination; that belief of substance, material or mental is a kind of wrong view and Mental substance cannot exist permanent in the essential doctrine of *Theravāda* Buddhism.

Keywords: mental substance, self, the essential doctrine, *Theravāda* Buddhism

Introduction

One of the most recurring ideas about the nature of a human being is the concept of self or mental substance. Down through history, this concept has been very important, at least in western culture. Men have blamed it for making us egotistical and religionists, both Eastern and western, have blamed the concept for keeping us separated from God or from attaining oneness with some ultimate reality. Yet, on the other hand, they have praised the concept of self for stressing their uniqueness, individuality, and autonomy and for the marvelous scientific discoveries, great philosophical system, and magnificent art works they have created throughout history.

The concept of substance is the focus of a group of philosophical problems which has its origins in Greek. There are various notions of mental substance to be learned from western philosophers. This research is to present the concept of mental substance and its philosophical implication from some western philosopher's point of view.

Problem of the Research

The research problem is whether there is a self or not and present theories about what self is thought to be.

Research Method

This research will be described the nature of the concept of mental substance and will also be evaluated its nature cannot be existed as permanence. By the principle of conditional relation, it will be proved that everything in the universe is ever changing from moment to moment and never permanent.

Various Notions of Mental Substance

The word ' self ' is used in three different senses. First, it is used in the sense of the permanent spiritual principle of unity underlying thinking, feeling and willing-the permanent mental substance which lies behind and beyond the fleeting mental processes. This spiritual substance is called the mind, soul, self. Secondly, it is used in the sense of an aggregate of mental states without any underlying principle of unity among them. The mind is a series of mental processes. Thirdly, it is used in the sense of a concrete spiritual unity, which is not

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above and beyond the mental phenomena, i.e. thinking, feeling and willing, but realities in them, without losing its unity and identity in them. It is the mental substance with the mental processes.

"The word 'self thus has three meaning; it
Means an abstract unity or substance apart
From its manifestation; or an aggregate or
Plurality states apart from their essence; or a
Concrete spiritual substance which realizes
Itself in its manifestations remaining identical
With itself in the midst of changes"

Thus, according to the first view, the self is an abstract unity, according to the second, an abstract plurality, according to the third, a concrete unity-in-plurality or identity-in-difference. The first is the numeral view of the self; the second empirical conception of the self and the third, the idealistic view of the self. The concept of substance is the focus of a group of philosophical problems which has its origins in Greek philosophy and is particular the philosophy of Aristotle. The principal term for substance in the writings of Aristotle is "ousia" which means "Property" in the legal sense of the word. Aristotle's account of substance has been the most influential in the history of philosophy. But it is obscure and probably inconsistent.

There are various notions of substance to be learned from other philosophies. Substance as

- (1) the concrete individual
- (2) a core of essential properties
- (3) what is capable of independent existence?
- (4) a center of change
- (5) a substratum, and
- (6) a logical subject are never thoroughly

Worked out and reconciled in Aristotle.

Discussions of substance in later philosophers have tended, with few exceptions, to take over one or more of the six senses proposed by Aristotle as the clue to the problem. Ancient atomism, founded by Leucippus and Democritus, developed by Epicurus, suggests that the truly real and substantial elements of nature are the atoms out of which everything is composed. It is these that are fundamental, unchangeable, and in the last resort, capable of independent existence. The problem of substance and attribute was not much discussed by the ancient atomists.

During the middle Ages, discussion of this problem was centered upon the theological repercussions of rival theories. But these theological logical outworks produced no new basic insights that can be regarded as an improvement on the work of Aristotle. Indeed, they are just variations upon Aristotelian themes.

In the work of Descartes the concepts of substance become associated naturally with those of the conscious self and its states, and the problem of substance becomes associated with the problem of personal identity. He gives a formal definition of substance as

follows; "Everything in which there resides immediately, as in subject, or by means of which there exists anything that we perceive, i.e. any property, quality, or attribute of which we have a real idea is called a substance; neither do we have any other idea if substance itself, precisely taken, than that it is a thing in which this something that we perceive or which is present objectively in some of our ideas, exists formally or eminently. For by means of our natural light we know that a real attribute cannot be an attribute of nothing."

Spinoza equated substance with God and nature, the three terms being synonymous for him. Another rationalist philosopher, Leibniz, makes the concept of substance fundamental to his philosophical system. He uses two of the Aristotelian criteria of substance, substance as a center of change and substance as a logical subject, but adds the concept of Simplicity. Leibniz in his Monadology he defines "monad" as "nothing" but a simple substance. By 'simple' is meant without parts.

Locke points out that "we find in experience groups of qualities which occur together in time and place. We therefore presume these qualities to belong to one thing and come to use one word, "gold," "apple," or "water" (whatever it may be) to refer to the collection of properties "which indeed is a complication of many ideas together." Further, not imagining how these simple ideas can subsist by themselves, we accustom ourselves to suppose some substratum wherein they do subsist, and from which they do result, which we therefore call substance.

Berkeley's attack on the concept of material substance and Hume was content to write off the whole idea as an "unintelligible chimaera". Moreover, Hume extended the skepticism of Locke and Berkeley in respect of material substance to question, on analogous grounds, the existence of spiritual substances or selves.

In Kant's view, "substance" does not refer to feature of the objective world independent of human thinking. On the contrary, the unity and permanence of substances are features contributed by the human understanding to the world of phenomena. This represents a very radical revision of the concept of substance.

Some Western Philosophers' View on Soul (or) Mental Substance

The early men believed that all nature was alive. Everything else in primitive man's universe had a soul, a spirit. Still others believed that the soul went to a place of shades and ghostly forms, there to pine for the world of men.

Some earliest Greek Philosophers' notion on Substance

The earliest Greek philosophers thought of this soul as the least material form of the particular substance out of which everything in the universe was made. Anaximenes held that the soul was very thin or rarified air and that this substance was the thing. When it left the body disintegration set in and the body was destroyed. In the teachings of Heraclitus we find the belief that the soul is the finest (most rarified) form of fire, ever changing, but never being destroyed. Leucippus, Democritus, and the other Atomists, taught that, just as the entire world is composed of atoms, tiny bits of matter, so the soul is composed of the finest, purest, most perfect fire atoms. These atoms are, they held, scattered throughout the body, a soul atom placed between two other atoms. While man lives, he breathes soul atoms in and out. When he dies, the soul atoms are scattered throughout the universe.

Aristotle taught that soul is to be found wherever there is life and, a series of souls beginning with the lowest or plant souls and moving upward to the highest or human souls. The human soul has the power of thinking in terms of concepts, is able to think about the

inner nature of things. Thus, the soul of man has the power of reason. This reason perceives concepts just as the lower part of the soul perceives objects in the world. Aristotle divides reason into two kinds, namely passive reason and creative reason. Creative reason was the form and passive reason the matter. Creative reason, the form, existed, he held, before either body or soul was created. While passive reason, or the matter part of the soul, is connected with the body and will perish when the body is destroyed, creative reason is not influenced by the body, is immaterial, and will continue to live after the death of the body. This creative reason is a spark of the divinity, a part of God, which comes into the soul from without and is not influenced by the baser side of the soul.

Since all but the creative reason perishes with the body, personal immortality is impossible in Aristotle's system. The only part of the soul which survives death is actually part of God and simply returns to God. All else perishes. Since the Epicureans based their metaphysics on the work of Democritus, they held that the soul is composed of atoms just like all other things in the universe. But the atoms of the soul are extremely fine (thin) and are of various kinds. There are atoms of fire, air, breath, and very fine matter. These atoms are scattered throughout the body and are controlled by a rational part which, according to the Epicureans, is located in the breast. Further, all sensations of the body are result of the soul.

Since the soul is, for these philosophers, material, it cannot be immortal. When the body dies and disintegrates, the soul atoms are scattered throughout the universe. Death, then, is the end for both body and soul. As Lucretius, one of the later Epicureans wrote.

"A fool will not make more out of the
hereafter than he has made of this life."

The Stoics held that man is both soul and body, and that the soul is spark from the divine fire controlled by a ruling part situated in the heart. The soul of man, the stoics taught, is the source of what we, know as perception, judgement, feeling, and willing. At its best, it becomes rational, able to think in terms of concepts or ideas. Thus, the soul makes it possible for man to deliberate and make choices before he acts.

Descartes' view on Substance

Descartes was a prominent modern philosopher who revived the soul-substance theory of Plato and Aristotle. He is a typical exponent of rationalism and also mathematician. Descartes regards that Mathematical demonstration is the perfect type of knowledge. So he took Mathematics as the model for the philosophical method. His aim was to find certain and self-evident truth. He tried to construct a system which would possess the certainty of Mathematics. He believed that Mathematics alone had been able to find those truths.

In Mathematics, we begin with axiom which is self-evident. From this we deduce other propositions which logically follow from them. The development of true knowledge consists in the deduction of other truths from the self-evident innate ideas, as propositions are deduced from axioms and definition in Geometry. Thus Descartes applies the mathematical method to philosophy.

Concerning this method, Descartes had drawn up a code of rule containing four steps. They are;

- (1). Never to accept anything as true which is not clear and distinct.
- (2). Analyzed or divided all ideas or difficulties into as many parts as possible.

- (3). Begin with the most simple idea and then go on to the most complex.
- (4). Make careful and complex enumeration in order to be sure of having omitted nothing.

Descartes began with the principle that one must doubt everything, and then went on to ask:

“Can I be certain that I am sitting here in this chair? No, for it is possible that I might be dreaming. What, then, do I exist, because I am thinking”.

Descartes had doubted everything which is known by experience. According to Descartes, one thing is certain and that is, he doubts. There can be no doubt that he doubts. Doubting means thinking. Therefore there must be a thinker. So Descartes arrived at the self-evident principle “I think, therefore, I am”(Cogito ergo sum). It is clear and distinct.

In this way, Descartes had demonstrated the existence of the self or the soul or, the mental substance. Descartes conceived the soul as a spiritual substance whose essential attribute is thinking or consciousness. There is no mind or soul without consciousness, and there is no consciousness without the soul.

Existence of the self is identical with its thinking or consciousness. The self exists as a thinking being. Its thinking or consciousness constitutes its essence. The self is never devoid of consciousness. It knows its existence intuitively. Intuition is immediate clear and distinct consciousness.

The existence of the soul is unquestionable. It is a primary certainty. He said that, “I think, therefore, I am,” is the first and most certain knowledge that occur philosophies orderly.

Descartes deduces the existence of God from the innate idea of God. The idea of God is the idea of an infinite Being. It cannot be produced by me, because I am a finite being. It cannot be produced by any finite thing in the world, or by the addition of all finite things, because the sum of finite things is finite.

The finite things cannot produce the idea of an infinite Being. The cause must contain at least as much reality as is contained in the effect. So God or Infinite Being is the cause of the innate idea of God. Therefore, God exists.

And then he deduces the existence to the external world from the veracity of God. If the external world did not exist really, then God the creator would be a deceiver. God is not the deceiver. So the existence of the external world is real. In this way Descartes proved the existence of god and the world from the innate ideas in the self.

According to Descartes, there is only one absolute substance are relative and they are body and mind. These two substances are part of God. Body is extended, inert, and subject to mechanical laws. Mind is un-extended, active, conscious, and subject to teleology or purpose.

Moreover, by substance it is meant for that which stands by itself without depending on any other thing. But Descartes took mind and body to be substance, although they are dependent on God. The relation between these two, mind and body, was not clearly described also. He maintained that mind and body are so different from one another that interaction between them is not possible. Mind cannot influence on body and vice versa.

But with regard to man, Descartes thought that there is interaction between mind and body that it is at the pineal gland where these two can influence on one another. Hence the problem concerning the relation between physical world and mental world, and the

interaction between mind and body were not solved clearly in Descartes' philosophy. Some of his followers tried to give consistent answers for these problems.

Leibniz's conception on Substance

Similarly, Leibniz explained by relation between mind and body on the basis of his doctrine of pre-established harmony. He continued to show the way in which the relation between a pin-prick in the body and pain in consciousness can be explained. This is the way in which body and soul are in agreement with each other. They are like the two clocks that have been so perfectly constructed that they keep time of themselves, without any mutual influences.

Spinoza's view on substance

There is only one substance according to Spinoza. According to the definition of substance it does not depend on anything else. The substance for Spinoza is external, infinite. It is the cause of itself and necessary principle of things. It is called God or Nature. God and Nature are the same. God or Nature is the permanent substance. It is the active principle or source of all reality.

God has infinite attribute. Man can only know two, they are mind and body. Body and Mind are independent of one another. They cannot influence each other. There can be no interaction between them. They exist in parallel. Mind and Body are the affects of the same God. So we have the Double-aspect, Theory of parallelism. With regard to the substance, Descartes, Spinoza and Leibniz are different. However they agreed that the human soul is immortal. British Empiricist Locke and Berkeley also believed that the soul cannot be mortal. According to empiricist, the facts are given by experience and the truth can be achieved by empirical method alone.

Locke's view on Substance

Locke thought of the universe as being composed to two substances, bodies and souls. The soul, for him, is spiritual substances with the power of perceiving, thinking, and willing. Man arrives at the idea of soul by combining the various operations of the human mind, such as willing, knowing, and the like and supposing a support for them. This support or ground is soul substance.

His argument for this is: "Having as clear and distinct ideas in us of thinking as of solidity, I know no way we may not as well allow a thinking thing without solidity, i.e., immaterial, to exist, as a solid thing without thinking, i.e., matter, to exist, especially since it is in harder to conceive how thinking should exist without matter than how matter should think". The soul is this immaterial thing which thinks. This soul of man is both active and passive for Locke. It is able to influence and move bodies and, at the same time, it is influence by bodies so that it has ideas. Thus, the soul interacts with bodies,

The soul is immortal, lives after death of the body is, for Locke, a matter of faith, and not anything of which we can have a clear and distinct idea. It is above reason, but can be believed on faith. Berkeley, the next Empiricist, also conceived the soul as a spiritual substance, which perceives ideas and acts upon them. The self or spirit is entirely distinct from ideas. The self perceives, while ideas are perceived. The self is active, while ideas are passive. Ideas cannot exist if there be no self. They exist in, and are perceived by, the self. Thus the self or spirit can never be regarded as a series of ideas. "Berkeley say, the soul or spirit is a real thing (substance) which is neither an idea nor like an idea, but that which perceived ideas, and wills, and reasons about them."

Thus Berkeley emphatically denies the identity of the soul with ideas. Ideas which are not the creation of the individual mind are the creation of God who is also mind. Hence man's soul is the beginning and end of the universe. And, of course, it cannot die but will live on as part of the spiritual essence of the universe.

Hume's view on Substance

Hume held that we can have no certain knowledge either of material or spiritual substance. We cannot know that either the outer world or the soul exists. All we know is that there is a succession of ideas, one following another. That there is a ground or support of these ideas, a soul which has them, cannot be known. We must therefore be agnostic (that is, without definite conviction) as regards the soul.

According to Hume, there is no permanent and abiding spiritual substance apart from a series of feelings and ideas; we can never perceive the so-called permanent self or spirit, whenever we try to perceive it we perceive only a series of feelings, sensations, or ideas: we perceive nothing beyond them. The so-called spirit or self is a figment of the imagination. Thus, the self, is nothing but a series of mental process. He writes: "When I enter intimately upon what I call myself, I always stumble on some particular perception or other, of heat or cold, light or shade, love or hatred, pain or pleasure. I never catch myself, at any time, without a perception, and never can observe anything but the perception."

Discussion and Conclusion

Then mind is nothing more than a succession or jumble of perceptions. Thus, any idea of the immortality of the soul is wholly without foundation and cannot be accepted. But Hume designated the felling of reality of the natural human consciousness as faith. The Skepticism of Hume showed that the reality of things cannot be derived from sense perception. Analysis of perception cannot lead to cognition of substance and causality; only through faith can we know the reality of things.

Hume thus ascribed to faith a positive theoretical function inasmuch as it is a source of knowledge of the reality of the things of experience. During the 18th Century the influence of Leibnitz was strong in Germany, where philosophers were striving to prove the existence of the soul and its immortality. However, in England, where the influence of Locke, Berkeley, and Hume was dominant, there was a trend toward a mechanistic theory of man and his universe. Here the idea that man was nothing more than a machine was prominent. Of course, such an idea left no room for the conception of a soul.

Henri Bergson, the famous French philosopher regards that change is the only reality and the universe is itself a stream of perpetual change." There is thus no self which changes; there is, indeed, nothing which changes, for in asserting the existence of that which changes we are asserting the existence of something which, from the mere fact that it is subject to change, is not itself change; there is simply change."

Most of the Psychologists like Philosophers reject the concept of mind or self. Among the early part of 20th century Psychologists Professor. J.B Watson Gnoress not only the soul but also man's ability to think. According to Watson, man who thinks does not have a mind distinct from the body with which he thinks. But, because of his finer organization and construction, he is able to perform acts which are characterized as thinking. Thus his doctrine is called behaviorism. The Behaviorist considers the mind to be the nervous system with its biological needs responding to the environment.

According to Watson thinking is sub-vocal speech or implicit speech movements, Emotion are a pattern of visceral responses. Thus he banishes the soul the mind,

consciousness, and mental process from psychology. Among the philosophers and psychologists who tried to explain concerning the concept of mental substance of soul, some were followed by idealism some were followed by materialism and other were followed and science. Bertrand Russell, among the twenty century thinkers, tried to explain the material substance and mental substance whether exist or not. Here we will state the essence of Russell's view. This view of Russell can be seen in his book, "The Problem of Philosophy". There are four factors involved in every act of perception a knowing mind, and object known, relations, and sense-data.

In this way, Philosophers had discussed the concept of mental substance and its philosophical implication. We have studied that various thinkers tried to explain the concept manta substance in different views. Of course this concept plays an important role in philosophy and religion.

Theravāda Buddhists deny the existence of any permanent substance; there is neither material nor mental substance. The whole universe is in a state of anicca (flux); everything is changing from moment to moment; nothing, thus, can stay fixed.

Everything including perceptions, feelings, passions, emotions, objects, etc is in the state of flux. The belief, thus, that there is substance is nothing, but a mere figment of our imagination; that the belief of substance, material or mental, is a kind of wrong view. Buddha had rejected the existence of mental substance. All phenomena is anatta, non-soul-ness. We cannot find any what we call self, ego, or soul.

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A Study on Work Satisfaction of Some Pathein University Teachers

Thi Thi Aung¹

Abstract

This paper is the study on work satisfaction of some Pathein University teachers. In this study, a questionnaire containing (19) items are used as an instrument. It was constructed by the researcher based on literature review. Hundred art and science teachers are used as subjects. They are (50) males and (50) females in Pathein University Teachers. According to this paper, most of the teachers are (100%) satisfied with their work. Most of the subjects are interested in their jobs. Most of the subjects answered that even if they do not get enough money, they are satisfied with their jobs.

Key words: satisfied, interested, enough money

Introduction

This paper intends to study “Work Satisfaction” of Some Pathein University Teachers. An extensive number of surveys and studies have been conducted to measure worker’s satisfaction but the findings have been a little contradictory.

Most notable findings have been the extensive studies of worker attitudes for social research. White income was important for the workers. These studies were found that dissatisfaction was varied from job to job, regardless of income.

When the Michigan researchers asked workers to rank the most important factors in their work, good pay ranked fifth. Ahead of it in priority were (1) doing interesting work, (2) sufficient help and equipment, (3) sufficient information about what should be done, (4) sufficient authority to get the job done. After pay, other priorities in order were growth opportunities, job security and seeing the result of one’s work. These findings reinforce the views of Durkheim and Marx about worker’s need to gain intrinsic satisfaction from the challenge, variety, control and results of their work.

In contrast, Japanese workers have high job satisfaction and identify closely with their company whose management takes a lifetime paternalistic interest in them and their families. Recent studies suggest white-collar job discontent reflects the changed, work orientations of a new generation of better educated workers. Called the “new breed” by Daniel Yankelovich they value individual, independence and leisure activity as much, if not more than the traditional benefits of work.

Consequently, they have less personal identity with their work, less loyalty to their employer but a willingness to remain in job they dislike if flexible or favorable work schedules permit more personal freedom. With greater education and higher expectations among professional workers, they place more value on fulfillment in work and are thus more sensitive to alienating conditions.

This paper intends to study “Work Satisfaction” of Some Pathein University Teachers.

Theoretical Background

Studies on the important of different job characteristics consistently find that the nature of the work itself is a major determinant of job satisfaction. Several recent studies have attempted to identify the major dimensions of content and to see how elaborate study of this

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type was conducted by Hackman and Oldham (1975). They administered a questionnaire called the Job Diagnostic Survey to several hundred employees working in 62 different jobs. The following five “core dimension” were identified:

Skill variety - The degree to which a job requires a variety of different activities in carrying out the work, which involve the use of a number of different skills and talents of the employee.

Task identity- The degree to which the job requires completion of a “whole” and identifiable piece of work –that is, doing a job from beginning to with a visible outcome.

Task significance- The degree to which the job has a substantial impact on the lives or work of other people- whether in the immediate organization or in the external environment.

Autonomy – The degree to which the job provides substantial freedom, independence, and discretion to the employee in scheduling the work and in determining the procedures to be used in carrying it out.

Feedback from the job itself- The degree to which carrying out the work activities required by the job results in the employee obtaining direct and clear information about the effectiveness of his or her performance.

Each of these core dimensions involves some aspects of the job content that can affect an employee’s work satisfaction. The greater the variety of activities performed by an employee, the less boring the job will be. The most boring jobs are those in which the same simple actions must be repeated every few minutes, hundreds of times each day. The more a job involves the use of skills and talents relevant to the employees, self-identity, the more the employee can feel that he or she is performing meaningful work rather than simply” putting in time”.

Task identity and task significance also affect the experienced meaningfulness of the work. An employee who solders three connections on an electrical panel as it passes by on the assembly line is not likely to find the work very meaningful. The employee is not really “making” a television set, or even a significant component of a television set. On the other hand, an employee who assembles the entire finished product, or who makes an important component of the finished product, will experience a sense of completion and will probably perceive the work to be meaningful.

The amount of autonomy an employee has in the job and the degree to which the work provides objective performance feedback will determine how much opportunity there is for satisfaction of higher-order needs, such as achievement and independence. When an employee has no control over work procedures or work place, as on most mechanically paced assembly lines, there is little opportunity to experience the intrinsic satisfaction of successfully accomplishing a challenging task.

Several studies have found that pay is the job characteristic most likely to be a source of employee dissatisfaction. The higher the level of education and professionalism, the more likely it is that an employee will make social comparisons with persons outside the immediate organization but in the same profession. If an organization pays less than the going rate in the probably be dissatisfied with their pay.

Job satisfaction is the way an employee feels about his or her job. Employee satisfaction is affected by several aspects of the job, including pay, working conditions, supervision, co-workers, job content, job security, and opportunity for advancement . Job attitudes are determined jointly by job characteristics and employee characteristics .What an employee wants in a job will depend on the individual’s needs, values, and personality traits,

whether an employee will perceive current job conditions to be satisfactory will also depend on social comparisons, previous job conditions, and reference group influences.

Major theories of job satisfaction include the discrepancy theory, equity theory, social influence theory, and two-factors theory. Each of these theories is narrowly focused, and none of them has been conclusively supported in research studies.

(1) Discrepancy Theory

According to Locke(1969), satisfaction or dissatisfaction with some aspect of the job depends on the discrepancy between what a person perceives he/she is getting and what is desired. The “desired” amount of a job characteristic is defined as the minimum amount necessary to fulfill the person’s current needs. A person will be satisfied if there is no discrepancy between desired and actual considerations. A person will be dissatisfied if there is less than the desired amount of a job characteristic. The greater the discrepancy and the more important the thing desired, the greater will be dissatisfaction. Other variations of the discrepancy model of job satisfaction have been proposed. For example, Porter(1961) defined satisfaction as the difference between how much of something there “should be” and how much there “is now”. This conception is basically similar to Locke’s model, but Porter’s “should be” implies more emphasis on equity considerations and less on needs as the determinant of the preferred amount of a job factor. A study by Wanous and Lawler (1972) found that employees respond differently depending on how the discrepancy is defined. They conclude that people have more than one kind of feeling about their job, and no “one best way” exists to measure job satisfaction.

(2) Equity Theory

Equity theory specifies the conditions under which an employee will perceive the benefits and inducements in the job to be fair and reasonable. The theory was developed by Adams (1963), and it is a variation of earlier theories of social comparison processes. The principal components in equity theory are “input”, “outcome”, “comparison person”, and “equity-inequity”.

In any work situation, be it a classroom or an office, we assess both our inputs-how much effort we are putting into the work-and our outcomes-how much reward we are receiving for input and compare our ratio with what we perceive are the ratios of fellow students or co-workers.

Are we getting equal outcomes as a function of our inputs or are we getting less than other people? If we are getting less, a state of inequity exists. If we are getting the same, a state of equity exists.

(3) Social Influence Theory

Salancik and Pfeffer (1997, 1978) and others have questioned the validity of such complicated social comparison notions as equity theory in explaining job satisfaction. These authors also take issue with the basic need satisfaction model that forms the foundation of job enrichment approaches. Instead, they suggest that perhaps people decide how satisfied they are with their jobs by simply making observations about other employees’ satisfaction levels. This implies that an employee infers a level of his or her own satisfaction by merely seeing how coworkers behave and by listening to what they are saying about their jobs. That is, satisfaction may be more of a result of how one’s coworkers react to the job rather than of the job itself.

This theory of job satisfaction is interesting because it recognizes the social factors that influence employees' affective reactions at work. Apparently, one's co-workers have a greater influence on our satisfaction levels than we realize.

(4) Two- Factor Theory

The two-factor theory of job attitudes states that job satisfaction is qualitatively different from job dissatisfaction. According to the theory, job characteristics can be grouped into two categories, one called dissatisfies or hygiene factors and the other called satisfiers or motivations. The hygiene factors include such things as pay, supervision, interpersonal relations, working condition, job security and status.

A person will only be satisfied if there is an adequate amount of the job factors called satisfiers. Satisfiers are job characteristics that are relevant to a person's higher-order that is interesting and challenging, responsibility and opportunity for achievement, recognition and advancement.

Methodology

Purpose

This paper intended to study "Work Satisfaction" of Some Pathein University Teachers.

Participants

In this study, the total number of subjects were 100 (males 50 and females 50) art and science teachers from Pathein University. They are tutors, demonstrators, assistant lecturers and lecturers respectively. This paper focused on teachers in some department of Pathein University.

Instruments

A questionnaire containing (19) items are used in this study. Each item has two answers, Yes or No.

Procedure

Work satisfaction questionnaire which included 19 items was administered to all subjects. Before the test was administered to the subjects the test instruction was read to them. After reading, the subject can easily answer by choosing either Yes or No. This test does not have any time limit but almost all of the subjects took about 20 minutes to finish. Participants completed the questionnaire anonymously and were ensured for confidentiality. Then the responses of each subject were scored. Scoring can be easily done by calculating with percentage.

Results and Discussion

Results

Table (1) Showing the Percentage of Work Satisfaction for Sex

Sr. No	Question	Male		Female	
		Yes (%)	No (%)	Yes (%)	No (%)
1	The task of teaching is interesting.	100		100	
2	Satisfied in having to read a lot for preparation.	96	4	100	
3	Not satisfied to undertake invigilation duty.	16	84	12	88
4	Satisfied for doing work concerning with teaching.	100		96	4
5	Satisfied to conduct tutorial work.	96	4	96	4
6	Satisfied to attend departmental seminars.	100		96	4
7	Not satisfied with transfer.	4	96	16	84
8	Satisfied as the job is stable.	100		100	
9	This job will not improve my life.	4	96		100
10	Satisfied with the job as we can enjoy vacation.	84	16	64	36
11	Teaching in hot season is boring for me.	32	68	32	68
12	Satisfied as we will enjoy pension.	84	16	88	12
13	Dissatisfied because there is no financial, social support from this job.	8	92	8	92
14	Satisfied with the job as the job environment is pleasant.	100		88	12
15	I am satisfied with the job regardless of the low pay.	96	4	80	20
16	I am satisfied to have the chance to share my knowledge to the students.	100		96	4
17	Not satisfied for getting a few chance to go although I work hard for further studies.	20	80	24	76
18	Satisfied with the job for the recognition received for being hard working.	92	8	96	4
19	Satisfied for being able to show my ability at the paper reading sessions.	92	8	100	

In table(1), item no.(1)and (8) are (100%) answered Yes in both male and female. Item no. (5), (96%)answer Yes and (4%) answer No in both male and female. Item no.(2), (96%) answer Yes and (4%) answer No in the male and (100%) answer Yes in the female. Item no.(3), (16%) answer Yes and (84%) answer No in the male and (12%) answer Yes and (88%) answer No in the female. Item no.(4), (6) and (16) are (100%) answer Yes in the male and (96%) answer Yes and (4%) answer No in the female. Item no.(7),(4%) answer Yes and

(96%) answer No in the male and (16%) answer Yes and (84%) answer No in the female. Item no.(9), (4%) answer Yes and (96%) answer No in the male and (100%) answer Yes in the female. Item no.(10), (84%) answer Yes and (16%) answer No in the male and (64%) answer Yes and (36%) answer No in the female. Item no. (11),(32%) answer Yes and (68%) answer No in both male and female subjects. Item no.(12), (84%) answer Yes and (16%) answer No in the male and (88%) answer Yes and (12%) answer No in the female. Item no.(13), (8%) answer Yes and (92%) answer No in both male and female subjects. Item no.(14), (100%) answer Yes in the male and (88%) answer Yes and (12%) answer No in the female. Item no.(15), (96%) answer Yes and (4%) answer No in the male and (80%) answer Yes and (20%) answer No in the female. Item no. (17), (20%) answer Yes and (80%) answer No in the male and (24%) answer Yes and (76%) answer No in the female. Forboth items no.(18) and (19) ,(92%) answer Yes and (8%) answer No in the male subjects. Item no.(18), (96%) answer Yes and (4%) answer No in the female subjects. Item no. (19), all the females are answered (100%) Yes.

Table(2), Percentage of work satisfaction for rank

Sr	Questions	Lecturer		Assistant Lecturer		Tutor/ Demonstrator	
		Y(%)	N(%)	Y(%)	N(%)	Y(%)	N(%)
1	The task of teaching is interesting.	100		100		100	
2	Satisfied in having to read a lot for preparation.	100		100		96	4
3	Not satisfied to undertake invigilation duty.	10	90		100	23	77
4	Satisfied for doing work concerning with teaching.	100		100		96	4
5	Satisfied to conduct tutorial work.	90	10	100		100	
6	Satisfied to attend departmental seminars.	95	5	100		100	
7	Not satisfied with transfer.		100	12	88	18	82
8	Satisfied as the job is stable.	100		100		100	
9	This job will not improve my life.	5	95		100		100
10	Satisfied with the job as we can enjoy vacation.	80	20	88	12	63	37
11	Teaching in hot season is boring for me.	40	60		100	36	64
12	Satisfied as we will enjoy pension.	95	5	75	25	82	18
13	Dissatisfied because there is no financial, social support from this job.	10	90		100	10	90

	Satisfied with the job as the job					
14	environment is pleasant.	95	5	100	90	10
15	I am satisfied with the job regardless of the low pay.	95	5	75	25	86
16	I am satisfied to have the chance to share my knowledge to the students.	100		100	96	4
17	Not satisfied for getting a few chance to go although I work hard for further studies.	20	80		100	32
18	Satisfied with the job for the recognition received for being hard working.	95	5	100	90	10
19	Satisfied for being able to show my ability at the paper reading sessions.	100		100	90	10

In table(2) Y=Yes and N=No

In table(2), for all of the lecturers, item no.(1),(2),(4),(8),(16), and (19) , (100%) are answered Yes. Item no.(3) and (13) are (10%) answered Yes and (90%) answered No. Item no.(6),(12),(14),(15) and (18) are (95%) answered Yes and (5%) answered No. Item no.(5),(90%) answer Yes and (10%) answer No. Item no.(7), (100%) answer No. Item no.(9), (5%) answer Yes and (95%) answer No. Item no.(10), (80%) answer Yes and (20%) answer No. Item no.(11), (40%) answer Yes and (60%) answer No. Item no. (17), (20%) answer Yes and (80%) answer No.

In all of assistant lecturers, item no.(1),(2),(4),(5),(6),(8),(14),(16),(17),(18) and (19), are answered (100%) Yes. Item no.(3),(9),(11),and (13) are (100%) answered No. Item no.(7), (12%) answer Yes and (88%) answer No. Item no.(10), (88%) answer Yes and (12%) answer No. Item no. (12) and (15) are (75%) answered yes and (25%) answered No.

In tutors and demonstrators, item no.(1),(5),(6) and (8) are(100%) answered Yes. Item no.(2) and (16) are (95%) answered Yes and (5%) answered No. Item no.(3), (23%) answer Yes and (77%) answer No. Item no.(4), (96%) answer Yes and (4%) answer No. Item no. (7), (18%) answer Yes and (82%) answer No. Item no. (10), (64%) answer Yes and (36%) answer No. Item no.(11), (36%) answer Yes and (64%) answer No. Item no. (12), (82%) answer Yes and (18%) answer No. Item no.(13), (10%) answer yes and (90%) answer No. Item no. (14),(18) and (19) are (90%) answered Yes and (10%) answered No.

Discussion

According to the data analysis, in table (1), we can see that most of the male and female teachers are interested in their work and satisfied as the job is stable. Most of the teachers are satisfied for doing work concerning with teaching, departmental seminars and tutorial work. Some teachers in this study were dissatisfied for getting a few chance to go although I work hard for further studies. In addition, all of the teachers are satisfied for

having good working surrounding and sharing their knowledge to the students. Next, we can see that most of the teachers are dissatisfied as the job will not improve their life and there is no financial support from the job. Finally, they are satisfied with the job for the recognition received for being hard working and able to show their ability at the paper reading sessions.

In the table(2), we can show that all of the ranks are completely interested in their work and satisfied as the job is stable. A little subject is dissatisfied to undertake invigilation duty and the transfer. Most of the subjects are satisfied as they will enjoy pension.

Conclusion

The present study is to find out the work satisfaction in university teachers. The total number of participants were 100 teachers. They are males and females. A questionnaire was used and included 19 items. It is carried out that there is no significant differences between (50) males and (50) females, (40) lecturers, (20) assistant lecturers, (40)tutors and demonstrators. In the conclusion we can see that most of the subjects are satisfied with their work. From data analysis and discussion we found that all of the subjects are interested in their job. Most of the subjects are satisfied for having good working surrounding and sharing their knowledge to the students.

Limitations of the study

- (1) The sample of this study was confined to some teachers who are working in Pathein University and the teachers do not consists of all the teachers in Pathein University.
- (2) The sample size of this study was very small. So, the findings could not be generalized to all teachers in Pathein University.

Recommendation

This study should be replicated with all the teachers in Pathein University in order that the finding of the study should be generalized to all the teachers in Pathein University.

Acknowledgements

My sincere thanks go to Dr. Nyunt Phay, the Rector of Pathein University, Dr. Wai Wai Nyunt and Dr. Mi Mi Gyi Pro- Rectors, Pathein University for their permission to conduct this research paper.

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I am greatly indebted to Pathein University teachers participated in this study for their sincere cooperation. Finally, I would like to acknowledge my thanks to my friends for helping me in data collection for this study.

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Appendix

Male/Female -----

Rank -----

A Study on Work Satisfaction of Some Pathein University Teachers

Please read the following questions and mark a tick(✓) with what is true for you

Yes / No

1. The task of teaching is interesting.
2. Satisfied in having to read a lot for preparation.
3. Not satisfied to undertake invigilation duty.
4. Satisfied for doing work concerning with teaching.
5. Satisfied to conduct tutorial work.
6. Satisfied to attend departmental seminars.
7. Not satisfied with transfer.
8. Satisfied as the job is stable.
9. This job will not improve my life.
10. Satisfied with the job as we can enjoy vacation.
11. Teaching in hot season is boring for me.
12. Satisfied as we will enjoy pension.
13. Dissatisfied because there is no financial, social support from this job.
14. Satisfied with the job as the job environment is pleasant.
15. I am satisfied with the job regardless of the low pay.
16. I am satisfied to have the chance to share my knowledge to the students.
17. Not satisfied for getting a few chance to go although I work hard for further studies.
18. Satisfied with the job for the recognition received for being hard working.
19. Satisfied for being able to show my ability at the paper reading sessions.

The Relationship Between Personal Characteristics and Leader's Performance

George Ko Ko Naing¹

Abstract

This is an archival research that is based on reading the relevant books and the complied knowledge is prescribed in the paper. According to the findings of different researchers, management, decision-making, and oral communication skills were highly correlated with leadership effectiveness, and high-performance managers have a leadership motive pattern which is a high need for power and a low need for affiliation. Person oriented leaders tend to have satisfied employees whereas task oriented leaders tend to have productive employees, and leaders scoring high in both have satisfied in productive employees whereas leaders scoring low in both tend to have unhappy and unproductive employees.

Key words: trait, needs, leadership, orientation

Introduction

In contrast to leader emergence, which deals with the likelihood that a person will become a leader, leader performance involves the idea that excellent leaders possess certain characteristics that poor leaders do not. For example, an excellent leader might be intelligent, assertive, friendly, and independent, whereas a poor leader might be shy, aloof, and calm. Research on the relationship between personal characteristics and leader performance has concentrated on three areas: traits, needs, and orientation.

Theoretical Background

Traits

A meta-analysis by Youngjohn (1999) found that individual difference variables were reasonably good predictors of leadership performance. More specifically, individuals who were charismatic, dominant, energetic, and high in self-monitoring (people who constantly change their behaviors to meet the demands of the situation or the person with whom they are dealing) were more effective as leaders than were people scoring lower on these four traits. In another meta-analysis, Judge, Bono, Ilies, and Gerhardt (2002) found that extraversion, openness, agreeableness, and conscientiousness were positively related to leader performance and that neuroticism was negatively related to leader performance. The meta-analysis by Youngjohn also found that management, decision-making, and oral communication skills were highly correlated with leadership effectiveness.

The concept of self-monitoring is especially interesting as it focuses on what leaders do as opposed to what they are. For example, a high self-monitoring leader may possess that trait of shyness and not truly want to communicate with other people. She knows, however, that talking to others is an important part of her job, so she says hello to her employees when she arrives at work, and at least once a day stops and talks with each employee. Thus, our leader has the trait of shyness but adapts her outward behavior to appear to be outgoing and confident.

An interesting extension of the trait theory of leader performance suggests that certain traits are necessary requirements for leadership excellence but that they do not guarantee it (Simonton, 1987). Instead, leadership excellence is a function of the right person being in the

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right place at the right time. The fact that one person with certain traits becomes an excellent leader while another with the same traits flounders may be no more than the results of timing and chance.

For example, Lyndon Johnson and Martin Luther King, Jr. were considered successful leaders because of their strong influence on improving civil rights. Other people prior to the 1960s had the same thoughts, ambitions, and skills as King and Johnson, yet they did not become successful civil rights leaders, perhaps because the time was not right.

Needs

A personal characteristic that has received some support pertains to a leader's need for power, achievement, and affiliation. Research by McClelland and Burnham (1976) and McClelland and Boyatzis (1982) demonstrates that high-performance managers have a leadership motive pattern, which is a high need for power and a low need for affiliation. The need is not for personal power but for organizational power.

This pattern of needs is thought to be important because it implies that an effective leader should be concerned more with results than with being liked. Leaders who need to be liked by their subordinates will have a tough time making decisions. A decision to make employees work overtime, for example, may be necessary for the organization's survival, but it will probably be unpopular with employees. Leaders with high affiliation needs may decide that being liked is more important than being successful, causing conflict with their decision.

This theory would also explain why internal promotions often do not work. Consider, for example, a person who worked for 6 years as a loan officer. He and 10 coworkers often went drinking together after work and went away on weekends. The friendships and his need to be liked hindered the new manager when giving orders and disciplining his employees. When he tried to separate himself from his friends, he was quickly thought of as "being through good for his friends" a tough situation with no apparent solution, according to this theory.

This does not mean a leader should not be friendly and care about subordinates. But successful leaders will not place their need to be liked above the goals of the organization. President Richard Nixon was thought to have a high need for being liked. He would often make a tough decision and then apologize for it because he wanted to be liked by both the public and the press.

Needs for power, achievement, and affiliation can be measured through various psychological tests. The most commonly used is the Thematic Apperception Test (TAT), a projective test in which a person is shown a series of pictures and asked to tell a story about what is happening in each picture. A trained psychologist then analyzes the stories, identifying the needs themes contained within them. Obviously, this technique is time-consuming and requires a great deal of training.

Another commonly used measure is the Job Choice Exercise (JCE), developed by Stahl and Harrell (1982). With the JCE, the person reads descriptions of jobs that involve varying of power, achievement, and affiliation needs, and rates how desirable she finds each particular job. These ratings are then subjected to a complicated scoring procedure that uses regression analysis to reveal scores on the three need categories.

Another method to determine leaders' needs is to examine the themes that occur in their writing in speeches. In one interesting use of this method, it was found that presidents Franklin Roosevelt, Kennedy, and Reagan had high needs for power; Presidents Harding,

Trumai, and Nixon had high needs for affiliation; and Presidents Wilson, Hoover, and Carter had high needs for achievement (Winter, 1988)

Gender

As with leader emergence, meta-analysis suggests that the role of gender in leader effectiveness is complex. When all studies are combined, men and women appear not to differ in leadership effectiveness (Eagly, Karau, & Makihijani, 1995). However, men were more effective as leaders in situations traditionally defined in masculine terms and in situations in which the majority of subordinates were men. Women were more effective as a leader in situations traditionally defined in less masculine terms. In a large-scale study of leaders, women were more likely than men to engage in behaviors associated with high-quality leadership (Eagly & Johannesen-Schmidt, 2001).

Task Versus Person Orientation

Over the last 45 years, three major schools of thought- Ohio State Studies(Fleishman, Harris, & Burt, 1955), Theory X (McGregor, 1960), and Managerial Grid (Blake & Mouton, 1984)_ have postulated that differences in leader performance can be attributed to differences in the extent to which leaders are task versus person oriented. As shown in Exhibit 12.01, though the three schools of thought use different terms, they say similar things.

Person- oriented leaders, such as Country club leaders, Theory Y leaders, and leaders high in consideration, act in a warm and supportive manner and show concern for their subordinates. Persons oriented leaders believe that employees are intrinsically motivated, seek responsibility, are self- controlled and do not necessarily dislike work. Because of these assumptions, person oriented leaders consult their subordinates before making decisions, praise their work, ask about their families, do not look over their shoulder, and use a more “ hands-off” approach to leadership. Under pressure, person-oriented leaders tend to become socially withdrawn (Bond, 1995)

Task-oriented leaders, such as task- centered leaders, Theory X leaders and leaders high in initiating structure define and structure their own roles and those of their subordinate to attain the group’s formal goals. Task-oriented leaders see their employees as lazy, extrinsically motivated, wanting security, undisciplined, and shirking responsibility. Because of these assumptions, task-oriented leaders tend to manage or lead by giving directives, setting goals, and making decisions without consulting their subordinates. Under pressure, task-oriented leader become anxious, defensive, and dominate (Bond, 1995). Interestingly, task-oriented leaders tend to produce humor (e.g., tell jokes and stories) whereas person-oriented leaders tend to appreciate humor (e.g., listen to others’ jokes) (Philbrick , 1989). As shown in Exhibits 12.01 and 12.02, the best leaders (team) are both task and neither person oriented, whereas the worst are neither task nor person oriented. Some leaders have moderates among of orientation.

A leader’s task or person orientation can be measure by several instruments, two of which are: Leadership opinion questionnaire and the leader behavior description questionnaire. A meta-analysis by Eagly and Johnson indicated that in laboratory study, women were more likely to have a person orientation and less likely have task- orientation than that of men. They did not find any such difference in study that was conducted in actual organizations. They did, however, find small gender difference in that women were more likely to use a more participated approach and men were more likely to use a more autocratic approach.

Research on the consequences of using a task or person orientation has brought interesting findings. Person oriented leaders tend to have satisfied employees; whereas task

oriented leaders tend to have productive employees. Leaders scoring high in both have satisfied in productive employee, whereas leaders scoring low in both tend to have unhappy and unproductive employees.

These results certainly make sense, but the relationship between person and task orientation is properly more complex than was first thought. Several studies have shown that leader experience and knowledge such external variables as time pressure and work importance tend to moderate the relationship between person orientation scores and satisfaction scores and between task orientation scores and subordinate performance.

Conclusion

The meta-analysis by Youngjohn also found that management, decision-making, and oral communication skills were highly correlated with leadership effectiveness. Research by McClelland and Burnham (1976) and McClelland and Boyatzis (1982) demonstrates that high-performance managers have a leadership motive pattern, which is a high need for power and a low need for affiliation. The need is not for personal power but for organizational power. Person oriented leaders tend to have satisfied employees; whereas task oriented leaders tend to have productive employees. Leaders scoring high in both have satisfied in productive employee, whereas leaders scoring low in both tend to have unhappy and unproductive employees.

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My sincere thanks go to Dr. Nyunt Phay, the Rector of Pathein University, and Dr. Wai Wai Nyunt and Dr. Mi Mi Gyi, Pro- Rectors, Pathein University for their permission to do this research paper.

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Sovereign Rights and National Jurisdiction of the Coastal State Over the EEZ and the Continental Shelf

Theingi Aye¹

Abstract

United Nations Convention on the Law of the Sea, 1982 (LOSC) prescribed the Exclusive Economic Zone (EEZ) and the continental shelf involves the conservation and management of natural resources. In this sense, the EEZ and the continental shelf can be considered as a 'resource-oriented zone'. Owing to the increasing importance of marine natural resources, these zones are particularly important for coastal States. Presently the extension of the continental shelf to a limit of 200 nautical miles attracts particular attention. Therefore, the subjects of the coastal State jurisdiction over the EEZ and the continental shelf, the difference between territorial sovereignty and sovereign rights and the freedoms of all States in the EEZ, are the important matters.

Keywords: Coastal, Continental, Convention, Economic, Exclusive, Jurisdiction, Rights, Sea, Shelf, Sovereign, Zone

Introduction

The legal regimes governing the EEZ and the continental shelf are essentially a result of the aspiration of coastal States for their need to control offshore natural resources. The coastal State exercises sovereign rights over the EEZ and the continental shelf for the purpose of exploring and exploiting natural resources. Other States cannot explore and exploit these resources in the EEZ and the continental shelf without the consent of the coastal State. On the other hand, as the EEZ and the continental shelf are part of the ocean as a single unit, legitimate activities in these zones by third States, such as freedom of navigation, over flight and the laying of submarine cables and pipelines, must be secured. An essential question that arises as to how it is possible to reconcile the sovereign rights of the coastal States and the freedom of the seas exercised by other States in the EEZ and the continental shelf.

Legal Status of the EEZ

The EEZ is an area beyond and adjacent to the territorial sea, not extending beyond 200 nautical miles from the baseline of the territorial sea. The landward limit of the EEZ is the seaward limit of the territorial sea.² It is said that the 200-mile EEZ amounts 35-36 percent of the oceans as a whole. Seven leading beneficiaries of the EEZ are: the USA, France, Indonesia, New Zealand, Australia, Russia and Japan.³ The seaward limit of the EEZ is at a maximum of 200 nautical miles from the baseline of the territorial sea. Given that the maximum breadth of the territorial sea is 12 nautical miles, the maximum breadth of the EEZ is 188 nautical miles, that is to say, approximately 370 kilometres. The outer limit lines of the EEZ and the delimitation lines shall be shown on charts of a scale or scales adequate for ascertaining their position. Where appropriate, lists of geographical coordinates of points may also be substituted for such outer limit lines or delimitation lines pursuant to Article 75 (1) of the LOSC. The coastal State is also obliged to give due publicity to such charts or list of

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² LOSC, Articles 55 and 57.

³ Churchill and Lowe, Law of the Sea, p. 178.

geographical coordinates and shall deposit a copy of each such chart or list with the UN Secretary-General under Article 75(2),¹

Sovereign Rights of the Coastal State over the EEZ

The coastal State jurisdiction over the EEZ is Article 56 of the LOSC. The first paragraph of Article 56 provides as follows:

In the exclusive economic zone, the coastal State has:

- (a) sovereign rights for the purpose of exploring and exploiting, conserving and managing the natural resources, whether living or non-living, of the waters superjacent to the seabed and of the seabed and its subsoil, and with regard to other activities for the economic exploitation and exploration of the zone, such as the production of energy from the water, currents and winds.

It is important to note that the sovereign rights of the coastal State over the EEZ are essentially limited to economic exploration and exploitation. In this respect, the concept of sovereign rights must be distinguished from territorial sovereignty, which is comprehensive unless international law provides otherwise.

The concept of sovereign rights can also be seen in the 1958 Geneva Convention on the Continental Shelf. Article 2(2) of the Geneva Convention provides that:

The rights referred to in paragraph 1 of this Article [sovereign rights] are exclusive in the sense that if the coastal State does not explore the continental shelf or exploit its natural resources, no one may undertake these activities, or make a claim to the continental shelf, without the express consent of the coastal State.

The sovereign rights in the EEZ are essentially exclusive in the sense that no one may undertake these activities or make a claim to the EEZ, without the express consent of the coastal State. It is true that third States have the right of access to natural resources in the EEZ.² Considering that the exercise of the right is conditional upon agreement with the coastal State, however, it does not challenge the exclusive nature of the coastal State's jurisdiction over the EEZ.³

With respect to matters provided by the law, the coastal State exercise both legislative and enforcement jurisdiction in the EEZ. In this respect, the key provision is Article 73 (1):

The coastal State may, in the exercise of its sovereign rights to explore, exploit, conserve and manage the living resources in the exclusive economic zone, take such measures, including boarding, inspection, arrest and judicial proceedings, as may be necessary to ensure compliance with the laws and regulations adopted by it in conformity with this Convention.

Whilst this provision provides the enforcement jurisdiction for the coastal State, the reference to 'the laws and regulations by it' seems to suggest that the State also has legislative jurisdiction. In fact, Article 62(4) prescribes specific contents of the laws and regulations of coastal States with regard to fishing of nationals of other States in the EEZ. Article 73(1) makes no reference to confiscation of vessels. However, ITLOS took the view that this provision may encompass confiscation of vessels in the EEZ.⁴

¹ Yoshifumi Tanaka, *The International Law of the Sea*, 2nd Edi., Cambridge University Press, 2015, pg. 129.

² LOSC, Articles 62(2), 69 and 70.

³ B. Kwiatkowska, *The 200 Mile Exclusive Economic Zone in the New Law of the Sea* (Dordrecht, Nijhoff, 1989), p. 15.

⁴ The M/V/Virginia G case, ITLOS Case No. 19, 14 April 2014, para. 257.

It is beyond serious doubt that the measures provided under Article 73(1) can be applied to foreign vessels within the EEZ. This is clear from Article 73(4), which provides that:

In cases of arrest or detention of foreign vessels, the coastal State shall promptly notify the flag State, through appropriate channels, of the action taken and of any penalties subsequently imposed.

Thus a coastal State jurisdiction within its EEZ contains no limit *ratione personae*. Overall the sovereign rights of the coastal State in its EEZ can be summarized as follows:

- (i) The sovereign rights of the coastal State can be exercised solely within the EEZ. In this sense, such rights are spatial in nature.
- (ii) The sovereign rights of the coastal State are limited to the matters defined by international law (limitation *ratione materiae*). On this point, sovereign rights must be distinguished from territorial sovereignty.
- (iii) However, concerning matters defined by international law, the coastal State may exercise both legislative and enforcement jurisdiction.
- (iv) The coastal-State may exercise sovereign rights over all people regardless of their nationality within the EEZ. Thus the sovereign rights contain no limit *ratione personae*. In this respect, sovereign rights over the EEZ differ from personal jurisdiction.
- (v) The sovereign rights of the coastal State over the EEZ are exclusive in the sense that other States cannot engage upon activities in the EEZ without consent of the coastal State.

In short, unlike territorial sovereignty, the sovereign rights of the coastal State over the EEZ lack comprehensiveness of material scope. With respect to matters accepted by international law, however, the coastal State can exercise both legislative and enforcement jurisdiction over all people within the EEZ in an exclusive manner. The essential point is that the rights of the coastal State over the EEZ are spatial in the sense that they can be exercised solely within the particular space in question regardless of the nationality of persons or vessels. Thus the coastal State jurisdiction over the EEZ can be regarded as a spatial jurisdiction. Due to the lack of comprehensiveness of material scope, this jurisdiction should be called a limited spatial jurisdiction.

National Jurisdiction of the Coastal State over the EEZ

Under Article 56(1) (b) of the LOSC, the coastal State possesses jurisdiction over matters other than the exploration and exploitation of marine nature resources, namely (i) the establishment and use of artificial islands, installations and structures, (ii) marine scientific research, and (iii) the protection and preservation of the marine environment. The coastal State also has other rights and duties provided for in this Convention (Article 56 (1) (c)). The coastal State jurisdiction with regard to these matters requires some comments.

Concerning the coastal State jurisdiction over artificial islands. Article 60 stipulates that:

1. In the exclusive economic zone, the coastal State shall have the exclusive right to construct and to authorize and regulate the construction, operation and use of

(a) artificial islands:

(b) installations and structures for the purposes provided for in article 56 and other economic purposes:

(c) installations and structures which may interfere with the exercise of the rights of the coastal State in the zone.

2. The coastal State shall have exclusive jurisdiction over such artificial islands, installations and structures, including jurisdiction with regard to customs, fiscal, health, safety and immigration laws and regulations.

At the same time, the rights of the coastal State on this matter are subject to certain obligations. Under Article 60(3), due notice must be given of the construction of such artificial islands, installations and structures, and permanent means for giving warning of their presence must be maintained. Any installations or structures which are abandoned or disused must be removed to ensure safety of navigation. Under Article 60(7), the coastal State may not establish artificial islands, installations and structures and the safety zones around them 'where interference may be caused to the use of recognized sea lanes essential to international navigation'.

It is clear that the coastal State has exclusive jurisdiction, including both legislative and enforcement jurisdiction, over installations and structures for economic purposes by virtue of Article 60. On the other hand, a question arises whether or not the coastal State also has the jurisdiction to authorize and to regulate the construction and use of installations and structures for non-economic purposes, such as military purposes. It appears that State practice is not uniform on this particular matter. When ratifying the LOSC, Brazil, Cape Verde and Uruguay made declarations claiming that the coastal State has the exclusive right to authorize and regulate the construction and use of all kinds of installations and structures, without exception, whatever their nature or purpose.¹ By contrast, when ratifying the LOSC, Germany, Italy, the Netherlands and the United Kingdom declared that the coastal State enjoys the right to authorize, construct, operate and use only those installations and structures which have economic purposes.² Whilst this is a debatable issue, the preferable view appears to be that a dispute falls within the scope of Article 59 because the LOSC does not explicitly attribute rights or jurisdiction in this matter to a coastal State or to other States.³

As noted, Article 56(1) (b) (ii) of the LOSC makes clear that the coastal State has jurisdiction with regard to marine scientific research in the EEZ. In relation to this, Article 246(1) stipulates that:

Coastal States, in the exercise of their jurisdiction, have the right to regulate, authorize and conduct marine scientific research in their exclusive economic zone and on their continental shelf in accordance with the relevant provisions of this Convention.

Marine scientific research in the EEZ and on the continental shelf is to be conducted with the consent of the coastal State in conformity with Article 246(2).

It is clear from Article 56(1) (b) (iii) that in the EEZ, the coastal State has legislative and enforcement jurisdiction with regard to the protection and preservation of the marine environment. Further to this, Articles 210(1) and 211(5) provide legislative jurisdiction of the

¹ A. V. Lowe and S. A. G. Talmon (eds.), *The Legal Order of the Oceans: Basic Documents on the Law of the Sea* (Oxford, Hart Publishing, 2009), pp. 915, 917 and 967.

² Churchill, "The Impact of State Practice", p. 136.

³ A. V. Lowe, "Some Legal Problems Arising from the Use of the Seas for Military Purposes" (1986) 10 *Marine Policy* p. 180.

coastal State concerning the regulation of dumping and vessel-source pollution. Moreover, Articles 210(2) and 220 contain enforcement jurisdiction of the coastal State with regard to the regulation of dumping and ship-borne pollution.

Scope of the Continental Shelf

The landward limit of the continental shelf in the legal sense is the seaward limit of the territorial sea. In this respect, Article 1 of the Convention on the Continental Shelf stipulates that the continental shelf is the seabed and subsoil of the submarine areas adjacent to the coast but outside the area of the territorial sea. Similarly, Article 76(1) of the LOSC stipulates that 'the continental shelf of a coastal State comprises the seabed and subsoil of the submarine areas that extend beyond its territorial sea'. It follows that the continental shelf in a legal sense does not include the seabed of the territorial sea.

Sovereign Rights of the Coastal State over the Continental Shelf

The coastal State exercise sovereign rights over the continental shelf for the purpose of exploring and exploiting its natural resources in accordance with Article 77(1). The principal features of the sovereign rights can be summarized in six points:

- (i) The sovereign rights of the coastal State over the continental shelf are inherent rights, and do not depend on occupation, effective or notional, or on any express proclamation.
- (ii) The sovereign rights of the coastal State relate to the exploration and exploitation of natural resources on the continental shelf. Non-natural resources are not included in the ambit of sovereign rights of the coastal State even if they are found on the continental shelf. For instance, wrecks lying on the shelf do not fall within the ambit of the sovereign rights over the continental shelf.¹ The sovereign rights are thus characterized by the lack of comprehensiveness of material scope. On this point, the sovereign rights must be distinguished from territorial sovereignty.
- (iii) The natural resources basically consist of the mineral and other non-living resources of the seabed and subsoil. However, exceptionally, sedentary species are also included in natural resources on the continental shelf. Under Article 77(4), the sedentary species are organisms which, at the harvestable stage, either are immobile on or under the seabed or are unable to move except in constant physical contact with the seabed or the subsoil. Examples include oysters, clams and abalone. Yet it is debatable whether crabs and lobster fall within the category of sedentary species.² Where the coastal State established the EEZ, that State has the sovereign rights to explore and exploit all marine living resources on the seabed in the zone.
- (iv) Although there is no provision like Article 73(1) there seems to be a general sense that the sovereign rights include legislative and enforcement jurisdiction with a view to exploring and exploiting natural resources on the continental shelf. In fact, Article 111(2) stipulates that:

The right of hot pursuit shall apply *mutatis mutandis* to violations in the exclusive economic zone or on the continental shelf, including safety zones around continental shelf installations, of the laws and regulations of the coastal State applicable in accordance with this Convention to the exclusive economic zone or the continental shelf, including such safety zones.

¹ Churchill and Lowe, *Law of the Sea*, p. 152.

² *Ibid*, p. 151.

This provision appears to suggest that the coastal State has legislative and enforcement jurisdiction with respect to the continental shelf.

- (v) The sovereign rights of the coastal State are exercisable over all people or vessels regardless of their nationalities. Thus there is no limit concerning personal scope.
- (vi) The rights are exclusive in the sense that if the coastal State does not explore the continental shelf or exploit its natural resources, no one may undertake these activities without the express consent of the coastal State.¹ At the same time, the exercise of the rights of the coastal State over the continental shelf must not infringe or result in any unjustifiable interference with navigation and other rights and freedoms of other States as provided for in the LOSC.

Overall sovereign rights of the coastal State over the continental shelf are limited to certain matters provided by international law. With respect to matters provided by international law, however, the coastal State may exercise legislative and enforcement jurisdiction over all peoples regardless of their nationalities in an exclusive manner. In essence, rights over the continental shelf are spatial in the sense that they can be exercised solely within the particular space in question regardless of the nationality of persons or vessels. Hence, like the EEZ, the sovereign rights of the coastal State over the continental shelf can also be regarded as a limited spatial jurisdiction.

National Jurisdiction of the Coastal State over the Continental Shelf

The coastal State has jurisdiction with regard to artificial islands, marine scientific research, dumping and other purposes. Relevant provisions can be summarized as follows:

First, under Article 80 of the LOSC, Article 60 concerning the coastal State's jurisdiction over artificial islands is applied to the continental shelf. It follows that on the continental shelf, the coastal State has exclusive rights to construct and to authorize and regulate the construction, operation and use of (a) artificial islands, (b) installations and structures for the purposes provided for in Article 56 and other economic purposes, and (c) installations and structures which may interfere with the exercise of the rights of the coastal State in the zone. The coastal State also has exclusive jurisdiction over such artificial islands, installations and structures, including jurisdiction with regard to customs, fiscal, health, safety and immigration laws and regulations.

Second, on the continental shelf, the coastal State has jurisdiction with regard to marine scientific research in accordance with Articles 56(1) (b) (ii) and 246 (1) of the LOSC. Article 246 (2) makes clear that marine scientific research in the EEZ and on the continental shelf shall be conducted with the consent of the coastal State. However, with regard to the continental shelf beyond 200 nautical miles, the discretion of the coastal State is limited by Article 246(6), the first sentence of which provides as follows:

Notwithstanding the provisions of paragraph 5, coastal States may not exercise their discretion to withhold consent, in respect of marine scientific research projects to be undertaken on the continental shelf, beyond 200 nautical miles from the baselines from which the breadth of the territorial sea is measured, outside those specific areas which coastal States may at any time publicly designate as area in which exploitation or detailed exploratory operations focused on those areas are occurring or within a reasonable period of time.

At the same time, this provision seems to suggest that within 'those specific areas in which exploitation or detailed exploratory operations focused on those areas are occurring or

¹ LOSC, Article 77(2); Article 2(2) of the Geneva Convention on the Continental Shelf.

will occur within a reasonable period of time', the coastal States may exercise their discretion to withhold consent if, as provided in Article 246(5) (a), a research project is of direct significance for the exploration and exploitation of natural resources. Furthermore, the restriction in Article 246(6) does not apply to the withdrawal of consent relating to marine scientific research on the basis of Article 246(5) (b)-(d).

Third, Article 210 (5) of the LOSC makes clear that the coastal State has the right to permit, regulate and control dumping on the continental shelf. At the same time, the coastal State has enforcement jurisdiction with respect to pollution by dumping on the continental shelf.

Finally, Article 81 provides that: 'The coastal State shall have the exclusive rights to authorize and regulate drilling on the continental shelf for all purposes'. The phrase, 'for all purposes', seems to suggest that the exclusive rights of the coastal State concerning drilling on the continental shelf are not limited to the purposes of exploration and exploitation of natural resources.

Conclusion

The coastal State exercises sovereign rights over the EEZ and the continental shelf for the purpose of exploring and exploiting the natural resources there. The sovereign rights are limited to the matters defined by international law. Thus the sovereign rights must be distinct from territorial sovereignty in the sense that such rights lack the comprehensiveness of material scope.

Concerning matters provided by international law, in the EEZ and the continental shelf, the coastal State may exercise legislative and enforcement jurisdiction over all peoples regardless of their nationalities in an exclusive manner. Furthermore, like territorial sovereignty, sovereign rights over the EEZ and the continental shelf are essentially spatial because they can be exercised only within the specific space concerned. Hence, it is argued that the sovereign rights of the coastal State can be considered as a sort of spatial jurisdiction, namely, limited spatial jurisdiction.

In the EEZ, all States enjoy freedoms of navigation, overflight and the laying of submarine cables and pipelines. In exercising these freedoms, however, States must have due regard to the rights and duties of the coastal State under Article 58(3) of the LOSC. To this extent, freedoms of the seas in the EEZ may be qualified by coastal State jurisdiction.

If an international dispute arises with regard to a matter where the LOSC does not specify which States are to have jurisdiction, such a dispute should be resolved on the basis of equality and in the light of all the relevant circumstances in accordance with Article 56 of the LOSC. This provision contains no presumption in favour of either the coastal State or other States.

The outer limit of the continental shelf beyond 200 nautical miles is to be determined by the criteria enshrined in Article 76 of the LOSC, namely, the sedimentary thickness test and the fixed distance (60 nautical miles) test. The coastal State is required to submit information with regard to the outer limits of the continental shelf beyond 200 nautical miles to the CLCS. On the basis of the recommendations of the CLCS, that State is to establish the outer limits of its continental shelf. Whilst the extension of the continental shelf beyond 200 nautical miles attracts growing attention between States, such a claim may create a difficult issue with regard to the delimitation of overlapping shelves between two or more coastal States.

The institution of the EEZ and the continental shelf rests on a balance between the rights of the coastal State on the basis of the principle of sovereignty and the right of other States according to the principle of freedom. Nonetheless, it is likely that the coastal State will attempt to extend its jurisdiction over matters which do not clearly fall within the rights of the State. The increasing influence of the coastal State may entail the risk of promoting 'territorialisation' of the EEZ.

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Study on Laws and Procedures Related to the Child Offenders in Myanmar

Tin Soe Soe Than¹

Abstract

In Penal Code of the Republic of the Union of Myanmar, the provision in dealing with the general exception is laid down in sections 76 to 106. A child offender is an exempt from criminal liability because the Court must take consideration in circumstances of the case that the child has attained or not attained sufficient maturity of understanding to judge of the nature and consequences of his conduct on that occasion. In addition, The Child Law The State Law & Order Restoration Council Law No.9 of 1993 was promulgated on 14th July 1993. Therefore the Juvenile Court shall follow sections 41,42,43,44,45,46,47,48,49, of the Child Law 1993 in the trial of child offenders and young offenders.

Key words: Child, Penal Code, The Child Law, Juvenile Court.

Introduction

Under Section 3 of the Majority Act, every person shall be deemed to have attained his majority when he shall have completed the age of eighteen years and not before. In the Child Law of Myanmar 1993, child is defined as a person who has not attained 16 (sixteen) years of age and youth as person who has attained 16 (sixteen) years of age but has not attained 18 (eighteen) years of age. At Common Law, a person who has not reached the age of fourteen, though the age now varies from jurisdiction to jurisdiction or a boy or girl, a young person, or a son or daughter, or a baby or fetus. According to the Penal Code, nothing is an offence which is done by a child under seven years of age. In The Child Law states that nothing is an offence which is done by a child under seven years of age and under twelve, who has not attained sufficient maturity of understanding to judge the nature and consequences of his conduct on that occasion is exempted from penal action.

Section 82 of the Penal Code of Myanmar

According to the Penal Code, nothing is an offence which is done by a child under seven years of age.²

Under the age of seven years no infant can be guilty of a crime, for under that age an infant is, by presumption of law, and cannot be endowed with any discretion. He cannot distinguish right from wrong. If the accused were a child under seven years of age, the proof of that fact would be *ipso facto* an answer to the prosecution.

Related Cases

In the case of the **King v Ba Ba Sein**,³ against children, however young, being registered owners of motor vehicles, even of hired motor vehicle cannot be convicted of the offence of playing a bus for hire without a licence. The immunity of children under seven years of age from criminal liability is not confined to offences under the Penal Code only, but extend to offences under any special or local law, unless a particular Act has special provisions to the contrary. Section 40 of the Penal Code governs section 82 of the Code

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² Section 82, the Penal Code (Myanmar) 1861.

³ 1938 R.L.R 227.

section 82 is in Chapter IV of the Penal Code, the word ‘offence’ denotes a thing punishable under this Code, or under any special or local law.

In the case of **The Union of Myanmar v Maung Tin Cho**,¹ Penal Code a child under 7 years of age cannot be guilty of an offence, and the offence contemplated there in not only includes an offences under the Penal Code but also an offence made punishable under Special or Local Law as laid down in section 4 of the Penal Code.

In the case of the **The Union of Myanmar v Rashin**,² the respondent, a child of six years of age was convicted under S.112, Railways Act. Held that S.82 of the Penal Code declared that nothing is an offence which is done by a child under seven years of age and although S.130 of the Railways Act suspends the operation of Ss. 82 and 83 of the Penal Code in respect of Ss.126 to 129 of the Railways Act, S.130 of the Railways Act has no effect upon offences committed under S.112 of the Railways Act and held that the immunity of children under 7 years of age from criminal liability extends to offences under any Special or Local Law. The conviction is bad in law and is set aside.

Section 83 of the Penal Code of Myanmar

The Penal Code provided that nothing is an offence which is done by a child above seven years of age and under twelve, who has not attained sufficient maturity of understanding to judge of the nature and consequence of his conduct on that occasion.³

In construing the section 83 the capacity of doing that which is wrong is not so much to be measured by years, as by the strength of the offender’s understanding and judgment. What the section contemplates is that the child should not know the natural and physical consequences of his conduct.⁴

According to this provision a child above seven years of age but under twelve years is also not guilty of an offence if his maturity of understanding is not up to the level to judge of the nature and consequences of his conduct on that occasion. The level of such a child’s maturity of understanding is to be judged by the Court taking into consideration the facts and circumstances of the case.

Related Cases

In case of **ULL a Mahapatra**,⁵ where the accused, a boy over eleven years but below twelve years of age, picked up his knife and advanced towards the deceased with a threatening gesture, saying that he would cut him to bits and did actually cut him, his entire action can only lead to one inference namely that he did what he intended to do and that he knows all the time that a blow inflicted with a knife would effectuate his intention. The boy was sentenced to transportation for life. The High Court confirmed his conviction, but sends him to a Reformatory School for five years.

In case of **TatiaMhadev**,⁶ the accused took a girl of six years to his room where he made her lie down and he lay on her. The girl immediately screamed and run away. For this act the accused was convicted and sentenced by the Magistrate, under section 352 and not under this section on the ground that the girl was too young to have any modesty. It was held

¹ 1954 B.L.R (H.C) 257.

² 1955 B.L.R (H.C) 304.

³ Section 83, the Penal Code (Myanmar) 1861.

⁴ Rantanlal and Dhirajlal’s, Law of Crime, 1860, p.276.

⁵ 1950 culta cut 293.

⁶ (1912) 14 Bom L.R 961.

that the act of the accused was punishable under section 354. For the girl though young, was a 'woman' as defined by section 10.

In **A v DPP**,¹ a boy of eleven years of age picked up a brick, threw the brick at a police vehicle, and run away, the Court concluded that the boy running away itself was not enough to prove that the boy knew he was committing criminal activity as the situation could also be interpreted as a naughty child running away from a teacher even when the naughty child has not committed criminal activity.

In **Krishna**,² related to theft, a child younger than twelve, but older than seven who commits a theft and then turns around and sells the stolen property, the child does not fit into this section 83 as the understanding of selling the stolen property is enough to show a sufficient level of maturity.

In **Goldi**,³ where a child of ten years married again during the lifetime of her husband, the marriage being negotiated and caused to be performed by her mother, the child was held not to have attained sufficient maturity of understanding to judge of the nature and consequences of her conduct on the occasion of the second marriage.

Section 520 of the Courts Manual

Section 520 of the Courts Manual provided about bond of minor, in all cases when a minor is required to execute a bond, a bond executed by a surety or sureties only may be accepted instead. When the bond is for the appearance of a person before a Court, that Court only may declare that the bond has been forfeited.⁴

About Child Offenders

The Child Law The State Law & Order Restoration Council Law No.9 of 1993 was promulgated on 14th July 1993. The Young Offenders Act of 1939 and The Children Act of 1955 were replaced by this law. Therefore the Juvenile Courts shall follow the provisions The Child Law of 1993 in the trial of child offenders and young offenders.⁵ In The Child Law child is defined as a person who has not attained 16 (sixteen) years of age and youth as person who has attained 16 (sixteen) years of age but has not attained 18 (eighteen) years of age. Therefore the Juvenile Court shall follow the provisions of sections 41,42,43,44,45,46,47,48,49, of the Child Law 1993.⁶

It is instructed to follow the provisions S.28 and the section provisions as follows:-

"Nothing is an offence which is done by a child under seven years of age." "Nothing is an offence which is done by a child above seven years of age and under twelve, who has not attained sufficient nationality of understanding to judge of the nature and consequences of his conduct on that occasion."⁷

The trial and conviction of Child Offenders

The Juvenile Court

(a) On receipt of a juvenile case shall scrutinize supporting evidence in respect of the age of the child and determine whether a child or not on the British

¹ 1991 COD 442 (DC).

² (1883) 6 Mad 373.

³ (1896) Cr .R No.55 of 1896, UnrepCr.C 876.

⁴ The Courts Manual, Volume 1, Fourth edition, published by Supreme Court, 1999, pp .316-317.

⁵ Section 743 of the Courts Manual.

⁶ Section 744 of the Courts Manual.

⁷ Section 745 of the Courts Manual.

Certificate, National Identity Card, Foreigner's Registration certificate, true extract of the school substantial evidence, submitted with the case.

(b) Shall have jurisdiction in respect of a child who has not attained age of sixteen years at the time of the commission of the offence and shall proceed with the trial after recording the decision that offender is a child.

(c) During the trial the child on the execution of a bond shall be released or entrust to the care of parents or guardians with certain conditions or temporary care station for child welfare or other suitable place with certain conditions. Under no reason remand shall be ordered.

(d) Pending the trial even if the child attains sixteen years of age he shall be deemed to be a child and passed order under this Law.

(e) Shall try juvenile offences punishable with death or transportation or imprisonment for a term exceeding 3 years in the manner in which a warrant case is tried.

(f) Shall try juvenile offences other than the type of offences in sub-section (e) in the manner in which a summons case to be tried.¹

Related Cases

AungKo Min and 3 others& Republic of the Union of Myanmar Vs

Republic of the Union of Myanmar &AungKo Min and 3 others²

In this case, the District Court did not review and consider upon the final application relating to the offender Myo Min Thu's age. That fact became the default of the District Court. So, after the final Appeal Court had been investigated the appellant Myo Min Thu's age, it had been held and instructed according to S.375 of the Criminal Procedure Code to resubmit the approved death penalty 22/2011.

The Republic of the Union of Myanmar Vs Aye Not³

In this case, the final Appeal Court accepted the appeal and it has been repealed Section 376 of the District Court's decision. In addition, the Court held that the offender was sentenced four years imprisonment under Section 376/511 of the Penal Code. He did not have any relief because he was a convicted person.

Binding facts upon Juvenile Court in juvenile cases

The Juvenile Court shall abide by the following in trying juvenile cases:-

(a) Shall try the case in a Separate Court or building or if there is no Separate Court or building in a building or room other than that in which the ordinary sittings of the court are held.

(b) No person other than the parents, guardians, staff of the Court, Law Officers, members of the Myanmar Police Force on duty and not in uniform, persons directly concerned with the case and persons who have been granted permission by the Juvenile Court shall be present at the place of trial;

¹ Section 746 of the Courts Manual.

² 2011, M L R 133.

³ 2009, M L R 48.

- (c) If the child or his parents or guardians cannot or do not wish to engage a lawyer and makes an application to be defended with the assistance of to do so;
- (d) Shall make available the service of an interpreter if necessary.
- (e) Shall dispose of the speedily.¹

Power of Juvenile Court

The Juvenile Court has the following powers in respect of the trial of juvenile Cases;

- (a) may direct anyone who is present at the place of trial including the child to leave court house at any time during the trial if it is considered it is necessary in the interest of the child. If necessary is may cause to use of force in so directing to leave the Court house.
- (b) may try the case in the inquiry or trial of the case if it is considered that the presence of the accused is not necessary.
- (c) may direct the parents or guardians in whose custody and care child is at present to attend everyday on which the sittings of the Courts are held.
- (d) may allow the interesting and announcing of information regarding the identity of the child who is accused of committing on offence or who is a witness in any case, in the Radio, Television, Newspapers, Magazines, Journals and publications and displaying and making use of photograph of the child if it is believed to be of benefit to the child.
- (e) may direct the relevant probation affair to make inquiries and to submit a report of the personal history, character, conduct, behavior and environmental circumstances of the child and his parents or guardians.
- (f) may, if it is considered appropriate inform the child or his parents or guardian of gist of the report submitted by the probation officer under sub-section (e) of section 43 of the law.²

The Juvenile court shall, before passing an order of a child who is found guilty, take into consideration the followings and pass an order which is reformatory and which will be beneficial to the child:

- (a) the age and character of the child
- (b) the environment circumstances of the child
- (c) the main course of committing the offence.
- (d) the report submitted by the Probation officer
- (e) other circumstances and facts which are required to be taken into consideration in the interest of the child.³

Notwithstanding anything contained in any existing law, a death sentence, transportation for life or a sentence of whipping shall not be passed on any child.⁴

A child shall not ordinarily be sentenced to imprisonment. Only if the Juvenile court is satisfied that the child has committed on offence punishable with death or transportation for life under any existing law or that the child is of so unruly or depraved a character or

¹ Section 747 of the Courts Manual.

² Section 748 of the Courts Manual.

³ Section 749 of the Courts Manual.

⁴ Section 750 of the Courts Manual.

absolutely uncontrollable, he shall be sentenced to imprisonment. Such sentence of imprisonment shall not exceed a term of seven years.¹

The Juvenile court may pass only of the following orders in respect of a child who should not be sentenced to imprisonment.

(a) If the offence committed is not serious and the character of the child is not yet perverted;

(1) May release him after due admonition;

(2) May imposed a fine if he has attained the

age fourteen years and has income. If he is a child who has not income a fine may be impressed on his parents or guardians;

(b) whether the offence committed is serious or not

if the character of the child is not yet perverted and in order to deter further commission of offence such a child shall be entrusted to the custody of his parents or guardians on execution of a bond for good behavior for a period not exceeding three years.

(c) may cause the child to submit to the supervision

and management of Probation officer for a period not exceeding three years.

(d) whether the offence committed is serious or not or if the child is of perverted character or if the child is not yet perverted but has no parents or guardians or even if the child has parents or guardians but they are not in a position to admonish and take care of the child, may commit such child to the custody of any training school for a minimum term of two years or till he attains the age of eighteen years as a maximum term;²

Related case

Daw Yin Myint Vs the Union Of Myanmar and two others³

The Final Appeal Court held that a guardian U Khin Mg Aye was sentenced the fine 1000ks under Section 47 (A) (2) of the Child Law and Section 48 (A) of that Law must be paid 35000ks to the aggrieved person Daw Yin Myint. That amount of fine and compensation must be paid to the original Court.

The Juvenile court may-

(a) in addition to the sentence of imprisonment passed under Sec 46 or passed under section 47 of

(b) if the following conditions are fulfilled pass an amending order to entrust a child who complied with the order passed under section 47 (c) or (d) for at least one year to the custody of his parents or guardians concerned with or without a bond

(1) improvement in the moral character of the child

(2) being a child who has parents or guardian;

(3)not being an offence under Narcotic Drugs and Psychotropic Substances Law;

¹Section 751 of the Courts Manual.

² Section 752 of the Courts Manual.

³1999 M L R 71.

(c) exercise the power mentioned in Sec 48 (b) on the application of the Principal of the training school concerned, Probation Officer or parents or guardians;

(1) There shall be right of appeal or right of revision against the order or decision passed in accordance with the provisions of the Criminal Procedure Code.

(2) If a sentence of imprisonment is passed on the child by a Juvenile or an Appellate Court or a court of Revision a copy of the sentence shall be sent to the Ministry.¹

As the Ministry of Social Welfare, Relief and Resettlement informed the Supreme Court by its letter no. 2160/sa.27/law/2-3/91. The Supreme Court redirect the Township Court to send the children who committed the offence to the different types of training schools mentioned below:-

(a) Boys under twelve years of age to Youth Training School at No. 114 (B) Inya Road, Yangon:

(b) Boys above twelve years of age to Youth Training School, Hnget-Au-San Village, Yangon Division:

(c) Boys above twelve years of age who committed petty crimes to Training School at N0.64, Kaba-aye-zedi Road at Myaukpin, Mandalay and at Khangyi ward, Mawlamyaing.

(d) Girls shall be sent to Training School for Girls at No.49, Malikka Street, Yangon and Training School for girls at the corner of 30th and 64th street, Mandalay.²

Section 52 of the Child Law contains provisions with regard to custody and care of Children and Youths in prisons. The Jail Department has made arrangements for the separate admittance and receptacles of child prisoners and youth prisoners so as to enable to put all the such prisoners at Meiktila Jail alone. The Jail Department has under its letter No. 1001/1/2/U Sa. Dated 16-2-95 informed the Supreme Court to send those children and youths who are convicted of offences by the Juvenile Courts and the Supreme Court has redirected all the courts concerned on 7th March 1995.³

Conclusion

Penal Code provides general exceptions and persons who are exempted from criminal liability. The Court must take consideration whether the offence covers in general exceptions or not even though the offenders do not claim. In general exceptions, nothing is an offence which is done by a child under seven years of age and nothing is an offence which is done by a child above seven years of age and under twelve, who has not attained sufficient maturity of understanding to judge of the nature and consequences of his conduct on that occasion. Therefore, in juvenile cases, The Juvenile Court shall, before passing an order of a child who is found guilty, take into consideration child's age, character and environment circumstances of the child, the main course of committing the offence, the report submitted by the Probation officer and other circumstances and facts which are required to be taken into consideration in the interest of the child and pass an order which is reformatory and which will be beneficial to the child.

¹Section 753 of the Courts Manual.

²Section 758 of the Courts Manual.

³Section 764 of the Courts Manual.

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Application of Ethical Lessons in the Jātakas

Mu Mu Win¹

Abstract

This paper attempts to prove “Ethical lessons in the *Jātakas*.” Ethical lessons in the *Jātakas* should be applied in daily affairs. *Jātakas* are Birth stories of Gotama Buddha in his previous existences. They are 550 numbers. They are classified in 22 sections. The Canonical Text has only verses and the Commentary explains them with the stories in prose given ethical lessons. These stories are so popular that they can be seen in the decorations of art such as wall painting, sculpture, votive tablets, terracotta, *pyos*, dramas and prose. At first they are for devotion. However afterwards they have the change from devotion to instructions or lessons. The stories seek to inculcate good manners, good sense and good behavior, all of which usually real an appropriate reward owing to the working of *Kamma* by which the result of bodily, verbal and mental acts is suited to the nature of that act. Every *Jātaka* illustrates an instruction or lesson. In the *Seriva Jātaka*, it gives the lesson of giving the life became of greed. In the *Vānarinda Jātaka*, it gives the lesson that if one is endowed with faithfulness, wisdom, effort and sacrifice, he can conquer the enemies. In the *Sammodhamāna Jātaka*, it mentions the lesson to have union among the group. The *Jātaka* depicts the result of effort. The *Nandivisāla Jātaka* illustrates the lesson of speaking harsh language. The 550 *Jātakas* describe instruction or lesson for the welfare of the people. So these lessons in the *Jātakas* are applicable or useful for all mankind in this present life.

Key words: Ethical, lessons, *Jātakas*

Introduction

The *Jātaka* is the tenth book of the *Khuddaka Nikāya*. It consists of stanza only. It is divided into 22 sections (*Nipāta*). The sections are arranged according to the number of stanzas belonging to or forming a *Jātaka* (Birth-Stories). Each successive section contains a larger number of stanzas and a smaller number of *Jātaka*. These stanzas (*gāthā*) are in many cases poetic tales or ballads or epic poems. Verses are attached to all the *Jātakas*. They are in the framework and not in the stories themselves. The stories without the verses may be said to have preserved the original form of Indian folklore. These stories have various purposes to serve.

The Birth-Stories (*Jātakas*) are of Gotama Buddha in previous existences. In his previous numerous existences he had been born according to the *Kamma*, sometimes as a god, sometimes as a king, or a merchant, or a nobleman, or an outcaste, or an elephant, or some other man or animal.

The *Jātakas* are highly important for the history of Buddhism they gave us and insight into popular Buddhism. The whole system of *Jātakas* is based on the most popular *dhamma* of *Kamma*. And the ethical ideal of this religious is not the *Arahat* who has attained *Nibbāna*, but the *Bodhisatta* who in all his former existences has shown one or more of the great virtues by which he prepared himself for becoming the future Buddha. In very *Jātaka* he is helpful, kind, self-sacrificing or brave, clever and even possessing supernatural wisdom.

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Structure of 550 *Jātakas*

The *Jātaka* is an extensive work in verses containing 547 stories. In these Birth-Stories are embedded moral principles and practices which the *Bodhisatta* had observed for self-development and perfection to attain *Buddhahood*.

Jātaka is one of the classes in the nine fold classification of the early Buddhist Canon. Elsewhere in the canon; there are a number of stories which are almost identical with *Jātaka*.

In the *Jātakaṭṭhakathā* or *Jātakaṭṭhavaṇṇanā* is the commentary which was composed by *Buddhaghosa*. It contains in all 547 stories, which are referred to former births of the Buddha and which are therefore called *Jātakas* (Birth-Stories). Every story consists of five parts:¹

- (1) The canonical *Gāthās*;
- (2) The *atītavattu*, the stories of the past; i.e., the prose narrative belonging to the *gāthā*;
- (3) The *paccuppannavatthuni* "stories of the present", in which is described the occasion on which the particular *Jātaka* was told;
- (4) The appended *Samodhāna*, in which is mentioned, what character have been assumed at present by the persons in the *Jātakas*;
- (5) The *veyyākaraṇa*, "the commentaries", in which the verses are explained word by word.

The whole work is preceded by an introduction called the *Nidānakathā*, which contains the story of the Buddha in his earlier existence and in the last birth up to the dedication of *Jetavana* monastery.

*Serivavāṇija Jātaka*² (No. 3) and lessons

Once upon a time in the kingdom of *Seriva* the *Bodhisatta* was a jewel dealer. In the company of another dealer in the same wares, a greedy fellow named *Seriva*, he came across the river *Nīlavāha* and entered the city of *Ariṭṭhapura*. Apportioning the streets between the two of them, he set about hawking his wares round the streets of his district, and the other did the same in district.

Now in that city there was a decayed family. They had lost all. The sole survivors were a girl and her grand-mother, and they got their living by working for hire. Nevertheless, they had got in their house the golden bowl out of which in the old days the great merchant used to eat; but it had been thrown among the pots and pans, and having been long out of use, was grimed over with dirt, so the two women did not know that it was gold.

The greedy hawker came to the door of their house on his round, crying "Jewels to sell! Jewels to sell! And the damsel said to her grand-mother to buy a trinket and gave her the bowl to be exchanged. The old woman had the hawker brought in and gave him the bowl and asks for something or other in exchange.

The greedy hawker knew that the bowl was made of gold. He wanted the bowl without giving anything whatever for it to the women. He cried that the bowl wasn't worth half a farthing. And therewith he threw the bowl on the ground rose up from his seat, and left the house.

The *Bodhisatta* came into that same street and appeared at the door of the house, crying, and "Jewels to sell! Jewels to sell! " Once again the damsel made the same request of

¹ G. T, 135.

² J. I, 2. J. A. I, 126. S. B. F. B. I, 110. D. P. P. N. II, 1286.

her grand- mother. They called the *Bodhisatta* and gave him a seat and put the bowl into his hands. Seeing that the bowl was gold, he said that the bowl was worth a hundred thousand pieces and he hadn't it value with him. At the time the *Bodhisatta* had 500 pieces of money and a stock worth as much more the whole of this he gave to them and asked to give him back the pair of scales, his sack and eight pieces of money. And with their consent he took these with him, and departed. He went with all speed to the river-side where he gave his eight coins to the boatman and jumped into the boat.

Subsequently the greedy hawker had come back to the house and said to bring him the bow and he would give them something or other for it. But the old woman flew out at him and said that there came an upright hawker who gave them a thousand pieces for it and took the bowl away.

Intense sorrow came upon greedy hawker, so he lost command over himself and became like one distraught. His money and goods in his hands he flung away at the door of the house. He threw off his upper and under cloths and, armed with the beam of his scales as a club, he tracked the *Bodhisatta* down to the river-side.

He saw the *Bodhisatta* going, he shouted to the boatman to put back the boat. But the *Bodhisatta* prohibited turning back. As the other stood there gazing and gazing at the retreating *Bodhisatta*, intense sorrow seized upon him. His heart grew hot; blood gushed from his heart cracked. He had borne grudge against the *Bodhisatta* and he perished then and there. The *Bodhisatta*, after a life spent in charity and other good works, passed away to fare according to his deserts.

When the Supreme Buddha had ended this lesson, he, the All-Knowing one himself: If in this faith you prove remiss, and fail to win the goal where to its teachings lead, then, like the hawker of Seriva, you'll regret full long the prize your folly lost.

***Vānarinda Jātaka*¹ (No. 57) and lessons**

While Buddha was at *Jetavana* monastery, monks heard the *Devadatta* was conspiring against Buddha and they met to counter that. Buddha said *Devadatta* had planned to kill Buddha even before but Buddha was unperturbed by that, so he gave the sermon of *Vānarinda Jātaka*.

Long ago, while *Brahamadatta* was king at *Banares*, *Bodhisatta* was the king of monkeys, living alone on the bank of the river. The island in the middle of the river was full of fruits like mangoes and jackfruits. The *Bodhisatta* had the strength of a mammoth and every day he would jump to the platform in the middle of the river and thence to the middle island to partake of the fruits and come back the same way.

At that time there was a couple of crocodiles in the river. Seeing the *Bodhisatta* the female wanted to have the heart of the creature and so asked the male to get it for her. The male decided to get it that day and waited under the platform.

Evening came and *Bodhisatta* looked at the platform and saw that it was higher up than before. He saw no increase in the water of the river and guessed that the rock platform had some life and hailed it as "O, Rock platform." He did it three times with no response. So he asked what the matter was. Thinking that the *Bodhisatta* did have daily conversation with the rock platform, it replied "O, king of monkey." The *Bodhisatta* asked who he was. He replied it was the crocodile. When *Bodhisatta* asked why he was there, the crocodile said it wanted heart of the *Bodhisatta*.

¹ J. I, 14. J. A. I, 298. S. B. F. B. I, 278; cp. *Kumbhila Jātaka*. D.P. P. N. II, 853.

The *Bodhisatta* told the crocodile to open his jaws when he came over. He had the knowledge that crocodiles closed their eyes when they keep their mouths open. The crocodile did as he was told. The *Bodhisatta* jumped with a step on the crocodile's head and then to the other bank so fast that he could escape the jaws of the crocodile.

Surprised, the crocodile said only *Bodhisatta* would escape its trap as he had the sense to get away with the use of truth, wisdom, tenacity and sacrifice needed of *Bodhisatta* saying it went away.

Buddha said *Devadatta* that day was the male crocodile and *Ciñcamāna* that day the female crocodile. Thus in the *Vānarinda Jātaka*, it gives the application of Ethical lessons that if one is endowed with truthfulness, wisdom, effort and sacrifice, he can conquer the enemies. One has the four *dhammas* (truthful, wisdom, effort and sacrifice) to overcome enemy.

***Sammodamāna Jātaka*¹ (No. 33) and lessons**

While Buddha was residing in *Nigrodha* monastery in *Kapilavatthu*, there were quarrels between relatives. Buddha summoned the relatives and said they should not quarrel; even animals in unity could overcome the enemy and achieve happiness: if they quarreled there was great misery. The relatives appealed for deliberation and Buddha gave the *Sammodamāna Jātaka*.

Long ago, when King *Brahamadatta* was reigning in *Banares*, *Bodhisatta* was the king of quails. There was a hunter catching quails with a net and selling them away for his trade. This led to perishing of many quails and the *Bodhisatta* thought of repelling the hunter with unity of the quails. It was so arranged for the quails to stick their heads at every opening of the net, and all these quails were to fly at the same time to move the net on a place of thorns while the quails escaped the net.

On the second day thereafter, the hunter cast the net. The quails did as guided by the *Bodhisatta* and escaped, leaving the hunter to disentangle the net on the thorns and getting nothing of the quails. When it happened on three consecutive days, the hunter's wife got angry. The hunter pacified his wife saying that the quails were united but they could not be united for long; they would quarrel over something some day; then he would capture them. Three or four days later, a quail stepped on the head of another while going out to search for food. He apologized but it did not quite pacify the other quail.

The *Bodhisatta* knew that the quarrel between the two quails would cause disunity among quails and it would lead to perishing of many. So, he took all those who would follow him to another place. At that time, the hunter came and cast his net. The quails, instead of doing what they did before, quarreled among themselves and they were caught easily by the hunter.

Thus Buddha showed the relatives that disunity would only result in perishing of many. So in the *Sammodhamāna Jātaka*, it mentions the application of ethical lesson to have union among the group in everywhere. There is no safety among those who are disputing.

***Nandivisāla Jātaka*² (No. 28) and lessons**

Once upon a time at *Takkasilā* in the land of *Gandhāra* there was a king reigning and the *Bodhisatta* came to life as a bull. When he was quite a tiny calf, a Brahmin received him

¹ J. I, 9. J. A. I, 224. S. B. F. B, 208-10. D. P. P. N. II, 1065.

² J. I, 7. J. A. I, 207. D. P. P. N. II, 20.

from the donors of cow as a donation. The Brahmin called in *Nandivisāla*, and treated it like his own child, feeding the young creature on rice-gruel and rice with great fondness. When the *Bodhisatta* grew up, he thought to himself to repay the Brahmin the cost of his nature by making proof of his strength. Accordingly, one day he said to the Brahmin to go to a merchant rich in herds, and wager him a thousand pieces that he could draw a hundred loaded carts.

The Brahmin went his way to merchant. The Brahmin and the merchant agreed to make a wager with a thousand pieces. Then he loaded a hundred carts with sand, gravel, and stones, and leashed the lot together, one behind the other, by cords from the axle-tree of the one in front to the trace-bar of its successor. This done, he bathed *Nandivisāla*, gave him a measure of perfumed rice to eat, hung a garland round his neck, and harnessed him all alone to the leading cart. The Brahmin is a person took his seat upon the pole, and flourished his goad in the air, shouting, "Now then, you rascal! Pull them along, you rascal!"

The *Bodhisatta* planted his four feet like so many posts, and budged not an inch. Straightway, the merchant made the Brahmin pay over the thousand pieces. The Brahmin took his bull out of the cart and went home and he lay down on his bed in an agony of grief. When *Nandivisāla* strolled in and found the Brahmin a prey to such grief, he went up to him and said that he called him a rascal who was not rascal and to go and bet him again two thousand this time. The Brahmin went off to the hundred carts to one another and he adorned *Nandivisāla* well and harnessed it to the leading cart.

So now seated on the people, the Brahmin stroked *Nandivisāla* on the back, and said, "Now Then, my fine fellow! Pull them along, my fine fellow!" With a single pull the *Bodhisatta* tugged along the whole string of the hundred carts till the hindermost stood where the foremost had started. The merchant, rich in herds, paid up the two thousand pieces he had lost to the Brahmin. Other folks, too, gave large sums to the *Bodhisatta*. All were the property of the Brahmin. Thus he gained great wealth by reason of the *Bodhisatta*.

The *Nandivisāla Jātaka* illustrates the application of the Ethical lessons to speak only words of kindness, never words of unkindness. For one who spoke him words of kindness, he moved a heavy load, and brought him wealth. So, he became one who had an up raised mind.

Evaluation

The four *Jātakas* extracted from the *Jātakas* are as this paper. As aforesaid '*Jātakas*' give ethical lessons of motif in human character and lead to teach a good life. In Myanmar the beginners of the Pāli literature have studied the *Jātakas* since ancient times. The *Jātakas* gives the scholars not only the ethical lessons of do's and don'ts in daily life but the knowledge of sources of Myanmar culture. Furthermore, one can be quite sure that in many families the *Jātaka* stories related and the implied ethical lesson brought out, thus making the home the first centre of practical and spiritual application.

Conclusion

Is the concept of ethical lessons beings which has successfully functioned as the Integrative Imperative that has held Myanmar society together, and the *Jātakas*, the code of conduct that has guided the Myanmar people and contributed to their ethics welfare, still relevant today? How do we apply the living tradition of our ethical principles to the development and problems of contemporary life? How should we try to incorporate whatever is worthwhile in later thoughts and views as a genuine developments, extension, clarification and applications of lessons of ethics? Since everyone must have a starting point to think clearly and consistently about the ethical problems we face daily at every level of our lives,

the ethical lessons in general and *Jatakas* in particular should be the starting point for the Myanmar.

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Abbreviation

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| 1. D.P.P.N. II | Dictionary Pāli Proper Name Vol. II |
| 2. G.T | Guide to Tipiṭka |
| 3. J. I | Jātaka Pāli (Pathamo Bhāgo) |
| 4. J. A. I | Jātakatṭakathā (Pathamo Bhāgo) |
| 5. S.B.F.B | Stories of the Buddha's Former Birth Vol. I-VI |

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Life-span and Morality in *Cakkavatti Sutta*

Win Win Maw¹

Abstract

This paper attempts to prove “Life-span and Morality in *Cakkavatti Sutta*.” The solution to the problem is that the life-span is a necessary factor for human society. All human beings searched life-span from different religious views with different forms. This paper highlights life-span and morality in *Cakkavatti Sutta* from the Buddhist point of views. Concerning long and short life, it is mentioned that they convey the morality in the *Cakkavatti Sutta*. The *Cakkavatti Sutta* is the third *sutta* of *Pāthika Vagga*, *Dīghanikāya*. The Buddha preached this *sutta* in the town of *Mātulā*, district of *Magadha*. In this *Sutta*, the Buddha said on the basis of the Universal Monarch that “when human beings abound with misdeeds, their life-span decreases, and when they abound with good deeds, their life-span increases.” So the Universal Monarch needs to rule the country with righteous ways and to protect the subjects in accordance with the constitution. In this paper, the decreasing and increasing of life-span is explained in detail one by one by giving reason about morality. It can be learnt by studying as evidence of the life-span of the Buddhas that have appeared. Therefore, summarizing up, it is learnt that it is man’s actions that give rise to the decrease or increase of their life-span. This paper will contribute towards “Life-span and Morality in *Cakkavatti Sutta*.”

Key words: Life-span, morality, *Cakkavatti*.

Introduction

There are different types of people in the world; those who are long and short life, those who are healthy and sick, those who are beautiful and ugly, those who are influential and un-influential, those who are rich and poor, those who are low and high born, those who are lack of wisdom and knowledge. We can find the above reasons in the teachings of the Buddha. Out of the above statements, dealing with long and short life could be found in detail in *Cakkavatti Sutta*. The reasons of shortening life-span are based on evil conducts, *ducarita*. There are ten kinds of evil conducts. They are explained in detail one by one by giving reason such as the decreasing of life-span. Besides, it has been stated that the practice of good conducts, *sucarita*, makes the life-span of human beings increase.

The various life-spans

The universe comprises of four great oceans, four great islands, and Mt. Meru.² When studying the life-span of man living in the universe, it is found that it varies depending on the island they live on.

It is invariably found that the life-span of the east islanders is 700 years, that of the west islanders 500 years, and that of the north islanders 1000 years. It can be learnt by studying as evidence the life-span of the Buddhas that have appeared on the south island.

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² D.B.T, 276.

Such Buddhas as *Taṇhaṅkarā*, *Dīpaṅkarā*, *Koṇḍañña*, *Anomadassī*, *Paduma*, *Padumuttara*, *Atthadassī*, *Dhammadassī*, *Siddhattha* and *Tissa* appeared in periods when man's life-span was 100,000 years.¹

Such Buddhas as *Medhaṅkarā*, *Saraṇaṅkarā*, *Maṅgala*, *Sobhita*, *Nārada*, *Sumedha*, *Sujāta*, *Piyadassī*, *Atthadassī* and *Phussa* appeared in periods when man's life-span was 90,000 years.²

Vipassī Buddha appeared in the life-span of 80,000, *Sikhī* Buddha in that of 70,000, the two Buddhas *Yevata* and *Vessabhū* in that of 60,000, *Kakusāna* Buddha in that of 40,000, *Koṇāgamana* Buddha in that of 30,000, and *Kassapa* Buddha in that of 20,000 years, respectively.³

Gotama Buddha appeared in the period when man's life-span was 100 years. According to the above-mentioned facts, it is obvious that the life-span of the south islanders were not stable, as can be studied in the *Cakkavatti sutta*.⁴

The decrease of man's life-span from 80,000 to 40,000 years

During the reign of the Universal Monarch King* *Dalhanemi*, and during those of his son and his grandson until the seventh king of their generation, the life-span of human beings was long, perfect with good appearance⁵ and good health since they ruled the country in justice.

On the seventh king of the dynasty, however, he did not provide his subordinates with property, and the number of the needy increased. As that happened, a man took another person's belongings without letting him know. The king's men-in-service seized him and sent him to the king. When asked, he answered that he did it 'because he did not have enough livelihood.'⁶ From that time, the misdeed of *Adinnādāna* of stealing arose. In addition, even in the period when man's life-span was 80,000 years, the king supported the thief without punishing him.

The king provided him with the money for rendering his livelihood, feeding his wife and offspring, getting capital for his work, and donating monks, Brahmins, and those asking for donations. Since the king gave the money to the thief without punishing him, another one stole like him, and the king did as he had done to the first. Another person hearing that stole like them. Then, the king ordered his men to seize him and kill him in order to prevent further thefts. Those who heard that kill the stealer with weapons. From that time, the misdeed of *Pāṇātipāta* of killing arose. Therefore, *Pāṇātipāta* that the second misdeed that arose.

When the king did not give things to the poor, the number of the poor increased. When that happened, more thefts occurred. As a result, uses of weapons increased leading to killings. When the misdeed of stealing (*Adinnādāna*) and that of killing (*Pāṇātipāta*) grew, the life-span of human beings decreased. Their appearance was damaged. Their health deteriorated. Those who had a life-span of 80,000 years could live just for 40,000 years.⁷

¹ Mbv. A, 348-9.

² Mbv. A, 348-9.

³ Mbv. A, 348-9.

⁴ D. III, 52.

*DPPN. Vol. I, 1063. **Dalhanemi**. A *Cakka-vatti* of long ago, when his cakka showed signs of disappearing, he handed the kingdom over to his eldest son and became a hermit. Later he taught his son how he, in turn, could become a Cakka-vatti. D. iii, 59f.

⁵ D. III, 52.

⁶ D. III, 52.

⁷ D. III, 56.

Although parents do misdeeds like *Adinnādāna*, their life-span did not decrease but that of their offspring did, because according to *Khettavisuddhi*¹, the bodies of creatures, future offspring to them were like seeds, and parents were like farms. Due to the purity of parents where their offspring depend on, the offspring's had a long life-span. Due to the impurity of parents like farms, their offspring had a decreasing life-span.

Decrease of man's life-span from 40,000 to 20,000 years

When human life-span reached 40,000 years, they came to tell lies from killing the thief. From that time on, the misdeed of telling lies arose. People committed the misdeeds of *Adinnādāna*, *Pāṇātipāta*, and *Musāvāda*, and their life-span decreased from 40,000 to 20,000 years.²

Decrease of man's life-span from 20,000 to 10,000 years

When the life-span of human beings reached 20,000 years, some man took something not given. Another man talked ill of him by reporting to the king: "this man took a thing not given."³ From that time on, the misdeed of slander (*Pisuṇavācā*) arose. By means of slander or *pisuṇavācā*, man's life-span decreased from 20,000 to 10,000 years.⁴

Decrease of man's life-span from 10,000 to 5000 years

When man's life-span reached 10,000 years, some creatures were good-looking in their appearance, and others were not. Some of those who were not good-looking committed adultery. Then, the misdeed of adultery or *Kāmesumicchācāra* arose.

Due to the fact that in man's life-span of 10,000 years, ugly men desired beautiful women belonging to others, and committed the misdeed of *Kāmesumicchācāra*. By doing so, their life-span was reduced from 10,000 to 5000 years.⁵

Decrease of man's life-span from 5000 to 2500 years

When man's life-span reached 5000 years, people came to use coarse and trivial language. Therefore, the two verbal misdeeds of coarse speech (*pharusavācā*) and trivial speech (*samphappalāpa*) arose. Therefore, in man's life-span of 5000 years, it was reduced to that of 2500 years due to the rising of the two verbal misdeeds of *pharusavācā* and *samphappalāpa*.⁶

Decrease of man's life-span from 2500 to 1000 years

When man's life-span reached 2500 years, they developed covetousness (*abhijjhā*) and ill will (*byāpāda*) towards others. Therefore, in man's life-span of 2500 years, it was reduced to that of 1000 years due to the rising of the two verbal misdeeds of *abhijjhā* and *byāpāda*.⁷

Decrease of man's life-span from 1000 to 500 years

When man's life-span reached 1000 years, *micchādiṭṭhi* or false belief arose. The wrong belief that there is no effect of *kamma* or action, no future existence, no use in

¹ D. T. III, 32. SPBT, 132.

² D. III, 57.

³ D. III, 57.

⁴ D. III, 57.

⁵ D. III, 58.

⁶ D. III, 58.

⁷ D. III, 58.

donations, etc, is *micchādiṭṭhi*. Due to this misdeed of *micchādiṭṭhi*, man's life-span was reduced from 1000 to 500 years.¹

Decrease of man's life-span from 500 to 250 years

When man's life-span reached 250 years, the three misdeeds such as *adhammarāga* or unjust desire, *visamalobha* or strong greed and *micchādhamma* or wrong practice grew.

'*Adhammarāga*' stands for wrong desire in one's mother, mother's sister, father's sister, and uncle's wife. In other words, it is raga or desire arising in what is not appropriate.²

'*Visamalobha*' is strong greed for what is appropriate for consumption. One's strong passion on one's wife regardless of time and place is termed '*visamalobha*.'³

'*Micchādhamma*' is a man's passion on another man or a woman's passion on another woman.⁴ Due to these three misdeeds, man's life-span was reduced from 500 to 250 years.

Decrease of man's life-span from 250 to 100 years

At man's life-span of 250 years, such misdeeds as no proper filial duty performed, and disrespect towards one's elders increased. Besides, due to disrespect to elders, and non-humbleness, man's life-span was reduced from 250 to 100 years.

Period of man's life-span of 10 years

When misdeeds like *adinnādāna* increased, man's life-span was gradually reduced, as stated earlier. In this way, man's life-span will reach 10 years. Then, women will marry at the age of five. Flavours such as ghee, butter, sesame-oil, molasses and salt will disappear. All good deeds will have vanished and all misdeeds will be flourishing. Grudge, ill will towards others, and killings will arise. The catastrophe characterized by war will occur for the whole period of seven days. Before doomsday arrives, creatures will perish through weapons.⁵

When people encountered the Catastrophe of Wars for seven days at their life-span of 10 years, they will hide themselves in forests and mountains as they see people killing one another with sophisticated weapons. And they live there feeding on fruits. After seven days, they will leave there, they realize the truth of the decline of life, appearance and health, and destruction of their relatives, and they will abstain from misdeeds like *Pāṇātipāta*, and do good deeds. By doing so, they will double increase in life, appearance and health from the period of 10 years until that of infinity.

The cause of abiding by good conducts of rule and good deeds leads to increase of man's life-span. According to what has been mentioned, misdeeds cause short life-span and good deeds cause longevity. Therefore, one should abstain from misdeeds and strive for good deeds.

Conclusion

In the *Cakkavatti Sutta*, it is found that the morality is the basic factor, concerning with the life-span. Due to the crime of stealing and killing, the life-span of people decreased from 80,000 to 40,000. After that, the case of lying appeared and the life-span decreased again from 40,000 to 20,000. Due to the case of slandering the life-span of human beings reduced from 20,000 to 10,000. And then, the case of sexual misconduct appeared. The life-

¹ Ibid, 58.

² D. A. III. 36. SPBT. 120.

³ D. A. III. 36. SPBT. 120.

⁴ D. A. III. 36. SPBT. 120.

⁵ SPBT, 126.

span went down up to 5,000. Due to harsh speech and frivolous talk, human beings turned to 2,500. And life-span went down to 1,000 due to covetousness and ill-will. Wrong view makes shorter life-span till 500. Incest and excessive greed created the life-span of generation up to 250. Among those whose life-span was two hundred and fifty years, people did not respect their parents and did not perform their duties to their parents and to the ascetics and *Brahmans* so their life-span decreased till 100 years. Due to the consequences of the evil conducts, the life-span of human beings will reduce until ten years old. At that time, girls will be marriageable at five years old. All flavours such as ghee, butter, sesame-oil, molasses and salt will disappear. Only the hardest grain known as Thali rice will be the chief food, just as rice and curry today.

People feel afraid of chaos that they will have to face and so they do meritorious deeds again. And the life-span of people will increase two or three times. Finally, the life-span will increase to the longest till in calculable.

So, the Buddha exhorted people to refuge oneself and rely on the morality that they observe. Doing meritorious deeds can make long life and committing unwholesome deeds can deprive life-span shorter.

Therefore, summarizing up, it is learnt that it is man's actions that give rise to the decrease or increase of their life-span.

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An Investigation of the Perceptions of Leaders' Leadership Skills in Higher Education Teachers: the Case of Heads of Departments in Pathein University

Wai Wai Nyunt¹

Abstract

This paper deals with the impact of leaders' leadership skills in achieving goals in higher education institutions. The focus is on teaching staff who take the dual role of leading and teaching. It investigates the most problematic issues namely receiving training on leadership skills, having experience in leading a team, doing professional development and leaders' personal characteristics. This paper aims at providing those who are involved in leadership and management process in some way in the educational field with some ideas so that they can deal with that sensitive issue of leadership and management. A questionnaire based on the model of Ramsden is used to investigate the perceptions of leaders, relationship between effective leadership, leadership development and achievement of the whole education programme because good leaders and their effective leadership can provide both motivation and direction to their colleagues. It is found that the perceptions of more than 50% of the leaders from the Pathein University are close to the theoretical model of effective leadership proposed by Ramsden.

Introduction

The success of any education programme depend Spartly on the effective leadership of the persons concerned. In the educational field, the term "leader" can refer to any person whether he or she is administrative staff or teaching staff who inevitably takes the responsibility of leadership and management. In Myanmar's higher education context, it is found that teaching staff that are at the level of lecturer and above have to take the leadership role depending on the situation of the university they are working. At that time, some teachers are found very reluctant to take the role of a leader for various reasons, some of which are that they are interested in teaching rather than leading and managing a team, that they do not receive any training on leadership and management, that they do not have confidence to take the leadership role and that they have no experience in leading a team. This results in their lack of confidence in leading a team and causes failure in implementing their tasks as most of them do not initiate the tasks they should do.

Aim and Objectives of the Study

This paper aims at providing those who are involved in leadership and management in some way in the educational field with some ideas so that they can deal with that sensitive issue of leadership and management. It also examines the relationship between effective leadership, leadership development and achievement of the whole education programme because good leaders and effective leadership of the leaders can provide both motivation and direction to their colleagues.

Scope and Significance of the Study

This study is mainly concerned with teachers and administrators who are involved in education implementing process in higher education sector. Emphasis is put on teachers especially those who are taking the dual roles of teaching and leading the team.

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Since it is not possible to make a study of leadership in all or a sample of these institutions due to constraint of time and resources, this research is based on academic leaders in one university only. The author is an administrator of Pathein University, therefore, a survey was made to twenty nine academic leaders from Pathein University, specifically professors, associate professors and senior teachers who are at the position of lectures and above. As the setting in which the leaders are operating is common, ways how these leaders operate under the same conditions are compared. The author is familiar with the setting, which helps in bringing additional insights in this study, as the author is able to verify from observing the leaders whether responses during the study are actually translated into practice or not. It also helps in validation of responses collected during the survey.

Theoretical background

In the context of higher education, distinctive areas of work on which teachers lead include teaching, planning, observing students, undertaking assessments, evaluation, identification of team development needs, record keeping, working with and reporting to the authorized persons, organizing time, space and resources and organizing people.

Interaction between leaders and followers are important because only when there is effective leadership, can there be change, collaboration and improvement. Building relationship, shared decision-making, and empowerment are seen as important characteristics of good leadership.

In terms of leaders who are involved in education sector, knowledge, skills and attitude are the basic requirements. Knowledge refers to knowing teaching methodology, teaching strategies, learning theories and knowing subject matter. As regard skills, professional skills, technical skills, conceptual skills and even managing financial skills are included. Interpersonal communication skills, group facilitation skills, decision making skills, and staff development skills are also included. Attitude is related to moral purpose, love of career and interest in the profession.

The following four areas can examine a person's leadership skills:

1. current job status and motivation for staying on or leaving the field
2. perceived short-and-long term outcomes from having participated in leadership training
3. subsequent professional development experiences and knowledge of professional development resources
4. feedback on the design and delivery of training

According to Ramsden (1998), effective academic leadership in higher education is a function of several factors or characteristics. These include leadership in teaching, leadership in research, strategic vision and networking, collaborative and motivational leadership, fair and efficient management, development and recognition of performance and interpersonal skills.

Ramsden also elaborates that teaching leadership refers, for example, to bringing new ideas about teaching to the department or creating excitement about teaching. Research on leadership can be evidenced, for example, by inspiring respect as a researcher, or leading by example. Strategic vision and networking are demonstrated through furthering interests of the department across the university. Collaborative and motivational leadership is demonstrated among others by honesty and integrity and openness. Fair and efficient management is evidenced by delegation, highly organised working of the department and getting things done with little resistance. Developing and recognition of performance includes aspects such as

praising and sustaining success of the staff of the department and giving good feedback to improve. Interpersonal skills refer to communicating well and having concern for others.

Some Definitions of Leadership

Good leadership is critical to a successful programme. Success comes from aiming high with the clear vision, ethos and communication that good leadership brings. According to Nivala and Hujala (2002), a traditional definition of leadership is found to be associated with individual skills characteristic and personal qualities in the leader. In terms of personal characteristics, self-confidence and a positive attitude are fundamental to leadership success. More recent view on leadership is that it is not an isolated activity but a collaborative task. It means that good leadership demands good relationship between co-workers, mutual understanding and respect, cooperation and individual's commitment.

Leadership vs. Academic Leadership

It is necessary to make a distinction between the concept "leadership" in general and "academic leadership" in particular. The term leadership has been variously defined in the literature on strategic management. According to BIJUR (2000, p.167) "leadership means enhancing human potential". Enhancing human beings refers to creating the right environment for people to develop as leaders. It also involves communicating clearly and effectively among all stake holders. Heifetz and Laurie (1997) state that leadership involves three fundamental tasks: (a) creating a holding environment (environment that facilitates achievement of goals), (b) directing, protecting, orienting, managing conflict and shaping norms, and (c) maintaining presence and poise. According to them, good leadership can ensure unity and cohesion upon decisions up and down the line.

Academic leadership is different from general leadership because academic institutions present a different setting compared to any private or public sector organisation. The persons that an academic institution enhances are stakeholders such as students, staff, community, and funding agencies. Thus, the stakeholders in academic institutions are more diverse. These special features of academic institutions pose a different set of challenge to leadership. This means that though academic leadership has some commonalities with leadership in general, there are special challenges involved.

Related Research Works

Research on academic leadership is evolving. In Australia, notable work has been done in recent years by Ramsden (1998), Harman (2002), Wolverson et al. (1999) Sarros et al. (1997) and Meek and Wood (1997). In particular, Ramsden (1998) has developed a model (which this study uses) that defines the characteristics that influence effective academic leadership.

In The Empowering leadership questionnaire: the construction and validation of a new scale for measuring leader behaviours by Josh A. Arnold, Sharon Arad, Jonathan A. Rhoades and Fritz Drasgow, the construction and empirical evaluation of a new scale for measuring empowering leader behavior is described. The writers constructed Empowering Leadership Questionnaire (ELQ) and administered the ELQ to team members and leaders from two organizations. Their findings indicated that five factors which are coaching, informing, leading by example, showing concern, interacting with the team, and participative decision making can affect the leadership process.

In Leadership in Higher Education: A Qualitative Study, Milind Sathye (2004) reports and documents an analysis of responses of three leaders in a tertiary institution in Australia. The author interviewed three leaders to obtain responses on various aspects of

leadership in higher education. The study finds that academic leadership poses problems that are distinctly different than leadership in business or government agencies. Academic leaders need to stay close to teaching, learning, research and scholarship to bring out the best among academics. The study could help leaders in tertiary institutions to reflect on their own qualities as academic leaders and such reflection may help improve their leadership style to achieve positive outcomes.

Ramsden (1998) has also made a study on leadership in higher education and the objective of the study was to describe how the practice of academic leadership of the leaders interviewed fits in with the theoretical framework of effective academic leadership. It also compares the academic leadership styles of the three leaders with each other to understand similarities and differences if any. The interview questions include job satisfaction, active participation in discussions and meetings at their departments, how staff development is done and feedback given (e.g. taking class, teaching, assessing, etc.)

Research Methodology

In order to know the existing leadership skills of the persons who are taking the leadership roles in the institution, an empowering leadership questionnaire is set and administered to 29 persons from fifteen academic departments of Pathein University. Most of the subjects are professors and associate professors except two who are senior lecturers from Department of English and also have been heads of departments. Data is analysed and factors that affect the leadership skills of leaders are determined. The ELQ questionnaire is an adapted one, based on the model developed by Josh A. Arnold, Sharon Arad, Jonathan A. Rhoades and Fritz Drasgow. In addition, Leadership Questionnaire is adapted from “21 Laws Leadership Evaluation” in Maxwell, J. C. (1998 & 2007). The 21 Irrefutable Laws of Leadership: 10th Anniversary Edition. Nashville: Thomas Nelson Publisher. Online leadership survey mentioned in <http://www.alnap.org/ourwork/current/leadership.aspx> is also taken as a model. The questionnaire has three separate parts namely – leadership skills, professional development and personal characteristics in the leaders of the academic departments of Pathein University. The questionnaire used in the research is shown in Appendix.

Then, discussion on the analysis is made so that each leader's perception on leadership style can be identified. Finally, suggestion is given in order to provide suggestions to the subjects to improve their leadership skills.

Findings and Discussion

Based on the data obtained from the questionnaire, leadership skills of the staff of Pathein University are analysed. Table 1 shows the percentage of the answers for 36 questions concerning leadership skills of 29 staff who are taking the leading roles in the academic departments of Pathein University. The highest percentage for each question is highlighted. According to the data, it can be generally said that more than 50% of the leaders in Pathein University are aware of the importance of leadership skills. 65.53% of them want to take responsibility in carrying out the tasks. Due to this responsible mind, they are found to be weak in nurturing potential leaders. However, regarding Question No 14 which shows the expectation of the leader to be similar to him in values, skills and leadership, it is found that 58% of the leaders ignores the fact that individual persons can have different values, skills and leadership ability. Again in Question No 19, 51.72% of the leaders rely on some key people to help accomplish the goal. This means that only a handful of people participate in a task, and can cause other members of the team feel discouraged thinking that they are unimportant ones in the team. In Question No 30, according to the data, 31.03 is the highest

percentage which shows that these leaders do not want to take risk as they do not do any task that does not have a tangible return or do not reward their personality.

Table 1: Data Analysis on Leadership Skills Questionnaire

Question No	No of Answers on each Question and Percentage									
	0	%	1	%	2	%	3	%	4	%
1	10	34.48	19	65.52	0	0	0	0	0	0
2	1	3.45	15	51.72	13	44.83	0	0	0	0
3	2	6.90	3	10.34	6	20.69	18	62.07	0	0
4	3	10.34	1	3.45	5	17.24	20	68.97	0	0
5	5	17.24	14	48.28	6	20.69	3	10.34	1	3.45
6	1	3.45	2	6.90	11	37.93	15	51.72	0	0.00
7	0	0.00	13	44.83	9	31.03	7	24.14	0	0.00
8	1	3.45	2	6.90	12	41.38	14	48.28	0	0.00
9	0	0.00	0	0.00	8	27.59	21	72.41	0	0.00
10	9	31.03	0	0.00	4	13.79	16	55.17	0	0.00
11	0	0.00	2	6.90	21	72.41	6	20.69	0	0.00
12	0	0.00	3	10.34	14	48.28	12	41.38	0	0.00
13	1	3.45	3	10.34	14	48.28	11	37.93	0	0.00
14	2	6.90	0	0.00	10	34.48	17	58.62	0	0.00
15	5	17.24	7	24.14	8	27.59	9	31.03	0	0.00
16	2	6.90	1	3.45	19	65.52	7	24.14	0	0.00
17	3	10.34	3	10.34	16	55.17	7	24.14	0	0.00
18	6	20.69	9	31.03	16	55.17	1	3.45	1	3.45
19	2	6.90	2	6.90	15	51.72	10	34.48	0	0.00
20	7	24.14	1	3.45	5	17.24	16	55.17	0	0.00
21	1	3.45	7	24.14	15	51.72	6	20.69	0	0.00
22	1	3.45	0	0.00	12	41.38	16	55.17	0	0.00
23	3	10.34	1	3.45	11	37.93	14	48.28	0	0.00
24	2	6.90	0	0.00	12	41.38	15	51.72	0	0.00
25	7	24.14	3	10.34	12	41.38	7	24.14	0	0.00
26	4	13.79	7	24.14	13	44.83	5	17.24	0	0.00
27	0	0.00	5	17.24	17	58.62	7	24.14	0	0.00
28	1	3.45	0	0.00	12	41.38	16	55.17	0	0.00
29	2	6.90	0	0.00	13	44.83	14	48.28	0	0.00
30	8	27.59	7	24.14	9	31.03	5	17.24	0	0.00
31	0	0.00	2	6.90	12	41.38	14	48.28	1	3.45
32	2	6.90	7	24.14	15	51.72	5	17.24	0	0.00
33	3	10.34	1	3.45	14	48.28	11	37.93	1	3.45
35	0	0.00	12	41.38	11	37.93	3	10.34	3	10.34
36	7	24.14	18	62.07	1	3.45	1	3.45	2	6.90

0= Never1= Rarely2= Sometimes3= Always4= Don't know

Regarding Professional Development, the data indicates that the highest percentage which is 44.83 is found in Question No 2. It seems to be irrelevant in the perceptions of the leaders because according to their answers in Questions 3, 4 and 5, they believe that developing leaders is an important issue, however, they do not spend some time to develop the top 20% of the potential leaders. The data show that, except Question No 5, only 44.83% of the subjects have right perceptions in leading a team. The answers of the subjects are shown in Table 2.

Table 2: Data Analysis on Professional Development

Question No	No of Answers on each Question and Percentage									
	0	%	1	%	2	%	3	%	4	%
1	1	3.45	12	41.38	13	44.83	3	10.34	0	0
2	0	0.00	13	44.83	11	37.93	3	10.35	2	6.90
3	5	17.24	2	6.90	11	37.93	10	34.48	1	3.45
4	1	3.45	8	27.59	13	44.83	6	20.69	1	3.45
5	0	0.00	2	6.90	21	72.41	5	17.24	1	6.90

0= Never 1= Rarely 2= Sometimes 3= Always 4= Don't know

Perceptions of the subjects' personal characteristics are indicated in Table 3 and the highest percentage for each question is highlighted. In Table 3, it can be seen that the results range between 37.93 and 72.41. Interestingly, in Question No 8, the highest percentage is only 37.93 (which is for "always") and it shows that they need confidence in leading a team. In addition, the answers to other questions and that of Question No 8 are found to be contradictory.

Table 3: Data Analysis on Personal Characteristics

Question No	No of Answers on each Question and Percentage									
	0	%	1	%	2	%	3	%	4	%
1	1	3.45	12	41.38	13	44.83	3	10.34	0	0
2	0	0	4	13.79	19	65.52	5	17.24	1	3.45
3	0	0	0	0.00	16	55.17	10	34.48	4	13.79
4	0	0	5	17.24	21	72.41	1	3.45	2	6.90
5	0	0	0	0.00	19	65.52	8	27.59	2	6.90
6	6	20.69	1	3.45	7	24.14	14	48.28	1	3.45
7	3	10.34	0	0.00	17	58.62	8	27.59	1	3.45
8	6	20.69	0	0.00	10	34.48	11	37.93	2	6.90
9	0	0.00	1	3.45	19	65.52	8	27.59	1	3.45
10	0	0.00	1	3.45	19	65.52	8	27.59	1	3.45
11	1	3.45	2	6.90	12	41.38	13	44.83	2	6.90
12	2	6.90	1	3.45	18	62.07	7	24.14	1	3.45
13	2	6.90	10	34.48	12	41.38	5	17.24	0	0.00
14	1	3.45	0	0.00	14	48.28	13	44.83	1	3.45
15	0	0.00	1	3.45	12	41.38	16	55.17	0	0.00
16	0	0.00	1	3.45	17	58.62	11	37.93	0	0.00
17	1	3.45	5	17.24	17	58.62	5	17.24	1	3.45

0= Never 1= Rarely 2= Sometimes 3= Always 4= Don't know

Suggestion

Leaders and going-to-be leaders should be aware that effective leadership and good management are two different phenomena. Management is about working within the boundaries of the status quo, whereas leadership has more to do with seeing other, wider possibilities and trying to make them happen. However, to be effective, leaders also have to be able to be managers too as good management is part of good leadership.

Secondly, they need to understand that leadership is divorced from rank. Lecturer level staff and support staff can demonstrate exceptional leadership. Catherine Harper states that leadership comes with being able to manage, but it is also personal quality, much bound up with inspiring trust, demonstrating empathy, and managing change in an emotionally intelligent fashion. According to her, visions and missions are only tools after all; one cannot manage soldiers into battle.

Thirdly, university leaders need to be academics to understand their colleagues. Building mutual understanding and good relationship between leaders and their colleagues is really important to achieve the goal in implementation of the tasks. In the end surely there is no right or wrong and it depends on the ability of the person as leadership roles often 'find' the individual according to Jenny Mathers. But higher education needs to be more proactive about making sure those who are in leadership positions choose proactively to do that.

According to Katie Normington, leaders and going-to-be leaders should start by sitting in on groups outside their own academic department as it is a chance to meet a greater range of people which may be of help later. Moreover, it is found that majority think that proper training is essential for them to be good leaders. Actually, it doesn't have to be a long mentoring relationship; sometimes one of two honest chats can make a difference or help make a decision. Another way to learn or to get training is learning from predecessors. However, sometimes they have to 'unlearn' too. To be successful leaders it is important to find one's own style as sometimes it is hard to find many role models around therefore, it is important to believe in self. Good leaders should be good listeners too and be also humble enough to say "sorry, I got that wrong, and "thanks for pointing that out" without feeling loss of face.

Above all, as the focus is on higher education leaders who are also teachers, the most important skill is their academic skills. They should be aware that it is the professional development that can bring best result in implementing higher education development. Even when they are weak in other skills, if their academic skills are good, they can lead the team successfully, building trust among team members, giving close supervision and mentoring in the teaching/learning process.

Conclusion

Academic leadership poses problems that are distinctly different than leadership in business or government agencies. The main difference lies in the need of academic leaders to stay close to teaching, learning, research and scholarship to bring out the best among academics. The data from the analysis show that the perceptions of more than half of the leaders from the Pathein University are close to the theoretical model of effective leadership proposed by Ramsden. The author finds that they conform to theory to a great extent and would like them to emulate these attributes in their own practice of academic leadership so that the whole higher education implementing process will be successful.

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Appendix

Questionnaire on Leadership Skills

Read each statement below and select the answer, which best describes how you would or do respond. Remember to answer as honestly as possible in order to accurately capture the way you really react (not how you think you should).

1. When faced with a challenge, my first thought is, ‘*Who can I enlist to help?*’ and not ‘*What can I do?*’

0	1	2	3	4
Never	Rarely	Occasionally	Always	Don’t know
2. When my team, committee, or organization fails to achieve an objective, my first assumption is that it’s some kind of leadership issue.

0	1	2	3	4
Never	Rarely	Occasionally	Always	Don’t know
3. I believe that developing my leadership skills will increase my effectiveness dramatically.

0	1	2	3	4
Never	Rarely	Occasionally	Always	Don’t know
4. I rely on influence rather than on my position or title to get others to follow me or do what I want.

0	1	2	3	4
Never	Rarely	Occasionally	Always	Don’t know
5. I rely on my relationships with others rather than organizational systems and procedures to get things done.

0	1	2	3	4
Never	Rarely	Occasionally	Always	Don’t know
6. I have a concrete, specific plan for personal growth that I engage in weekly.

0	1	2	3	4
Never	Rarely	Occasionally	Always	Don’t know
7. I have found experts and mentors for key areas of my life with whom I engage on a regular basis.

0	1	2	3	4
Never	Rarely	Occasionally	Always	Don’t know
8. I spot problems, obstacles, and trends that will impact the outcome of initiatives my organization puts into place.

0	1	2	3	4
Never	Rarely	Occasionally	Always	Don’t know
9. I look for ways to make things better for the people I lead.

0	1	2	3	4
Never	Rarely	Occasionally	Always	Don’t know
10. I avoid undermining others or talking behind their backs.

0	1	2	3	4
Never	Rarely	Occasionally	Always	Don’t know
11. People are naturally drawn to me and often want to do things with me just to spend time with me.

0	1	2	3	4
Never	Rarely	Occasionally	Always	Don’t know
12. I go out of my way to show respect and loyalty to the people I lead.

0	1	2	3	4
Never	Rarely	Occasionally	Always	Don’t know

13. I make courageous decisions and take personal risks that could benefit my followers even if there is no benefit to me.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

14. I expect the people I attract to be similar to me in values, skills, and leadership ability.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

15. I recognize that no personnel process can improve the quality of people I recruit compared to improving myself.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

16. When I am new to a leadership situation, one of the first things I try to do is to develop a personal connection with the individuals involved.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

17. I know the stories, hopes, and dreams of the people I lead.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

18. I avoid asking people to help accomplish the vision until we have built a relationship that goes beyond the nuts and bolts of our work together.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

19. I regularly rely on some key people in my life to help accomplish my goals.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

20. I believe that 50 % or more of the credit for my accomplishments goes to the people on my team.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

21. It is my regular practice to give people I lead the authority to make decisions and take risks.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

22. If I observe an undesirable action or quality in team members, I check for it in myself first before addressing it with them.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

23. I am continually working to try to make my actions and words consistent with one another.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

24. I do what I should rather than what I want because I am conscious that I am setting an example for others.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

25. I recognize that a lack of credibility can be as harmful to an organization as alack of vision.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

26. I wait until I see that most of the people on the team have confidence in me before asking for a commitment to the vision.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

27. If members of my team are not unified in their efforts to achieve the vision, I take action to get them on the same page.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

28. Whenever I make a major leadership decision, I consider how that decision will impact momentum in my team, department or organization.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

29. I initiate specific actions with the purpose of generating momentum when introducing something new or controversial.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

30. I avoid tasks that are not required by my leadership, don't have a tangible return, or don't reward me personally.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

31. I set aside time daily, monthly and yearly to plan my upcoming schedule and activities based on my priorities.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

32. I delegate any task for which a team member can be at least 80 percent as effective as I could be.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

33. I know making trade-offs is a natural part of leadership growth, and I make sacrifices to become a better leader as long as they don't violate my values.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

34. I expect to give more than my followers do in order to accomplish the vision.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

35. I expend as much effort figuring out the timing for an initiative as I do figuring out the strategy.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

36. One of my strongest motivations is to leave any team I lead better than I found it.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

37. When I lead a team, I feel ultimate responsibility for whether it achieves its goals.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

Professional Development

1. To promote my professional growth, I have read at least six books (or taken at least one worthwhile class or listened to twelve or more audio lessons) per year for the last three years.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

2. I spend a significant amount of time every week investing in the development of the top 20 % of my leaders.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

3. I believe that I can grow my organization more rapidly by developing leaders than by any other method.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

4. I would rather see leaders I develop succeed out on their own than keep them with me so that I can keep mentoring them.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

5. In each position I've held, I have identified people who can carry on after me, and I have invested in them.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

Personal Characteristics

1. During discussions or brainstorming sessions, people turn to me and ask for my advice.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

2. I can sense whether or not people are ready for an idea.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

3. I possess a strong sense of why I am in my position and why I am leading.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

4. Even when my ideas are not very good, my people tend to side with me.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

5. I am strategic and highly selective about which people are closest to me personally and professionally.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

6. I am enthusiastic and maintain a positive attitude every day for the sake of my team members.

0 1 2 3 4
Never Rarely Occasionally Always Don't know

7. The people I lead confide in me regarding sensitive issues.

0	1	2	3	4
Never	Rarely	Occasionally	Always	Don't know

8. I believe that no matter how talented the people who work for me are, my position is secure.

0	1	2	3	4
Never	Rarely	Occasionally	Always	Don't know

9. I can read situations and sense trends without having to gather hard evidence.

0	1	2	3	4
Never	Rarely	Occasionally	Always	Don't know

10. I can easily gauge morale, whether in a room full of people, on a team, or in an organization.

0	1	2	3	4
Never	Rarely	Occasionally	Always	Don't know

11. I often take the right action as a leader even if I cannot explain why.

0	1	2	3	4
Never	Rarely	Occasionally	Always	Don't know

12. I can clearly see a pathway for the implementation of a vision, including not only the process but also the people and resources needed.

0	1	2	3	4
Never	Rarely	Occasionally	Always	Don't know

13. I am called upon to plan initiatives for my organization.

0	1	2	3	4
Never	Rarely	Occasionally	Always	Don't know

14. Rather than being annoyed when team members have issues preventing them from doing their jobs effectively, I see the issues as an opportunity to serve and help those people.

0	1	2	3	4
Never	Rarely	Occasionally	Always	Don't know

15. I find great personal satisfaction in helping other people become more successful.

0	1	2	3	4
Never	Rarely	Occasionally	Always	Don't know

16. When I tell someone in my organization that I will do something, s/he can count on me to follow through.

0	1	2	3	4
Never	Rarely	Occasionally	Always	Don't know

17. I am satisfied with the caliber of people who report to me or work with me.

0	1	2	3	4
Never	Rarely	Occasionally	Always	Don't know

18. I embrace change easily and become dissatisfied with the *status quo*.

0	1	2	3	4
Never	Rarely	Occasionally	Always	Don't know

Why the Teaching of Civic Education in Schools is Essential for Democratic Myanmar

Mi Mi Gyi¹

Abstract

Myanmar is transitioning to democracy since 2010 general election. Democratic political system means people's sovereignty in a country. Thus, the people need to understand how to govern their country by themselves. Civic education or citizenship education called in Myanmar language ပြည်သူ့နိတိ in a democracy is educating the people about democratic self-government. This paper discusses the contents of civic education and why teaching civic education in schools is essential for democratic Myanmar. Democracy depends upon the effective and competent participation of its citizens. Therefore, all democratic countries provide formal and informal opportunities for civic education. Formal civic education is carried out through the curriculum of schools. In democratic countries, "schools" generally prepare students for democratic citizenship through civic education. Informal civic education happens through the "interaction" of individuals in various societal organizations. The whole society is provided lifelong opportunities for civic education through the mass media and by participation in community service and political parties. This paper is a qualitative research based on primary and secondary documents. It argues that throughout Myanmar's history, civic education was ignored by successive authoritarian governments except a little spark in the 1950s. Authoritarian political culture is deep-rooted in the politics and society of Myanmar. In order to plant democracy in Myanmar, we need to embed democratic political culture in the society and educate the people democratic civics.

Key Words: Civic education, self-government, citizenship, schools, democracy, Myanmar

Introduction

In order to succeed democracy in Myanmar, the people need to be trained and educated to become democratic citizens. Today's democratic countries put civic education in school curricula and it is taught from kindergarten to high school for at least 10 years. Myanmar was under the authoritarian rule since independence except one decade of parliamentary democracy system between 1948 and 1962. During these days of parliamentary period, civic education was included and taught in the formal education curriculum. As Myanmar was an authoritarian country for many years, authoritarian political culture is deep-rooted in Myanmar culture. Therefore, if Myanmar wants to transition to democratic political system, first of all, it needs to change its political culture from authoritarian to democratic culture. Democracy is popular self-government. However, Myanmar people didn't have any experience about self-governance and self-administration due to the successive authoritarian regimes and their leaders. Military leaders didn't want people to be interested and competent in governance and politics. They worried about people participating in political movements or discussing public policies. Dr Maung Maung Gyi, former professor of History department, at University College in Mandalay, wrote in his book *Burmese Political values: the Socio-Political Roots of Authoritarianism* (1983) that Myanmar political culture is the authoritarian political culture.² In Myanmar, not only the successive military governments and leaders were authoritarian, but also Myanmar society was in authoritarian nature. Until now, there are still tyrants or autocrats in every part of society. For example, in an ethnic group, tribe leaders

¹ Dr., International Relations and Political Science, Pro-rector, Pathein University

² Maung Maung Gyi, *Burmese Political Values: The Socio-Political Roots of Authoritarianism*, Praeger Publishers, New York, 1983

are dictatorial. Likewise, headmaster/headmistress in a school, departmental heads in a government department and family heads in a family are also domineering. To become a democratic society, we need to develop democratic culture with the practice of the majority rule while respecting the wishes of the minority. In every part of the society, the people must practise democratic political culture such as discussion, negotiation, compromise and tolerance. The best way to train the youth democratic political culture is to start democratic civic education at the schools from the very young age, kindergarten. In the class, the teacher can train students the practice of following the majority's wishes while protecting the interest of the minority. For example, the children can practice the voting to choose the class monitor.

What is Civic Education?

The word "civics" is derived from the Latin word "civitas", which means "citizen", or "of citizen". It is also a root word for "city," so civics can also mean anything related to a city.¹ Generally, civics is the study of the rights and duties of citizens and of how government works. So, it studies the theoretical and practical aspects of citizenship, its rights and duties and duties of citizens to each other as members of a political body and to the government. It includes the study of civil law and civil code and the study of government with attention to the role of citizens in the operation and oversight of government. Nowadays, the expression civic education takes on different names in different countries such as civic education, citizenship education, civic engagement, education for democratic citizenship, civic culture, political education, or moral education with no significant difference in their essence and purpose.

According to UNDP definition, "Civic Education is learning for effective people participation in democratic and development processes at both local and national levels. It is an important means for capacity development on the societal level by empowering people for effective civic engagement. It is an essential dimension in strengthening a society's ability to manage its own affairs and is complementary to capacity development on the individual and institutional levels." At the core of Civic Education are the values and principles of transparency, participation, responsiveness, accountability, empowerment and equity. Communication and access to information are also integral to civic education.² In other words, civic education is a subject which basically addresses the rights and duties of citizens. Civic education in a democracy is actually education in self government. Democratic self government means that citizens are actively involved in their own governance instead of submissively accepting the orders of others and complying with the demand of others. By "democratic education," it means "educating youth for active participation in a democratic society.

Components of Civic Education

Civic Education is generally understood to comprise three elements: civic knowledge, civic skills and civic disposition. Civic knowledge means citizens understand their political and civic context. They know their social and economic rights as well as their political and civil rights and understand the roles, rights and responsibilities of citizenship. Civic skills involve citizens acquiring the ability to explain, analyze, interact, evaluate, defend a position, and monitor processes and outcomes using knowledge for informed participation in civic and political processes. Civic disposition involves citizens developing confidence to be able to participate in civic life; assuming the roles, rights and responsibilities usually associated with

¹ Vocabulary.com Dictionary, <<https://www.vocabulary.com/dictionary/civic>>

² Civic Education Practical Guidance Note, UNDP, Bureau for Development Policy, Democratic Governance Group, April 2004 (Henceforth: Civic Education Practical Guidance Note)

citizenship in democratic systems; and being open, tolerant and responsible in exercising their rights and responsibilities.¹ These are essential for becoming informed, effective, and responsible citizens.

Civic Knowledge

Civic knowledge is concerned with the content or what citizens ought to know. Informed citizens have basic knowledge of such subjects as history, economics, geography, and government or political science. They comprehend core concepts of democracy, the Constitution, institutions of democracy in their own country, and public issues in the past and present pertaining to the practice of democracy. Concerning civic knowledge, main questions to understand are: what are civic life, politics and government?; what are the foundations of the Myanmar political system?; how does the government established by the Constitution embody the purposes, values, and principles of Myanmar democracy?; what is the relationship of the Republic of the Union of Myanmar to other nations and to world affairs?; and what are the roles of citizens in Myanmar democracy? Democracy is a dialogue, a discussion, a deliberative process in which citizens engage. The use of these questions is intended to indicate that the process is never-ending and an on-going marketplace of ideas and a search for new and better ways to realize democracy's ideals.

Civic Skills

Civic skills are skills needed to enable citizens to use knowledge effectively as they act individually and collectively in the public life of their democracy. These are capacities of citizens to read, write, and speak effectively; to think critically; and to make and defend sound judgments about public issues. Others skills are thinking and participating in politics in combination with civic knowledge; and becoming citizens with common interests to influence the decisions of their representatives in government. There are two kinds of civic skills: intellectual and participatory. Intellectual civic skills are skills concerning being able to think critically about political issues. For example, one must have an understanding of a particular political issue, its history, its contemporary relevance, as well as command of a set of intellectual tools or considerations useful in dealing with such an issue. Usually it is called "Critical Thinking Skills." Its necessary skills are identifying and describing; explaining and analyzing; and evaluating, taking, and defending positions on public issues. On the other hand, if citizens are to influence the course of political life and the public policies adopted, they need to expand their buildup of participatory skills. Participatory civic skills are interacting, monitoring and influencing, petitioning, speaking, or testifying before public bodies, joining ad-hoc advocacy groups, and forming coalitions.

The development of participatory skills begins in the earliest grades in Schools. The youngest pupils can learn to interact in small groups or committees, to pool information, exchange opinions or formulate plans of action commensurate with their maturity. They can learn to listen attentively; to question effectively; and to manage conflicts through mediation, compromise, or consensus-building. For older students, they should develop the skills of monitoring and influencing public policy; researching public issues using electronic resources, libraries, the telephone, personal contacts, and the media; attending at public meetings ranging from student councils to school boards, city councils, zoning commissions, and legislative hearings.² These skills ought to be a required part of every high school student's experience. They also need to observe courts and exposure to the workings of the

¹ *Civic Education Practical Guidance Note*, p.5

² *Civic Education Practical Guidance Note*, pp.6-7

judicial system. They should have well-planned, structured opportunities to reflect on their experiences under the guidance of knowledgeable and skillful mentors.

Civic Dispositions

Civic dispositions are essential traits for the maintenance and improvement of constitutional democracy and the well-being of their community and democracy. There are two kinds of civic dispositions: private and public characters. Examples of the imperative private characters are moral responsibilities such as honesty (telling truth, not cheating), courage (standing up for what you believe in and advocating for a group), compassion and charity (caring, helping, loving, volunteering at a nursing home, and asking how a friend is doing), open mindedness (accepting others ideas and beliefs, not criticizing), persistence (never giving up), self discipline or self-restraint, respect for the worth and rights of others' privacy and belongings, and patriotism (such as doing community service and respecting the national flag). On the other hand, "public" character traits are public spiritedness (motivated by or exhibiting devotion to the public welfare), civility (caring about friends and family), respect for the rule of law (obeying laws and rules), critical mindedness (reading periodicals to gain new perspective), civic Mindedness (not littering, planting trees), active listening, negotiation and compromise (be willing to give up something you want for a friend) and tolerance of ambiguity (accepting that I won't always be correct). ¹ Civic Dispositions are imperative as they contribute to the political efficacy of the individual, the healthy functioning of the political system, a sense of dignity and worth, and the common good.

Main characteristics of civic dispositions are becoming an independent member of society; assuming the personal, political, and economic responsibilities of a citizen; respecting individual worth and human dignity; participating in civic affairs in a thoughtful and effective manner; and promoting the healthy functioning of constitutional democracy. Civic disposition also encompasses adhering voluntarily to self-imposed standards of behavior rather than requiring the imposition of external controls; accepting responsibility for the consequences of one's actions; and fulfilling the moral and legal obligations of membership in a democratic society. As an independent member of society, citizens take care of one's self, support one's family, and care for, nurture, and educate one's children. They serve in leadership positions commensurate with one's talents. Respecting others means listening to their opinions, behaving in a civil manner, considering the rights and interests of fellow citizens, and adhering to the principle of majority rule but recognizing the right of the minority to dissent.

Citizens with civic dispositions participate in civic affairs in a thoughtful and effective manner. They become informed prior to voting or participating in public debate. They engage in civil and reflective discourse and assume leadership when appropriate, evaluating whether and when one's obligations as a citizen require that personal desires and interests be subordinate. They evaluate whether and when one's obligations or constitutional principles obligate one to reject to the public good certain civic expectations. Citizens promote the healthy functioning of constitutional democracy. They are informed and attentive to public affairs, learn about and deliberate on constitutional values and principles, monitor the adherence of political leaders and public agencies to those values and principles. They take appropriate action if adherence is lacking and work through peaceful, legal means to change

¹ Civic Dispositions, <<http://civicdispositionspb.yolasite.com/definitions.php>>

laws that are thought to be unwise or unjust.¹ In democratic countries, schools prepare people to become “responsible citizens.” Sharing is essential in a democratic society. We need to share power, resources and responsibilities. In a democratic society, the possibility of an effective social change is ever present, if citizens have the knowledge, the skills and the will to bring it about. That knowledge, those skills and the will or necessary traits of private and public character can be built up just by means of a good civic education.

Civic Duty

Civic Duty is an action or responsibility expected of every member of a society. Generally, there are five civic duties or basic tenets of citizenship. They are obeying laws, serving on juries, paying taxes to the government, voting in elections and doing volunteer works² such as helping in a shelter, serving on a committee, raising money for charity, working as a volunteer firefighter or advocating for political issues. On the other hand, basic Civil Rights of citizens are freedom of religion, freedom of speech and the press, the right to assemble, the right to petition government and equality before the law. Others are also free education, free health care and social security depending upon a particular nation’s wealth and its public policies. In Myanmar, citizen, fundamental rights and duties of citizens are stated in detail in the chapter VIII of the 2008 Constitution. Article 354 of the Constitution states that:

Every citizen shall be at liberty in the exercise of the following rights, if not contrary to the laws, enacted for Union security, prevalence of law and order, community peace and tranquility or public order and morality: (a) to express and publish freely their convictions and opinions; (b) to assemble peacefully without arms and holding procession; (c) to form associations and organizations; and (d) to develop their language, literature, culture they cherish, religion they profess, and customs without prejudice to the relations between one national race and another or among national races and to other faiths.³

Article 376 points that no person shall be held in custody for more than 24 hours without the remand of a competent magistrate.⁴ However, the uniqueness of the 2008 Myanmar constitution is that first and foremost civic duties of the citizens are three our causes such as (a)non-disintegration of the Union; (b)non-disintegration of national solidarity; (c)perpetuation of sovereignty (Article 383).

Responsible Citizens

The best way to prepare ‘responsible citizens’ is to instill basic democratic values and ideals into the nation’s youth, which is most effectively achieved through civic education. It includes instruction about the specifics of Myanmar’s democratic processes and a general introduction to open-minded engagement with the challenges facing the nation. It is a key factor in personal and social development, as well as essential to the democratic process. So, civic education is essential for Myanmar to have “democratic citizens.” As all citizens become eligible voters by age eighteen in Myanmar, it is important that they understand their roles and responsibilities as democratic citizens. Without a thorough understanding of the “civic education” learned at school, we cannot expect citizens to perform their civic duties.

¹ Margaret Stimmann Branson (Associate Director), “The Role of Civic Education, A Forthcoming Education Policy Task Force Position Paper from the Communitarian Network”, Center for Civic Education, September 1998 <http://civiced.org/papers/articles_role.html>

² What are five civic duties?, reference.com, <<http://www.reference.com>>

³ Constitution of the Republic of the Union of Myanmar (2008), Printing and Publishing Enterprise, Ministry of Information, Naypyidaw, September 2008, p.150 (Henceforth: Constitution of Myanmar, 2008)

⁴ Information, Naypyidaw, September 2008, p.150 (Henceforth: Constitution of Myanmar, 2008), p. 154

Development of Civic Education in Myanmar

During the colonial period, civic education was taught together with history or moral subjects at the national schools until the World War II. After independence, civic education was taught in formal education in Myanmar for ten years under the parliamentary democracy governments. Concerning civic education, the first book published in Myanmar was *Civics* written by U Ba Pe, ex-Rector of Education College in 1953. In the chapter 4, vol. 1 of his book, he wrote that “the basic principles underlying democracy is that every individual and party has the right to speak and think freely. Likewise, every individual or party must be liberal to the opinions of others.” Also in the chapter 4, vol. 2, he stated that “the onus is on the government to protect the lives and properties of the citizens and promote the interests of the citizens. The education is the capital for the development of the nation. Therefore, there must be strategic plans to educate people.” In the Chapter 6, vol. 1, he emphasized that “rights and responsibilities are closely related to each other, so one must take both of them together.”¹ After General Ne Win took over power in 1962, the teaching of civic education ceased and the new Revolutionary Council government neglected civic duties and rights of the citizens. Since then, Myanmar people were inexperienced to civic duties and rights as well as the knowledge of the citizens. Later generations have not even heard of civic education in their whole lives. Currently, there are no civic education curriculums in Myanmar schools yet. However, civic education has been implementing in Myanmar by a wide variety of organizations and individuals since 2010s. Like in the most of the countries in the world, it is supported and sponsored by human rights commissions and international, regional, and domestic civil society organizations (CSOs). In 2010, a civil society group called *New Myanmar Foundation (NMF)* started to educate civic and voter education among the citizens.

Between September 2011 to February 2012, a non-profit organization, Phaung Daw Oo Monastic Education High School based in Mandalay collaborated with the California based non-profit organization named the Center for Civic Education (CCE) to start a Civic Education Program called “the Project Citizen: A Portfolio-Based Civic Education Program.” It was a curricular program for middle, secondary, and post-secondary students and adult groups that promote competent and responsible participation in local and state government.² The program helped people learn how to monitor and influence public policy. In the process, they develop support for democratic values and principles, tolerance, and feelings of political efficacy. Entire classes of students or members of youth organizations work cooperatively to identify a public policy problem in their community. They then research the problem, evaluate alternative solutions, develop their own solution in the form of a public policy, and create a political action plan to enlist local or state authorities to adopt their proposed policy. Participants develop a portfolio of their work and present their project in a hearing showcase before a panel of civic-minded community members.

Likewise, *Daw Khin Kyi Foundation (DKKF)* partnering with a local NGO called “*Mote Oo*” has been conducting civic education training to teachers from monastic schools and from high schools since 2013. Mote Oo’s Civic Education Project (CEP) started with the development of the civic education textbook *Active Citizenship* in early 2013. The project provided non-formal educators with the knowledge and skills to promote social justice and political awareness through civic education materials and training. Its objectives were to

¹Civic Education (ပြည်သူ့နိတိ), New Myanmar Foundation, <<https://www.youtube.com/watch?v=PzZR7Eb8iRk>>

² Civic Education Program, Phaung Daw Oo Monastic Education High School <<http://pdo-education.blogspot.com/search/label/Civic%20Education%20Program>>

produce context appropriate, affordable and user-friendly textbooks and curriculums for civic educators and their learners; and provide training and professional support to civic educators. It has already been produced three textbooks: *Active Citizenship*; *Politics: Ideas, Institutions and Actors*; and *Democracy*. CEP training staff provided professional support for civic educators through trainings, workshops and curriculum advice. Trainings have been based on the pedagogical approach that is used in Mote Oo's textbooks and how to apply this in teaching. Mote Oo's civic education textbooks develop learners' knowledge and understanding, civic skills and ability to reflect on their values. Recognizing that this approach may be unfamiliar to Myanmar educators, CEP training workshops introduced this system and provided training on how to use it in the classroom.¹ CEP trainings also included some approaches as cooperative learning, experiential learning, values education and democratic classrooms.

In September 2012, a group called *Institute for Political and Civic Engagement in Burma (iPACE)* was established and funded by US Department of State. It has also been providing education and training courses to build the capacity of local democracy, labor, and civil society activists in Myanmar. It used courses such as civic education, human rights, voter education, and English for special purposes, as well as activities which support networking and consensus building among Myanmar's socio-political actors. With political reforms since 2011, people are tremendously engaged in such kind of activities. Since 2012, iPACE has trained more than 1,137 participants from 33 different political parties and 404 organizations, including a diverse array of civil society organizations (CSOs), labor unions, nongovernmental organizations (NGOs), community-based organizations (CBOs), student unions, disability rights groups, women's empowerment groups, and political prisoner societies, among others. In June 2014, it made a critical expansion to the iPACE program by establishing a presence at the U.S. Embassy's Jefferson Center in Mandalay. Since then, the institute has trained 133 democracy leaders who represent 47 organizations.² iPACE has also expanded its reach and programmatic footprint in Chin State, Kachin State, Karen State, Mandalay Division, Mon State, and northern and eastern Shan State through a series of eight mobile trainings.

Between March 13 to 17 2012, *Myanmar Egress* which is a nonprofit organization based in Yangon since 2006 organized a training for "Civic Education for Civil (CEC)" for local Chin people in Sagaing division, Myanmar. It also conducted trainings related to political and social issues in Arakan state. The declared objectives of Myanmar Egress are to promote civil society organizations in the country and to help youth by a group of Myanmar nationalists committed to state-building through positive change in a progressive yet constructive collaboration and working relationship with the government and all interest groups, both local and foreign.³

Between April and November 2013, the "Together for Burma: Civic Education" project was carried out by *the Other Space Foundation* in Myanmar. The activities carried out within the framework of this project took place mainly in Shan, Kayah and Rakhine states. The project has been co-financed by the Polish development cooperation programme 2013 of the Ministry of Foreign Affairs of the Republic of Poland, Programme "Support for

¹ "Civic Education Project," Mote Oo Education, < <http://www.moteoo.org/projects/civic-education-project/> >

² "Institute for Political and Civic Engagement for Myanmar (iPACE)", World Learning, 2017, < <http://www.worldlearning.org/projects/institute-for-political-and-civic-engagement-in-burma/> >

³ "Civic education training for Chins by Myanmar Egress", 20 March 2012, *Khonumthung news*, <<http://khonumthung.org/2012/03/20/civic-education-training-for-chins-by-myanmar-egress/>>

Democracy”.¹ The goal of this project was to identify the biggest challenges and opportunities for civic education in Rakhaine and Shan regions. According to their observational report of the grassroots activities carried out in these states, general challenges for civic education were isolation and lack of space for a dialogue, fear of politics, lack of capacity and knowledge amongst many CBO members, lack of sustainability in the activities carried out by INGOs, lack of women participation, and ongoing violence and lack of sustainable peace agreements. In terms of challenges for electoral education were lack of electoral awareness, lack of clear electoral legislation, doubts surrounding the preparation and implementation of 2014 nationwide Census, ongoing violence and influence in post-conflict areas and influence of cronies in these areas.²

Since 2012, the institute called *the International Foundation for Electoral Systems (IFES)* has been supporting electoral stakeholders in Myanmar to build a transparent, credible and inclusive electoral system. IFES began work in Myanmar during the April 2012 by-elections through a voter education program with civil society partners that targeted the inclusion of women in the electoral process. In early 2013, IFES began to scale up operations in Myanmar by providing workshops and electoral assessments to the Union Election Commission (UEC).³ In order to conduct a widespread civic education program entitled “*Naing Ngan Thar Kaung*”, or Model Citizen, IFES partnered with seven civil society organizations (CSOs) in Myanmar – Creative Home, Kadu Youth Development Organization, Hornbill Organization, Magway Regional Youth Network, Myanmar Network for Free and Fair Elections (MYNFREL), the Myanmar Youth Capacity Building Network (MYCBN) and Scholar Institute.⁴ IFES also held a one-week curriculum design workshop with CSO representatives and Union Election Commission (UEC) officials in July 2016 to develop an interactive civic education training curriculum for the program.

The Naing Ngan Thar Kaung curriculum was presented through a wide-variety of creative strategies designed by IFES’ CSO partners. These included cascade training programs, advocacy campaigns, plays, debates and documentary viewings. The curriculum provided information on democracy, qualities of good representatives and how to be an active citizen. Targeted populations for this project were areas with low voter turnout and high invalid ballot numbers from the 2015 elections, with a specific emphasis on traditionally marginalized groups such as women, youth, ethnic minorities and internally displaced persons (IDPs). The program was well-received, resulting in 13,745 trained individuals who spread the information to an additional 55,000 people in their communities. A total of 45 different ethnic minorities were included and 80 percent of the program participants were youth between the ages of 18-35. The program was also piloted in six IDP camps. IFES did a survey on the civic knowledge of Myanmar citizens in 2015. According to its survey, only 26 percent of survey respondents reported they had knowledge of how a candidate is elected in the election. Additionally, 44 percent of men reported that they had participated in at least one civic activity compared to 22 percent of women. The survey also found that while 72 percent believed that democracy is the best form of government, 78 percent believed that

¹ “Civic Education in Myanmar: challenges and opportunities Observations from grassroots Activities carried out in Shan, Kayah and Rakhine States,” December 2013, <<https://projektbirma.files.wordpress.com/2014/02/report-civic-education-in-myanmar-challenges-and-opportunities.pdf>>

² Civic Education in Myanmar: Challenges and Opportunities, Observations from grassroots Activities carried out in Shan, Kayah, Rakhine States, December 2013 <<https://projektbirma.files.wordpress.com/2014/02/report-civic-education-in-myanmar-challenges-and-opportunities.pdf>>

³ International Foundation for Electoral Systems (IFES), <<http://www.ifes.org/myanmar>>

⁴ “Sharing Democratic Principles and Civic Knowledge with Myanmar’s Citizens,” IFES, 14 March 2017, <http://www.ifes.org/news/sharing-democratic-principles-and-civic-knowledge-myanmars-citizens> (Henceforth: “Sharing Democratic Principles and Civic Knowledge with Myanmar’s Citizens,” IFES, 2017)

Myanmar's democracy is functioning with minor or major problems.¹ These survey findings pointed out the need to educate the people about civic education and encourage them for active participation in the country's democracy process.

Significantly, Myanmar's first civic education mobile application, *New Niti* was launched by a project of UN Educational, Scientific and Cultural Organization (UNESCO) in 2014. It was the result of UNESCO's educational project on teaching the country's high school students about human rights and active citizenship. It was also a part of a global initiative called "Connect to Learn," which provided training to teachers and education professionals on how to utilize information and communications technology (ICT) to improve learning outcomes. The UK-based non-governmental organization "One World", together with UNESCO made the app available in its ICT digital library, which was part of the "Empowering Women and Girls through Mobile Technology in Myanmar" project launched in June 2014 as a public-private partnership among UNESCO, Ericsson and the Ministry of Education.

New Niti means "new knowledge" on "morality" and the app provides exactly that: knowledge that is important for everyone in modern Myanmar, with a specific focus on young people. The app's goal is to educate the country's youth populations on five main concepts—citizenship, democracy, elections, rule of law, and peace. In this way, it intends to provide greater political transparency and accountability, encouraging critical thinking and active community engagement among Myanmar's young people. The app includes animated cartoon characters, engaging stories both in script and in audio, quizzes, surveys, games, a glossary, and a feature that allows you to ask a civic education question to an expert. All features are available both in Myanmar and English. The fundamental vision of the app is to promote active citizenship on the individual level while also improving access to information and education. The ICT project has already provided more than 3,000 tablets, some 180 laptops and projectors to the Ministry of Education, school leaders and teachers at 31 project schools in Mandalay Division, Pegu Division and Mon State. The app was primarily developed in Myanmar and released in October 2015 in collaboration with a number of other local civil society groups and creative initiatives such as the Center for Youth and Social Harmony, Kalyana Mitta Foundation, Mote Oo, Saitta Thukha Development Institute and other partners who created illustrations and dialogues.² On the other hand, after the new NLD government came to power in April 2016, it started to engage and have been considering for teaching the Civic Education subject in schools.

Conclusion: Why is the Teaching of Civic Education in Schools is essential for Democratic Myanmar?

Democratic values are not natural. They have to be nurtured for each generation. Education's most basic purpose should be preparing young people to become reflective citizens who would value liberty and democracy and resist the appeals of demagogues. Citizens should be educated civic education so they could discern serious leaders of high character from con men who do not have the nation's interests at heart. Students need to recognize the genius of democracy: When people are free to dissent, to criticize, to protest and publish, to join together in common cause, to hold their elected officials accountable, democracy's magnificent capacity for self-correction is manifest."³ Education in democratic

¹ "Sharing Democratic Principles and Civic Knowledge with Myanmar's Citizens," IFES, 2017)

² "New App Aims to Give Youth Civic Education", Tin Htet Paing, *The Irrawaddy*, 21 June 2016, <<https://www.irrawaddy.com/news/burma/new-app-aims-to-give-youth-civic-education.html>>

³ "Education for Democracy A Statement Signed by Over 100 Distinguished Leaders," American Federation of Teachers, p.14 <<https://www.aft.org/periodical/american-educator/fall-2003/education-democracy>>

Myanmar must aim to instill a love of liberal democracy; a respect for the separation of powers, for a free press and free religious exercise; and for the rights of political minorities. Educating common people the democratic civics was the answer to the oligarchs who said the average citizen could not be trusted to choose leaders wisely. In a country where most citizens fervently support democracy, where anti-system parties are marginal or nonexistent, and where major political forces respect the rules of the political game, democratic breakdown is extremely unlikely.¹ Therefore, by means of educating the citizens the democratic civics, democracy can be firmly consolidated in Myanmar. Schools in Myanmar need to put democracy back into education. Rigorous courses in history, literature, and civics would cultivate knowledge of democratic practices and a belief in democratic values. Civic education plans teaching the knowledge, skills, and virtues needed for competent citizenship in a democracy.

Myanmar's democracy cannot be maintained unless its citizens are educated sufficiently to carry out certain duties and responsibilities of a self-governing people. These are voting intelligently; communicating effectively about public issues; cooperating with others to solve common problems; and making judgments about the performance of their government. Therefore, all democratic countries in the world provide formal and informal opportunities for civic education (citizenship). Wherever in the world democracy exists, formal civic education is carried out through the curriculum of "schools." informal civic education occurs through the "interaction of individuals" in various societal organizations. The society outside the school also provides lifelong opportunities for civic education through "the mass media" and by "participation in community service" and "political parties."

In Myanmar, the legacy of dictatorships still influences the development of a democratic political culture which is central for democratic consolidation. According to studies, the legacy of previous authoritarian regimes impacts on citizens' political attitudes and behavior today. In other words, the citizens' formative experiences in non-democratic systems have long-term impacts on individual political attitudes, values, and behavior, as well as on the prospects of a democratic political culture in a transitioning society. Democracy depends upon the competent participation of its citizens. In the despotic forms of government, the people are merely passive receivers of orders from their rulers. Unlike them, democracy involves a significant measure of independent thinking and popular decision-making. Myanmar people were used to the despotic forms of government. Periods of authoritarian rule have a lasting impact on Myanmar's political structure and culture. It means that Myanmar people are used to the commands and without them, they do nothing voluntarily. They don't dare to stand against wrong-doings although they know they should do. They are tolerant to the bullying of bureaucrats and government servants just like normal condition. They ignore on violations of public interest. They don't want to think critically. Most of Myanmar society is used to these bad habits. So, we need to change these attitudes. The basic concept of democracy is to implement the interest of the majority while respecting and protecting the interest of the minority. In democratic culture, the sole solution to the differences is by means of discussion, negotiation and compromise. In order to practise civic education with democratic ideals in Myanmar public schools, we need to make changes in school syllabuses and curricula. Myanmar schools should model democratic values for students by encouraging community members to be actively engaged in education decisions and inviting teachers to participate in a democratic workplace. Only in a society with such democratic political culture, democracy that we love, we inspire and we strike for, will

¹ Roberto Stefan Foa and Yascha Mounk, "The Danger of Deconsolidation," *Journal of Democracy*, July 2016, Vol. 27, No. 3, p.16 <<http://www.journalofdemocracy.org/sites/default/files/Foa%26Mounk-27-3.pdf>>

develop and flourish. By means of teaching civic education in schools, people will become informed, effective and responsible citizens for democratic Myanmar.

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Isolation and Characterization of Fungi from Soil Samples Collected in Selected Sites of Pathein Township

Ohnmar Aye¹

Abstract

In this research work, fungi were isolated from different soil samples collected in selected sites of Pathein Township. Fourteen different fungi were isolated by using physical treatment dilution method and soil plating method. Low carbon agar (LCA) and potato glucose agar (PGA) media were used for this isolation. All isolated fungi were studied by cultural morphologic characteristics and photomicrographic image. Besides, the biomass powder were prepared by using isolated fungi in potato dextrose broth (PDB) medium. To understand the characterization of functional group and chemical constituents of isolated fungi, the prepared biomass were analyzed by FTIR and EDXRF techniques. FTIR spectra is effective assay for detection and classification between different fungal genera. In the present study, FTIR spectral verify the presence of many functional groups indicating the complex nature of isolated fungi. Therefore, the results proved the possibility of classification between the isolated fungi on the genus level.

Keywords: LCA, PGA, PDB, biomass

Introduction

Fungi constitute a group of microorganism that are widely distributed in environment especially in soil. Fungi have many different structure but they can act in similar ways. Fungi perform important functions within the soil in relative to nutrient cycling, disease suppression and water dynamics, all of which help plant becomes healthier and more vigorous. Fungi tend to dominate over bacteria and actinomycetes in acid soils as they can tolerate a wide pH range. Fungal cell walls are complex macromolecular structures mainly consisting of chitins, glucans, mannans and protein, but also containing other polysaccharides, lipids and pigments, e.g. melanin. The sequestering of heavy metal ions by fungal biomass has mainly been traced to the cell wall. Many types of polysaccharides are the main (up to 90%) constituents of the fungal cell wall. FTIR spectroscopy is one of the methods that have been successfully used for detecting and identifying microorganisms. Moreover, the chemical composition of the samples can be simultaneously visualized. The detection of microorganisms using FTIR technique is promising as valuable tool because of its sensitivity, rapidity, low cost and simplicity.

Experimental

Sampling

Seven different kinds of soil samples were collected within the studied area of Pathein Township in Jun-July, 2015. Soil texture and pH were analyzed at department of agriculture (land use), Yangon.

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Media Used for the Isolation of Soil Fungi

1. LCA Medium (Ando, 2004) 2. PGA Medium (Ando, 2004)

Glucose	2.0g	Potato	200g
Sucrose	2.0g	Glucose	20g
K ₂ HPO ₄	1.0g	Agar	18g
MgSO ₄ ·7 H ₂ O	0.5g	Yeast Extract	1.0g
KNO ₃	1.0g	DW	1000mL
KCl	0.5g	pH	6.5
Agar	18g		
DW	1000mL		
pH	6.5		

(After autoclaving chloramphenicol 0.03g was added to the medium)



Figure 1. Map of Soil Collected Area at Patheingyi Township

Table 1. Different Soil Samples Collected at Patheingyi Township

Soil No.	Collected Places	Locations	Soil Types	pH	Date
S-1	Taung Paw Road	N16°49'14" E94°45'25"	Sandy clay loam	6.2	24.6.2015
S-2	University Campus	N16°47'46.6" E94°44'55.3"	Clay loam	5.3	24.6.2015
S-3	ZayChaung Road	N16°46'58.2" E94°44'14.5"	Loam	6.1	28.6.2015
S-4	Wai Lu Wun	N16°45'75.6" E94°42'82.1"	Loam	6.2	2.7.2015
S-5	MahaBandoola Road	N16°47'32.2" E94°44'25.7"	Sandy loam	5.8	3.7.2015
S-6	Pan Tin Gone	N16°46'36.8" E94°44'43.3"	Sandy clay loam	5.8	4.7.2015
S-7	Yan Kin Taung	N16°49'21.1" E94°45'70.3"	Sandy loam	6.4	6.7.2015

Isolation Methods of Soil Fungi

Isolation of soil fungi from collected soil samples were carried out by physical treatment dilution method and soil plating method. These procedures were performed by the methods of Phay, Yamamura (2005) and Ando, Inaba (2004).

Physical Treatment Dilution Method (Phay and Yamamura, 2005)

The collected soil sample was air-dried at room temperature. It was ground and sieved in 2mm screen. The sample was placed in hot air oven at 120°C for 1hr. The dried soil sample was diluted with sterile water. The final test tube of dilution series were cultured on LCA medium and incubated for 5 to 7 days. Pure colonies were picked up to start containing in PGA medium.

Soil Plating Method (Ando and Inaba, 2004)

The collected soil sample was air-dried at room temperature. It was ground and sieved in 2mm screen. 0.1 g of soil sample was put into empty petri dish. Nutrient agar (LCA medium) was poured into the petri dish and shake gently to suspended soil particles in medium. The medium was cooled down to solidify.

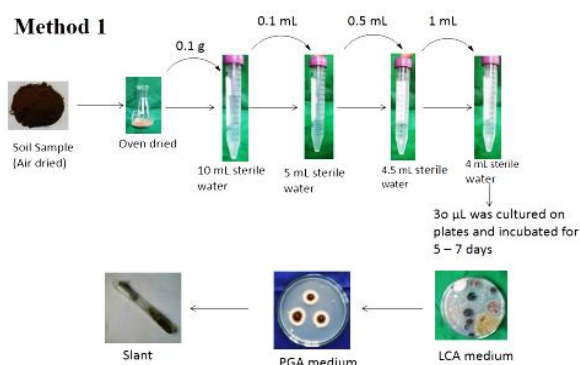


Figure 2. Procedure of physical treatment dilution Method

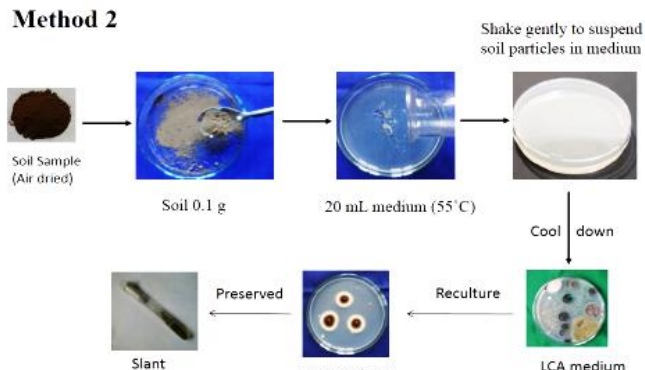


Figure3. Procedure of soil plating method

Preparation of Pretreated Biomass

A liquid medium potato glucose broth (PGB) was prepared by 200g of potato boiled in distilled water and the filtrate is mixed with 2g of glucose and volume made up to 1000 mL of distilled water. Sterilized by autoclaving at 121°C for (15 lb pressure) 15 minutes. After autoclaving, 50 mL medium were inoculated by fungal mycelium from 3-5 days old culture and incubated at 25°C for 7 days. Fungal cell mass was prepared by filtering the culture medium through filter paper.

Mycelium was thoroughly washed with deionized water and suspended in 0.5 N NaOH solution. The pretreated biomass was washed with deionized water until the pH of the solution was adjusted to neutral range. Biomass was autoclaved for 15 min at 121°C and dried in an oven at 80°C for 24 hour. Dried biomass was ground and sieved. The prepared biomass powder was stored in air tight bottle for further biosorption experiment.

Results

Table 2. Colony Characters of Isolated Fungi

No.	Strain	Cultural Character	
		Surface Color	Reverse Color
1	OMA – 01	White	White
2	OMA – 02	Grey	Grey
3	OMA – 03	Brown, margin White	Cream
4	OMA – 04	White	Yellow, edge cream
5	OMA – 05	Yellowish green	Cream
6	OMA – 06	Grey	Grey
7	OMA – 07	Green, edge white	White
8	OMA – 08	Cream, edge white	Brown, edge Cream
9	OMA – 09	Black, edge white	Grey
10	OMA – 10	Pink, margin white	Yellow, edge cream
11	OMA – 11	Pale green, edge white	Brick
12	OMA – 12	White	Orange red, edge cream
13	OMA – 13	Grey, edge white	Grey
14	OMA – 14	Green	Cream

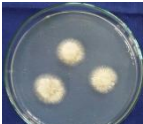
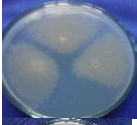
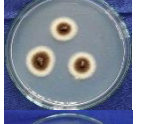
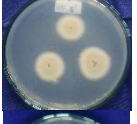
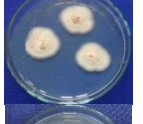
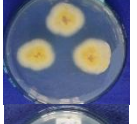
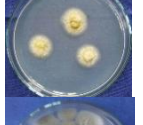
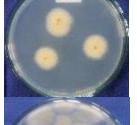
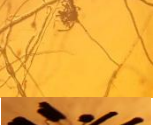
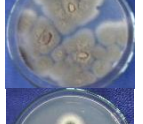
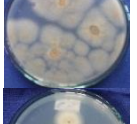
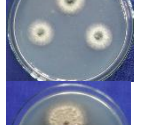
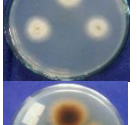
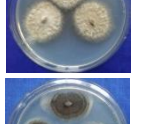
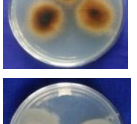
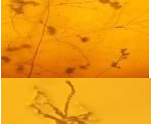
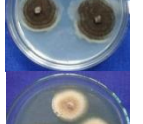
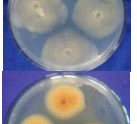
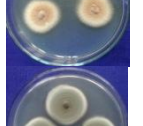
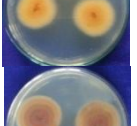
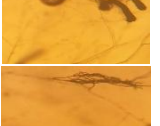
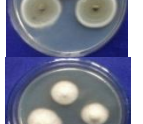
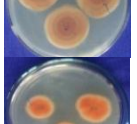
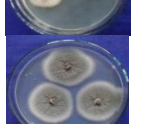
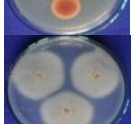
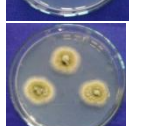
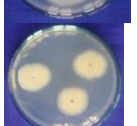
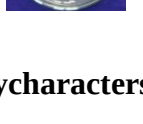
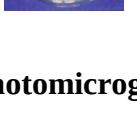
Name	Front View	Reverse View	Photomicrograph
OMA-1			
OMA-2			
OMA-3			
OMA-4			
OMA-5			
OMA-6			
OMA-7			
OMA-8			
OMA-9			
OMA-10			
OMA-11			
OMA-12			
OMA-13			
OMA-14			

Figure4.Colonycharacters and photomicrograph of fungi OMA-1to OMA-14

Characterization of Isolated Fungi by FTIR Analysis

FTIR analysis is sensitive and comprehensive method for detection of molecular changes in microbial cells. The analysis was carried out at URC. From these spectral, isolated fungi were corresponding functional group with different intensities.

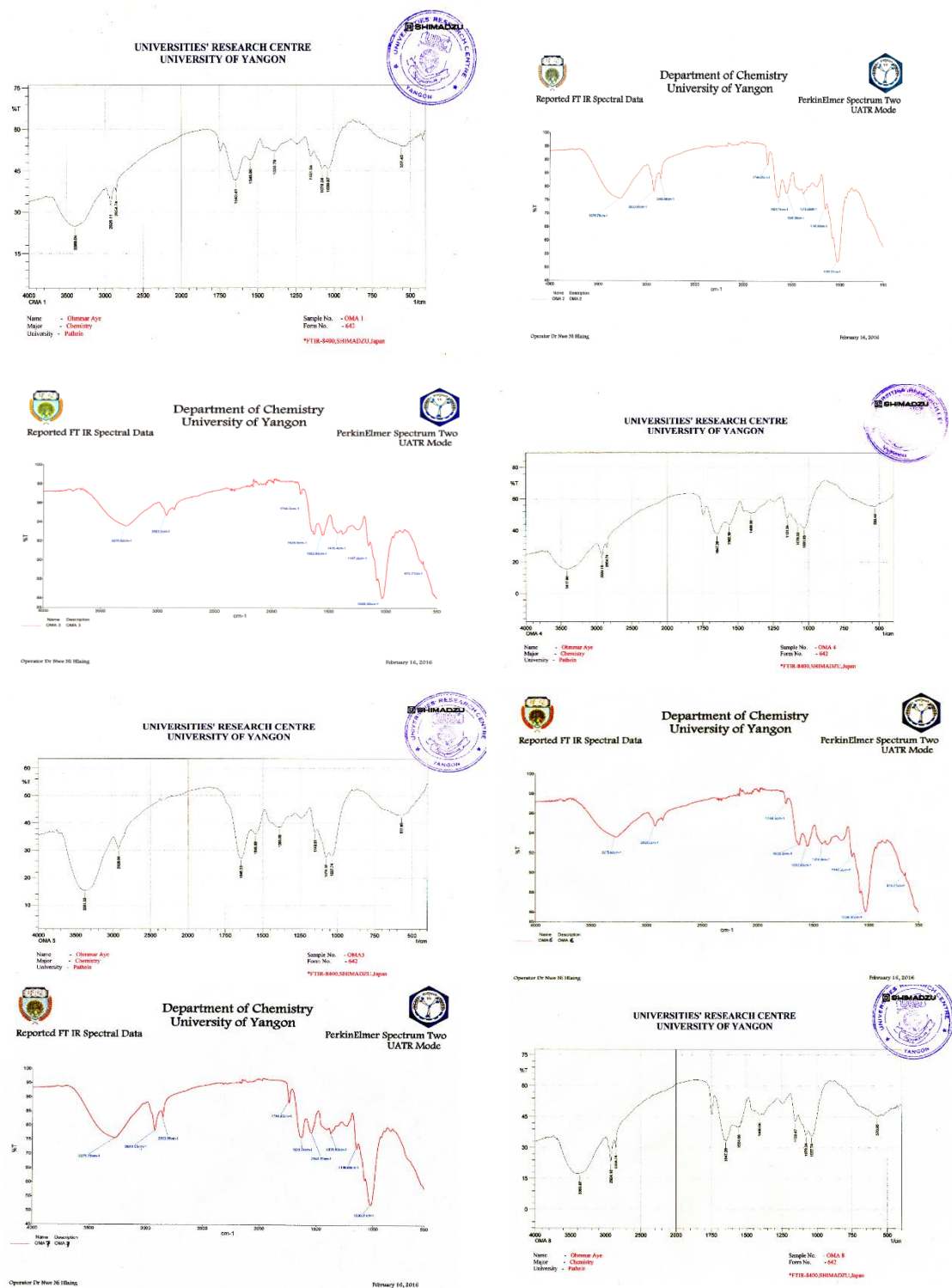


Figure.5. FTIR spectral of isolated fungi OMA-1 to OMA-8

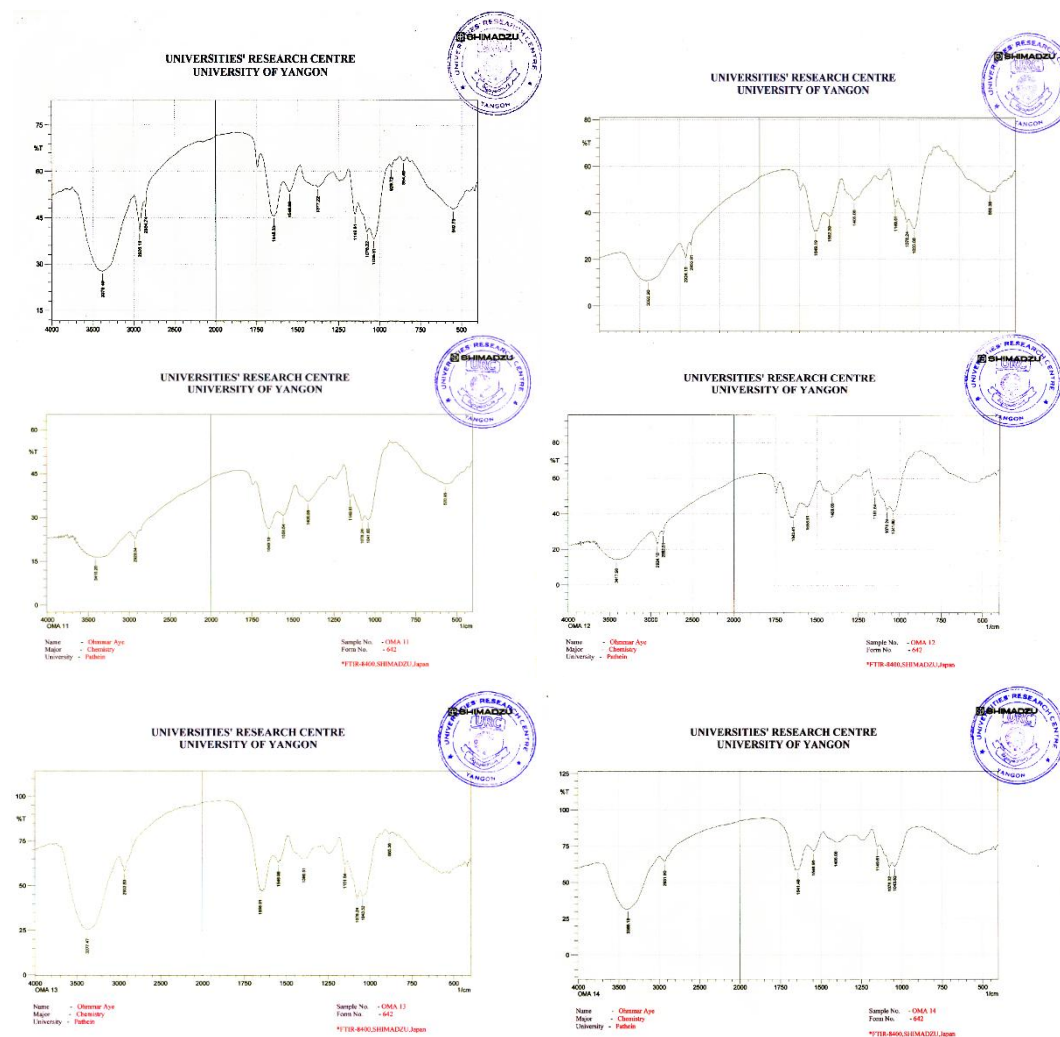


Figure6. FTIR spectral of isolated fungi OMA-9 to OMA-14

Characterization of Isolated Fungi by EDXRF Analysis

The relative abundance of the elements comprising in samples were quantitatively determined by EDXRF analysis.

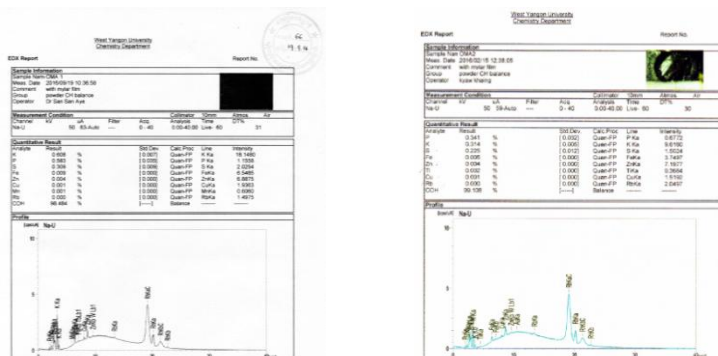


Figure 7. EDXRF Spectral of isolated fungi OMA-1 and OMA-2



Figure 8. EDXRF spectral of isolated fungi OMA-3 to OMA-14

Table3. FTIR Spectral Data of Isolated Fungi

Wave number (cm ⁻¹)	Band Assignment
3300-3600	$\nu_{\text{O-H}}$, O-H and N-H stretching
2800-2900	$\nu_{\text{C-H}}$, (sym&asym) of -CH ₂ , -CH ₃ group
1600-1400	$\nu_{\text{C=C}}$, stretching
1400-1300	$\delta_{\text{C-H}}$, (sym&asym) bending
1100-1020	$\nu_{\text{C=O}}$, stretching

Table4. Relative Amount of Elements in Isolated Fungi of EDXRF analysis

Element	Result (%)						
	OMA-1	OMA-2	OMA-3	OMA-4	OMA-5	OMA-6	OMA-7
C-OH	98.484	99.108	98.557	97.494	98.105	98.557	98.490
Al	-	-	-	1.303	-	-	-
P	0.583	0.341	0.532	0.485	0.569	0.532	0.488
K	0.608	0.314	0.535	0.133	0.942	0.535	0.133
S	0.309	0.225	0.269	0.288	0.368	0.269	0.380
Si	-	-	-	0.269	-	-	0.369
Fe	0.009	0.005	0.009	0.015	0.009	0.009	0.125
Ca	-	-	0.091	0.005	-	0.091	0.007
Zn	0.004	0.004	0.004	0.002	0.002	0.004	0.002
Ti	-	0.002	-	0.002	-	-	0.002
Cu	0.001	0.001	0.003	0.001	0.003	0.003	0.002
Mn	0.001	-	-	0.001	0.001	-	0.001
Ni	-	-	-	-	0.001	-	0.001

Cont'd

Element	Result (%)						
	OMA-8	OMA-9	OMA-10	OMA-11	OMA-12	OMA-13	OMA-14
C-OH	97.359	99.108	99.169	98.970	99.065	97.950	97.150
Al	1.524	-	-	-	-	-	1.459
P	0.439	0.341	0.340	0.451	0.376	0.640	0.570
K	0.406	0.314	0.202	0.284	0.258	1.00	0.232
S	0.262	0.225	0.275	0.267	0.257	0.400	0.391
Si	-	-	-	-	-	-	0.193
Fe	0.005	0.005	0.005	0.012	0.013	0.006	0.002
Ca	-	-	-	0.009	-	-	-
Zn	0.001	0.004	0.002	0.004	0.004	0.002	0.001
Ti	-	0.002	0.005	-	0.003	-	0.001
Cu	0.001	0.001	0.001	0.001	0.020	0.001	0.001
Mn	0.001	-	0.001	0.001	-	0.001	0.001
Ni	-	-	-	-	0.004	-	-

Discussion and Conclusion

In this present work, soil samples were collected within the studied area of Pathein in June-July, 2015. Fungi were isolated from different soil samples by physical treatment dilution method and soil plating method. LCA medium for first culture and PGA medium for pure culture were used. In the preliminary study, fourteen representative isolated fungi were designated as OMA-1 to OMA-14. Among which OMA-1, 3, 4, 9, 11 and 12 were obtained from physical treatment dilution method. OMA-2, 5, 6, 7, 8, 13 and 14 were obtained from soil plating method. From the results, it was found that all these fungi were different according to their colony characters. Then the biomass powder was prepared for further study.

Moreover, the elemental composition of isolated fungi were determined by FTIR analysis as shown in figure (5-6). It was observed that, the peaks at $\approx 3300\text{ cm}^{-1}$ are caused by the O-H and N-H stretching. The peaks at about $\approx 2900\text{ cm}^{-1}$ are the symmetric and asymmetric ($-\text{CH}_2$, $-\text{CH}_3$) stretching. The peaks at $\approx 1680\text{ cm}^{-1}$, $\approx 1580\text{ cm}^{-1}$ are caused by the vibration of $-\text{C}=\text{O}$ and $-\text{C}=\text{C}$ respectively. The bands observed at $\approx 1450\text{ cm}^{-1}$ are C - H bending of the aromatic ring. The relative abundance of the elements in samples by EDXRF analysis as shown in figure (7-8). It was observed that the major abundance of C-OH element were observed in isolated fungi. Silicon (Si) was found only in OMA-4, 7, 14 and aluminium (Al) was found only in OMA-4, 8, 14. Calcium (Ca) was observed in OMA-3, 4, 6, 7, 11 and the rest of other isolated fungi were not observed for these elements. Potassium (K), sulfur (S) and phosphorous (P) were found in minor constituent elements and other elements such as zinc (Zn), copper (Cu), titanium (Ti) and iron (Fe) were observed relatively small amount. Trace amount of other elements such as Mn and Ni were rarely found in isolated fungi. Therefore, it was observed that the active surface of biomass may include polysaccharide, carbohydrate, amine, carboxyl, hydroxyl, aromatic groups and other elements.

Acknowledgements

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Isolation of Bacteria from Soil Samples Collected from Kan Gyi Daung Township

Yee Yee Thin¹

Abstract

Soil samples were collected from 4 different places of KanGyiDaung Township. Eleven bacteria was isolated from these 4-different soil samples. Soil was analyzed at the Applied Geology Department, Yangon University. Isolation of bacteria was undertaken by the physical and chemical treatment method (Phay and Yamamura, 2005). Glucose Yeast Tryptone medium were used for soil bacteria. Isolated bacteria were given as temporary names YTB-1 to YTB-11. In the colony morphology of isolated bacteria YTB-1 to YTB-11 were small, medium and large in size of colony and the color were cream, yellow, pale and white. In the margin YTB-1 to YTB-11 were lobate, undulate, entire and filamentous. In the elevation and form, YTB-1 to YTB-11 was flat and raised and they produced cream, yellow, pale, white and red pigments.

Keyword: Glucose Yeast Tryptone medium (GYT)

Introduction

Microorganisms live in every part of the biosphere including soil, hot spring, seven mile deep in the ocean, 40 miles high in the atmosphere and inside rocks far down within the Earth's crust. Soil is the largest source of microorganisms. There are billions to hundreds of billions of soil microorganisms in a mere handful of a typical garden soil. The handful might well contain thousands of different species of bacteria, hundreds of different species of fungi and protozoa. Almost all of these countless soil organisms are not only beneficial, but also essential to the life giving properties of soil. Microorganisms constitute an important source of biodiversity in soils and an integral part of terrestrial ecosystems. They contribute to major biological functions such as nutrient and gas cycling, biogeochemical processes and the decomposition and transformation of organic matter. Bacteria are tiny, one-celled organisms generally 4/100,000 of an inch wide (1 μm) and somewhat longer in length. A teaspoon of productive soil generally contains between 100 millions and 1 billion bacteria. Various species of bacteria thrive on different food sources and in different microenvironments. Soil contains varieties of microorganism including bacteria that can be established in any natural environment. Bacteria are the most important and abundant microorganism which is present in surrounding environment. These are very small, unicellular, primitive and non chlorophyll containing microorganism. Dilution method is one of most important method to isolate the soil bacterium which allows the list of living cells in the soil (Benson 2001). The term soil refers to the outer loose material of the earth crust. It may be regarded as a three phase's system composes of solids, liquids and gases, dispersed to form a heterogeneous matrix. On the whole, the soil is composed of five major components, these include; Mineral matter, Water, Organic matter, Air and living Organisms. The various component of the soil environment constantly changed and the quantity of these constituents are not the same in all soil but vary with locality. Living portion of the soil body includes small animals and microorganisms but it is generally considered that its microorganisms that plays the most important role in the release of nutrient and carbondioxide for plant growth. The bacteria are the most abundant group usually more numerous than the four combined. Soil bacteria can be rod, (bacilli) cocci (spherical) spirilla (spirals), of these, bacillus are more numerous than the

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others. They are one of the major groups of soil bacteria population and are very widely distributed. The number and type of bacteria present in a particular soil would be greatly influenced by geographical location such as soil temperature, soil type, soil pH, organic matters contents, cultivation, aeration and moisture content (Davies *et al* 1999).

Soils are highly complex systems, with many components playing diverse functions mainly due to the activity of soil organisms. Soil microflora plays a pivotal role in evaluation of soil conditions and in stimulating plant growth (Kiran Singh *et al.*, 1999). Microorganisms are beneficial in increasing the soil fertility and plant growth as they are involved in several biochemical transformation and mineralization activities in soils. Type of cultivation and crop management practices found to have greater influence on the activity of soil microflora (MC. Gill *et al.*, 1980). Continuous use of chemical fertilizer over a long period may cause imbalance in soil microflora and there by indirectly affect biological properties of soil leading to soil degradation (Manickamet *al.*, 1972).

Soil bacteria dominate, or participate, in a number of earth's biogeochemical cycles, including the carbon, nitrogen, oxygen, phosphorus, and sulfur cycles (Giriet *al.*, 2006). Some of the specific processes of soil bacteria include carbon fixation, decomposition of organic matter, respiration, nitrogen fixation, nitrogen mineralization, nitrification, denitrification, phosphorus mineralization, and sulfur oxidation and reduction. These processes can directly or indirectly affect the concentrations of atmospheric gases, as well as the availability of nutrients to plants and animals (Giriet *al.*, 2006).

Such large scale effects by these tiny cells are possible because of their fantastic abundance. One gram of soil contains, on average, a billion bacteria cells (Schloss and Handelsman, 2004), though not all of these may be viable. The majority of bacteria in soils are found in the top 1 meter of soil (Whitman *et al.*, 1998), and according to the Food and Agricultural Organization (FAO) of the United Nations (2000), there are approximately 31,823,000 km² of non-constrained agricultural soil on earth. Presuming one gram of soil is approximately equal to 15 cubic centimeters, then there are 2.12×10^{24} total bacterial cells in arable soil on earth (Whitman *et al.*, 1998), however, determined there are approximately 2.6×10^{29} total soil bacterial cells on earth by including the estimated bacterial abundance of desert and other non-arable soils, and adding a calculated abundance from depths of 2 to 8 meters.

Bacteria have been evolving diverse metabolic processes for around 3.8 billion years (Delong and Pace, 2001), much longer than the several hundred million years of evolution seen by plants and animals (Giriet *al.*, 2006). This evolution has resulted in complex, enzyme-driven metabolism that allows bacteria to survive in nearly every conceivable environment on earth (Schlegel and Jannasch, 2006). Large and complicated molecules, such as cellulose, are degraded by extracellular enzymes that bacteria exude directly into the environment (Guggenberger, 2005). Other life forms such as plants, are dependent upon such degradation processes from soil bacteria to gain access to nutrients such as nitrogen (Smith and Goodman, 1999).

The diverse degradative abilities of soil bacteria have been utilized in an array of bioremediation projects, from oil spills to acid mine drainage to sewage waste (Crawford, 2006). Other enzymes, such as cellulases, xylanases, and proteinases, are utilized in a variety of industries, including textile, ethanol, paper, and dairy production (Quax, 2006; Doyle and Meng, 2006). Furthermore, antibiotics, anti-tumor medications, bio-herbicides, and bio-pesticides are successfully exploited in human enterprise (Demain, 1999; Handelsman and Stabb, 1996; Doyle 2006).

Materials and Methods

Soil samples were collected from four different places of KanGyiDaung Township, Ayeyarwady Region (Figure 1 and Table 1). Soil was analyzed by Applied Geology Department, University of Yangon.

Soil samples of four different places were collected during July 2011 to August 2011.

Isolation of Bacteria from the Soil Samples.

The soil bacteria were isolated by physical and chemical treatment dilution method on medium such as (GYT) Glucose Yeast Tryptone medium.

Table 1. Four different soil samples collected from KanGyiDaung Township

Soil samples No.	Sample collected areas	pH	Soil Type	Location
SI	KanGyiDaung (Community & Government)	6.40	Clay Loam	N 16° 55' 05.649" E 094° 54' 12"
SII	Ta KoneGyi (Basic Education High School)	6.08	Loam	N 16° 51' 07.699" E 094° 50' 19.345"
SIII	Kyon Pa Doke (Basic Education School)	5.47	Clay	N 16° 50' 21.941" E 094° 51' 06.449"
SIV	NyaungGyaung (Monastery)	4.01	Silty clay	N 16° 47' 29.297" E 094° 51' 59.458"

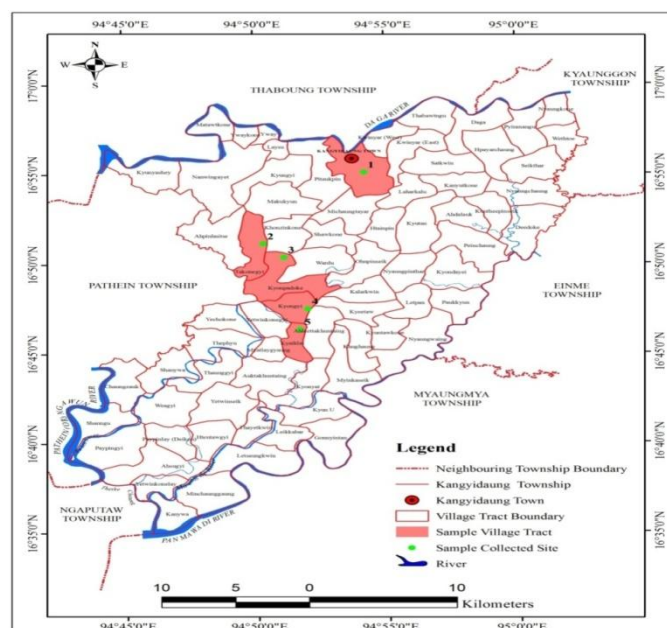


Figure. 1. Map of KanGyiDaung Township

Physical and Chemical Treatment Dilution Method

(Phay and Yamamura, 2005)

The collected soil was air-dried at room temperature for 5 days. The soil sample was grounded and sieved in 2 mm screen. The sample was placed in the hot air oven at 120°C for 1 hr. The dried soil sample was suspended with 1.5 % phenol and diluted with sterile water. The dilution series were cultured on GYT medium. 30µL of soil suspension was cultured on plates containing GYT medium and incubated for 5-10 days. Pure colonies were picked up to start containing in PGA medium.

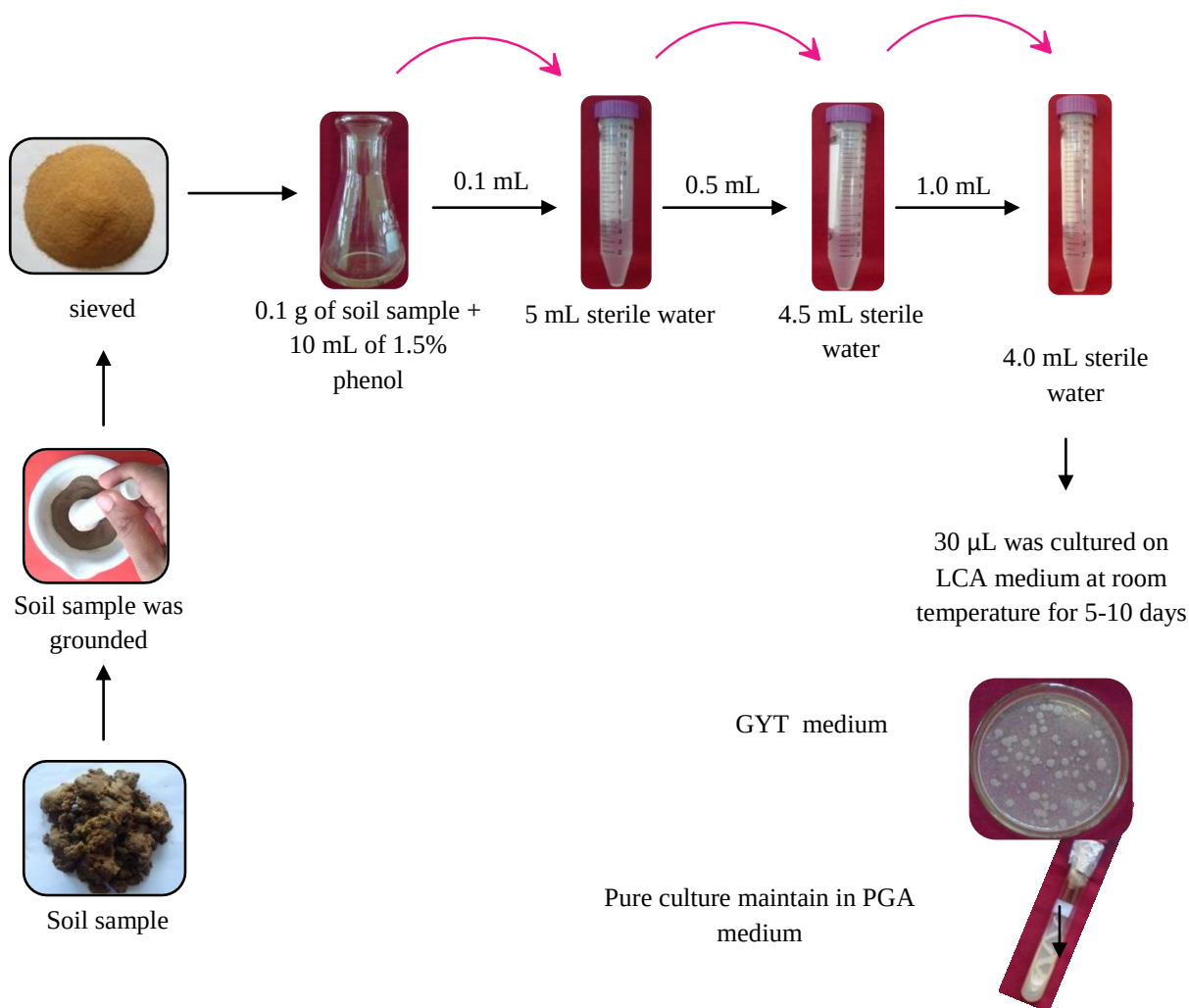


Figure. 2. Isolation procedure for bacteria from soil samples

Media used for the isolation of bacteria (Ando, 2004)

Glucose Yeast Tryptone (GYT) medium Components per liter

Glucose	10g
Yeast extract	3g
Tryptone	5g
K ₂ HPO ₄ , 6H ₂ O	1g
MgSO ₄ , 7H ₂ O	0.5 g
Agar	18g
pH	6.5

After autoclaving cycloheximide or nystatin was added into the medium

Potato Glucose Agar (PGA) medium Components per liter For pure culture

Potato	2g
Glucose	2g
Agar	18g
pH	6.5

After autoclaving chloramphenicol was added into the medium

Staining Method of Isolated Strains

The morphology of the isolated strains were recorded and they were subjected to Gram staining. The staining reactions were carried out according to the requirements and procedures described by Atlas (1993), Santra *et al.* (1998), Woodland (2004) and Aneja (2005).

Gram Staining

To identify the bacteria as either Gram positive or Gram negative, gram staining performs were used with counter stain, which contain crystal violet solution, iodine solution with 95 % ethyl alcohol and safranin. A drop of sterile distilled water was placed on a free glass slide and a loopful of bacterium was smeared and dried by heating. Then, slide was covered with crystal violet solution and dried for about 30 seconds. Iodine solution was added as drop by drop for 60 seconds. Next steps, 95 % ethyl alcohol, about 20 seconds were used for decolourization and washed the slide with distilled water. Moreover, safranin was dropped about 30 seconds and washed with distilled water. Finally, air dry the slide was examined under the oil immersion objective of microscope. Those bacteria that appear purple are referred to as Gram positive, those appearing pink are described Gram negative (Aneja, 2005).

Results

Isolation of Bacteria from Soil Samples

In the course of the investigation for antimicrobial metabolite producing fungi, isolated bacteria YTB-1 to YTB-2 were collected from KanGyiDaung, YTB-3 to YTB-6 were collected from Ta KoneGyi, YTB-7 to YTB-9 were collected from Kyon Pa Doke and YTB-10 to YTB-11 were NyaungGyaung. The isolated bacteria were designated as YTB-1 to YTB-11. In the colony morphology of isolated bacteria YTB-1, 5, and 7 were medium YTB-

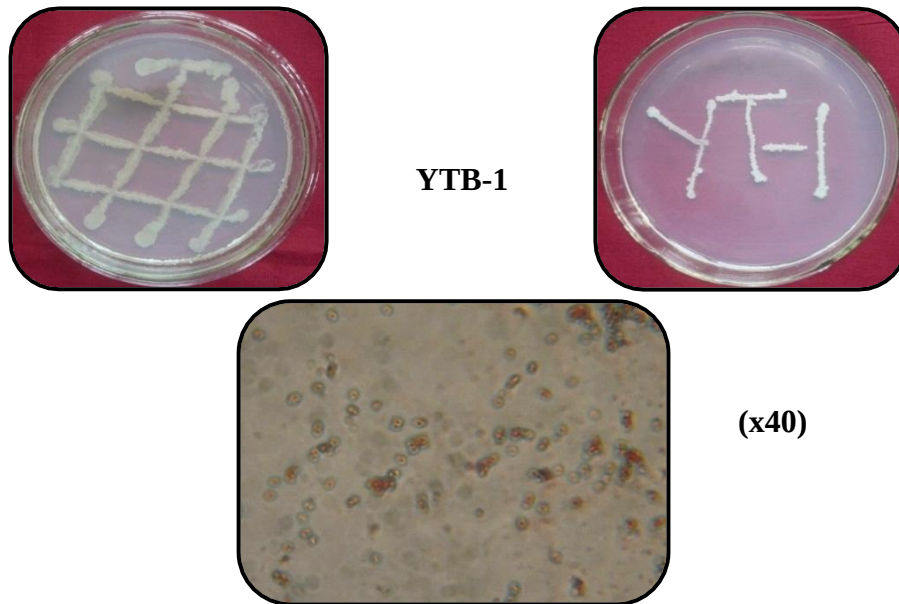
2, 4, 6, 8 to 10 were small and YTB-11 was large in size of colony. The color of YTB-1, 3, 7, 9 and 10 were cream, YTB-2 was yellow, YTB-4 was pale, YTB-5, 6, 8 were white and YTB-11 was white at the center and red at the periphery. In the margin YTB-1, 2 and 4 were lobate, YTB-3, 5, 7, 9 to 11 were undulate YTB-6 was entire and YTB-8 was filamentous. In the elevation and form YTB 1, 2, 7 to 10 were flat and YTB-3 to 5 and YTB-11 were raise. They produced cream, yellow, pale white and red pigment (Table 3).

Table 2. Isolated Bacteria from Soil Samples

Soil Samples No	Isolated Bacteria
S I	YTB-1, YTB-2
S II	YTB-3, YTB-4 YTB-5, YTB-6
S III	YTB-7, YTB-8, YTB-9
S IV	YTB-10, YTB-11

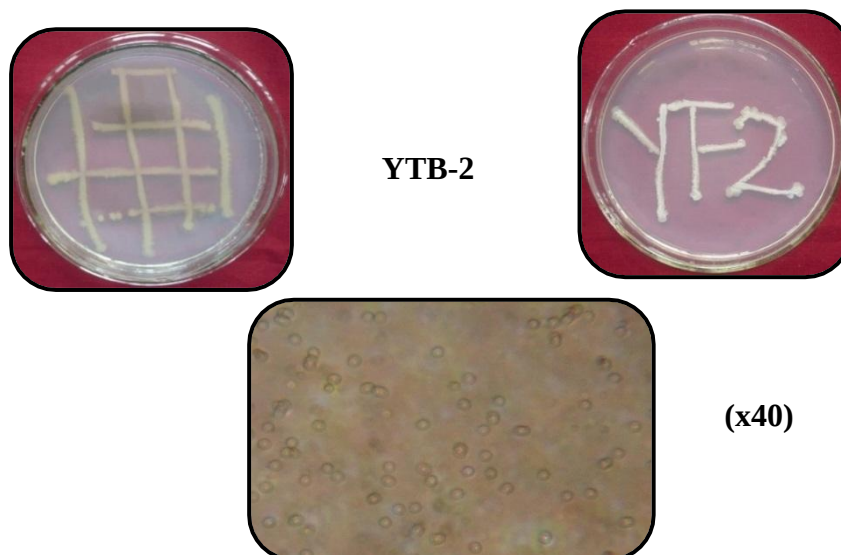
Table 3. Colony Morphology of Isolated Bacteria

Isolated Bacteria	Size of colony	Margin	Color	Elevation and Form	Pigment on agar
YTB-1	medium	lobate	cream	filamentous	Cream glistening
YTB-2	small	lobate	yellow	flat	Yellow glistening
YTB-3	large	undulate	cream	raise	Cream glistening
YTB-4	small	lobate	pale	raise	Pale glistening
YTB-5	medium	undulate	white	raise	White glistening
YTB-6	small	entire	white	raise	White glistening
YTB-7	medium	undulate	cream	flat	Cream glistening
YTB-8	small	filamentous	white	flat	White glistening
YTB-9	small	undulate	cream	flat	Cream glistening
YTB-10	small	undulate	cream	flat	Cream glistening
YTB-11	large	undulate	White at the center & red at the periphery	raise	Red pigment



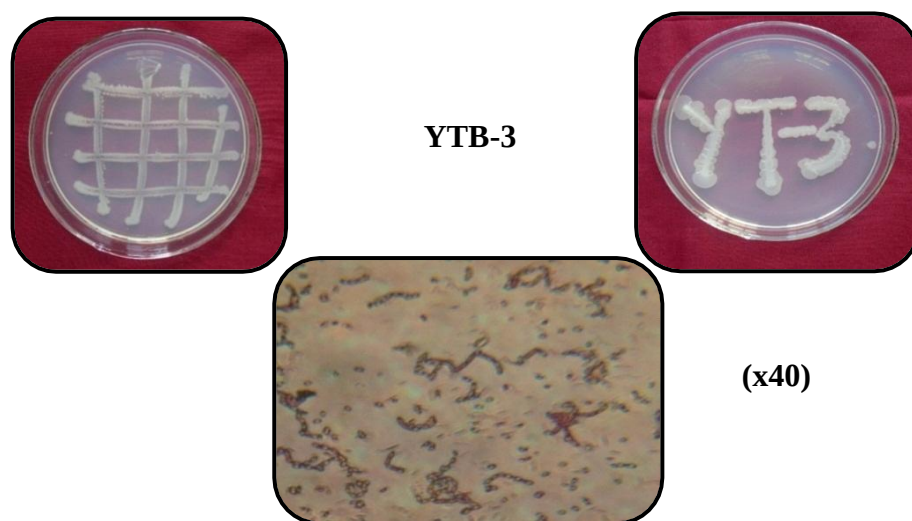
Microscopical character of isolated bacterium YTB-1

Figure. 3. Morphological and microscopical character of isolated bacterium YTB-1



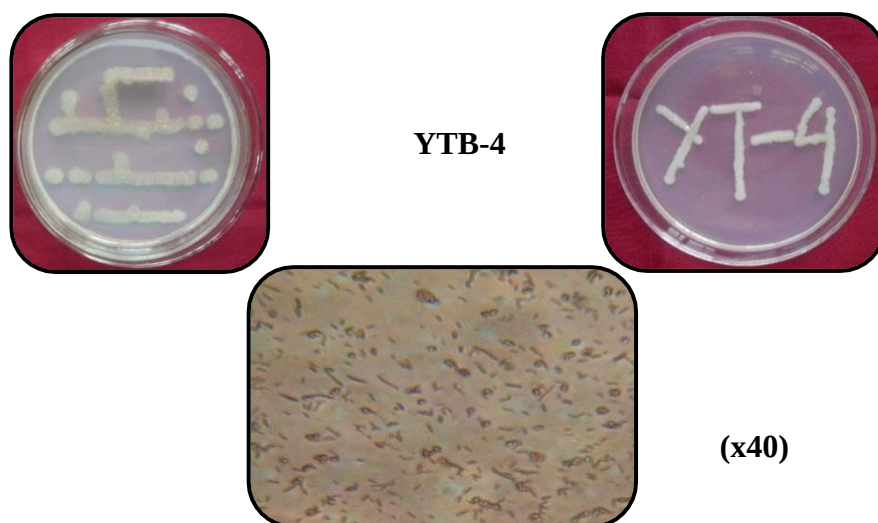
Microscopical character of isolated bacterium YTB-2

Figure. 4. Morphological and microscopical character of isolated bacterium YTB-2



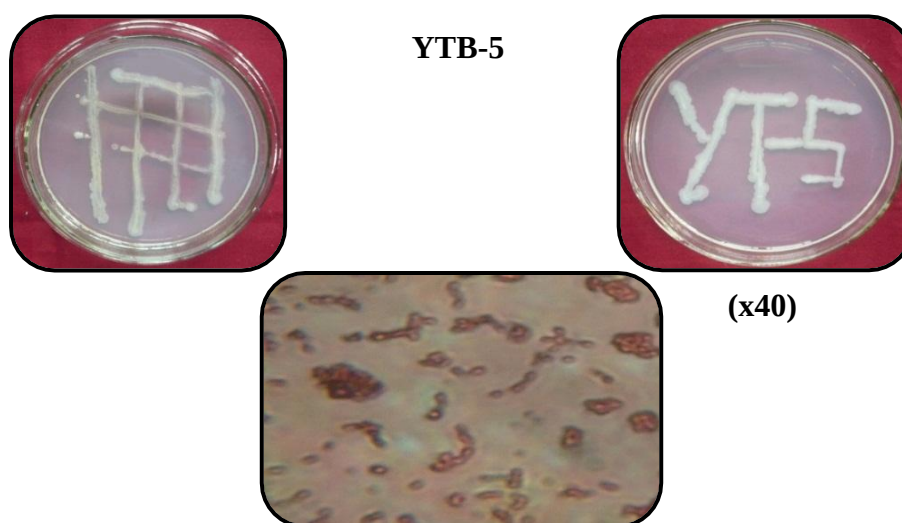
Microscopical character of isolated bacterium YTB-3

Figure. 5. Morphological and microscopical character of isolated bacterium YTB-3



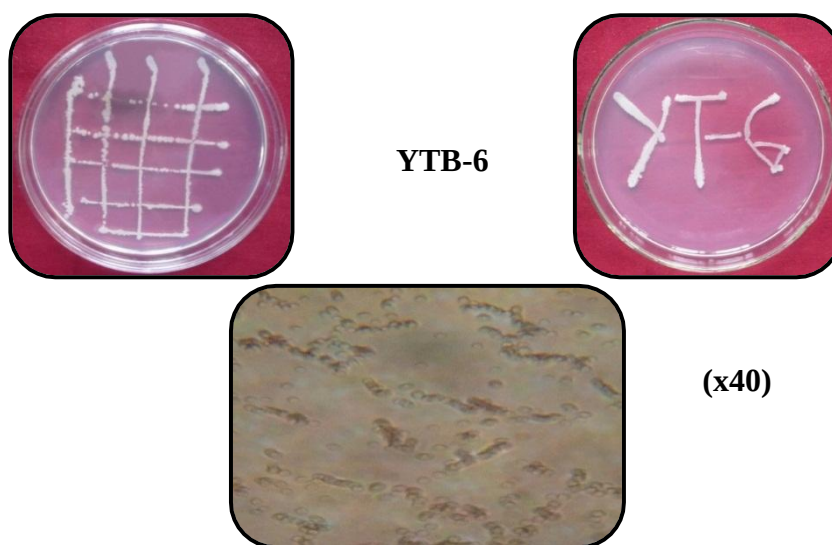
Microscopical character of isolated bacterium YTB-4

Figure. 6. Morphological and microscopical character of isolated bacterium YTB-4



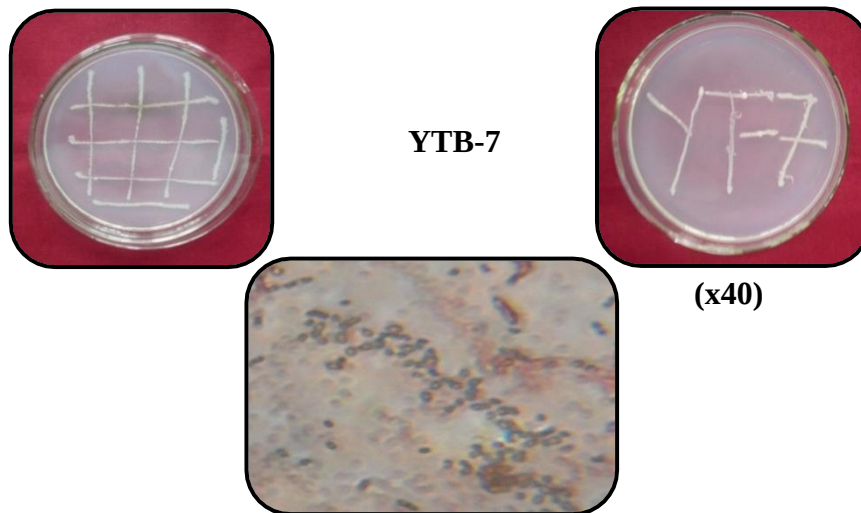
Microscopical character of isolated bacterium YTB-5

Figure. 7. Morphological and microscopical character of isolated bacterium YTB-5



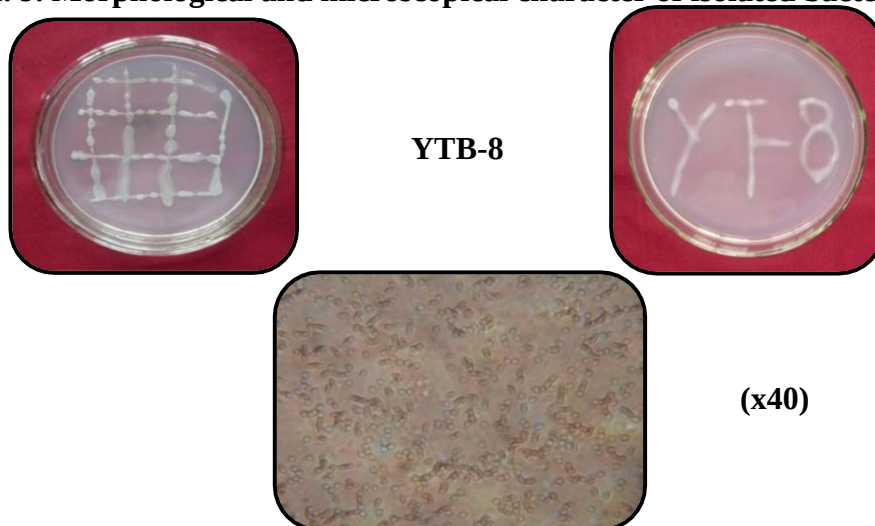
Microscopical character of isolated bacterium YTB-6

Figure. 8. Morphological and microscopical character of isolated bacterium YTB-6



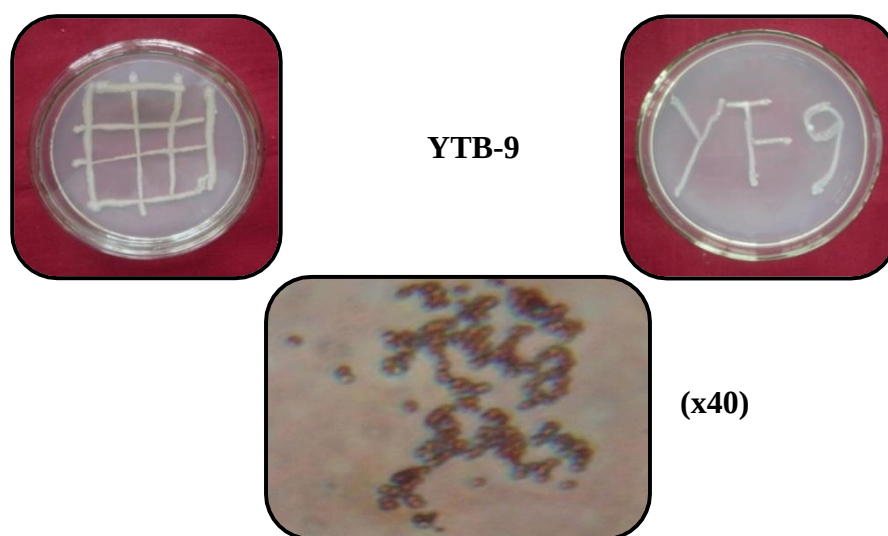
Microscopical character of isolated bacterium YTB-7

Figure. 9. Morphological and microscopical character of isolated bacterium YTB-7



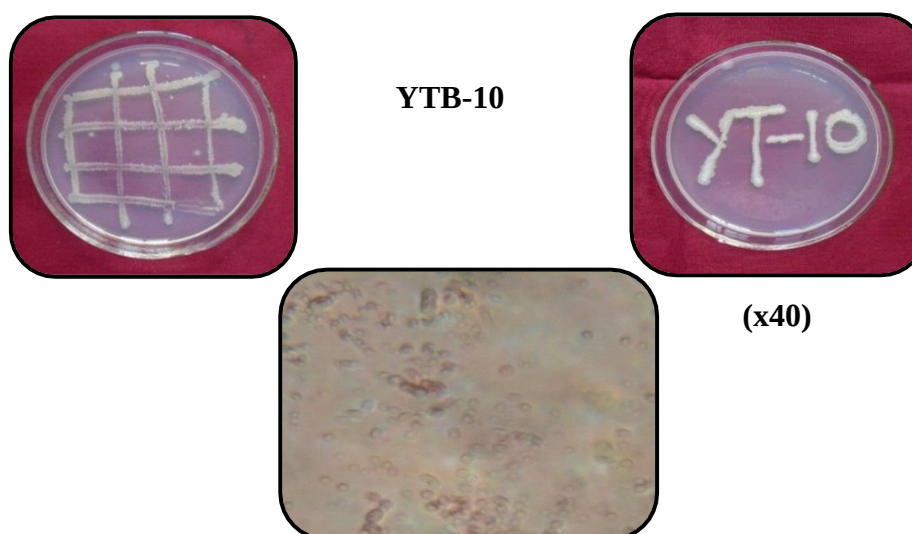
Microscopical character of isolated bacterium YTB-8

Figure. 10. Morphological and microscopical character of isolated bacterium YTB-8



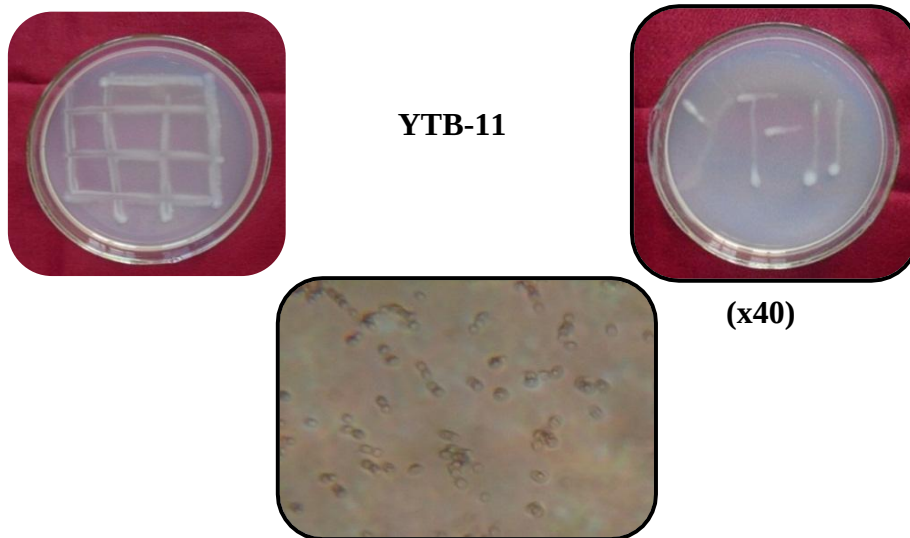
Microscopical character of isolated bacterium YTB-9

Figure. 11. Morphological and microscopical character of isolated bacterium YTB-9



Microscopical character of isolated bacterium YTB-10

Figure. 12. Morphological and microscopical character of isolated bacterium YTB-10



Microscopical character of isolated bacterium YTB-11

Figure. 13. Morphological and microscopical character of isolated bacterium YTB-11



Figure. 14. Pure cultures of isolated bacteria from soil samples 1 and 2



Figure. 15. Pure cultures of isolated bacteria from soil samples 3 and 4

Discussion and Conclusion

Soil is a primary source of microorganisms. Soil bacteria and fungi have played a significant and an important role in antibiotic discovery. The numbers and species of microbes in soil is dependent on environmental conditions like nutrient availability, soil texture, presence of moisture in soil and type of vegetation cover, and their number varies according to the type of environmental condition (Atlas and Bartha, 1998). Microorganisms are found in almost every habitat present in nature. Historically, the soil of planet comprised of natural microorganisms. There are a healthy soil literally hundreds and species of soil bacteria, soil fungi, and many other microscopic soil critters. Therefore, the isolation and screening of effective soil microorganisms were investigated. Soil samples were collected from four different places of KanGyiDaung Township, Ayeyarwady Region. 11 bacteria were isolated from four different soil. Among them, YTB-1 and 2 were isolated from soil sample No.1 (Clay loam), YTB-3 to YTB-6 were obtained from soil sample No.2 (loam), YTB-7,8 and 9 were isolated from soil sample No.3 (clay), and YTB-10 and YTB-11 were isolated from soil sample No.4 (silty clay).

The isolated bacteria were designated as YTB-1 to YTB-11. In the colony morphology of isolated bacteria YTB-1 to YTB-11 were small, medium and large in size of colony and the colors were cream, yellow, pale and white. In the margin, YTB-1 to YTB-11 was lobate, undulate, entire and filamentous. In the elevation & form, YTB-1 to YTB-11 was flat and raised and they produced pigments. All these bacteria are different according to their morphological characters.

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Molecular Vibrational Investigation of Spinel-Type Nickel Ferrite Using FTIR Spectroscopic Method

Aung Ye Htun¹

Abstract

Nickel ferrites, NiFe_2O_4 , have been prepared by using three different preparation methods of solid state reaction method, chemical co-precipitation method and auto-combustion method. FTIR spectroscopic technique was used to investigate the vibrational characteristics of constituent molecules of the samples. FTIR spectra were observed in the wavenumber range of $400\text{ cm}^{-1} - 4000\text{ cm}^{-1}$ region using Potassium Bromide, KBr pellet method. Vibrational modes of tetrahedral site and octahedral site molecules were found in the observed FTIR spectra and assigned by using standard molecular vibrational wavenumbers. This work is intended to confirm the phase formation from the results of XRD.

Keywords: Nickel ferrites, NiFe_2O_4 , solid state reaction, co-precipitation, auto-combustion, FTIR, vibrational characteristics

Introduction

Ferrite nanocrystals are interesting materials due to their rich physical properties. Spinel ferrites, with common formula of MFe_2O_4 (M: a divalent metal ion), have wide technological applications, e.g., in multilayer chip inductor (MLCI), ferrofluids, high-speed digital tape or recording disks, rod antenna, and humidity sensor [Islam, (1998)]. Ferrite nanocrystals are also of interest in various applications, such as inter-body drug delivery [Iyer, (2009)], bioseparation, and magnetic refrigeration systems [Kumar, (2009)], in particular due to their specific properties, such as superparamagnetism. In addition, among ferrosinels zinc ferrites are used in gas sensing [Kony, (2004)], catalytic application, photocatalyst [Marial, (2013)], and absorbent materials [Pathan, (2010)].

The unit cell of spinel ferrites is composed of 32 oxygen atoms in cubic closed-packed arrangement distributed in tetrahedral ("A") and octahedral sites ("B"). Chemical and structural properties of spinel ferrite nanocrystals are affected by their compositions and synthesis methods, and corresponding electric and magnetic properties depend on cationsubstitutions.[Iyer, (2009); Pathan, (2010)]

In technologies where ferrites are to be used for magnetic or electrical applications, high-density materials are generally required and the ferrites are often prepared by high temperature solid-state reactions between finely ground powders. Although most applications of ferrites as ceramic materials require high densities to achieve the desired properties, there are many applications for which lower densities and high surface area are preferred. [Marial, (2013)] Spinel-type oxides with a general formula of AB_2O_4 are important mixed oxides in gas sensors, and have been investigated for the detection of both oxidizing and reducing gases. In particular, Nickel ferrite as a p-type semiconducting oxide has shown to be a very good sensor to detect oxidizing like chlorine, whereas nickel ferrite was prepared by the hydrazine method showed an n-type semiconducting behaviour. [Iyer, (2009); Marial, (2013)]

A large number of methods has been developed to prepare NiFe_2O_4 (NFO) nanoferrites, such as the standard solid-state reaction method, co-precipitation method, auto-combustion

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method, solvothermal method and hydrothermal method. In this work, Nickel ferrites, NiFe_2O_4 were prepared by auto-combustion method and their structural characteristics were reported by the use of the standard solid-state reaction method, co-precipitation and auto-Combustion method. The obtained Nickel ferrites were characterized by FTIR to investigate the vibrational characteristics and to confirm the phase formation of the samples.

Materials and Method

Preparation of Nickel Ferrites using Three Different Methods

Nickel ferrites, NiFe_2O_4 , have been prepared by the standard solid state reaction method, co-precipitation and auto-combustion method.

The chemical reagents used were as follows:

- (1) Nickel Oxide [NiO] and Ferric Oxide [Fe_2O_3] for standard solid-state reaction method,
- (2) Nickel Sulphate Hexahydrate [$\text{NiSO}_4 \cdot 6\text{H}_2\text{O}$], and Ferrous Sulphate Heptahydrate, [$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$] in which Sodium Hydroxide [NaOH] as an agent for co-precipitation method and
- (3) Nickel Nitrate Hexahydrate [$\text{Ni}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$] and Ferric Nitrate Nonahydrate [$\text{Fe}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$] in which Urea [$\text{CO}(\text{NH}_2)_2$] as a fuel for auto-Combustion method.

In solid state reaction method, Nickel Oxide (NiO) and Ferric Oxide (Fe_2O_3) were weighed with stoichiometric composition and mixed each other. Then the mixed powders were heat-treated at 850°C for 8 h by using JLabTech Electric Oven.

In co-precipitation method, Nickel Sulphate Hexahydrate [$\text{NiSO}_4 \cdot 6\text{H}_2\text{O}$], and Ferrous Sulphate Heptahydrate, [$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$] were weighed with stoichiometric composition. The weighed powders were mixed and dissolved in de-ionized (DI) water to prepare saturated solution. Next, the solution was stirred and heated up to at 70°C for 30 min. After reaching the temperature at 70°C , NaOH solution was added to the solution to precipitate the co-precipitated ferrite particles. The co-precipitated ferrites were washed by de-ionized water and followed by acetone. Then, the co-precipitated ferrites dried at room temperature (29°C) for one day. Finally, the dried ferrites were heat-treated at 800°C for 4 h using JLabTech Electric Oven.

In auto-combustion method, the stoichiometric ratio of metal nitrates and Urea were mixed in de-ionized (DI) water to obtain precursor solutions. The obtained precursor solution was heated on a hot plate to dry the solution with evolution of large amount of gases (N_2O and CO_2) and then the solution was started to burn with release of lots of heat. The whole procedure takes place for 2 – 3 h. The obtained powder samples were annealed at 1000°C for 30 min in JLabTech Electric Oven.

Results and Discussion

Ferrites possess the structure of mineral spinel (AB_2O_4) that crystallizes in the cubic form with space group $Fd3m$ [Ross, (1972)]. It is generally known that the spinel ferrites exhibit four IR active bands, designated as ν_1 , ν_2 , ν_3 and ν_4 . The occurrence of these four bands has been rationalized on the basis of group theoretical calculations employing space group and point symmetries, both in normal and inverse spinels. The first three IR bands are due to tetrahedral and octahedral complexes while the fourth one is due to some type of lattice vibrations. However, the ν_3 -mode and ν_4 -mode are normally appeared in the wavenumber range of 300 cm^{-1} – 400 cm^{-1} region. In this work, the observed wavenumbers of the FTIR

spectra are in the range of $400\text{ cm}^{-1} - 4000\text{ cm}^{-1}$ (mid-IR region). Thus, the ν_3 -mode and ν_4 -mode are out of range of the mid-IR region of $4000\text{ cm}^{-1} - 400\text{ cm}^{-1}$.

From the molecular vibrational theory and standard wavenumbers, vibrational wavenumbers of Nickel Ferrite, NiFe_2O_4 , are mainly 486 cm^{-1} , 587 cm^{-1} and 602 cm^{-1} for A atoms on tetrahedral sites (assigned as ν_1 -mode) and 413 cm^{-1} for B atoms on octahedral sites (assigned as ν_2 -mode). The vibrational frequencies of a molecule may be changed due to the crystalline environments or sample preparation conditions. In the present work, FTIR transmission spectrum of Nickel ferrites, NiFe_2O_4 , prepared by solid state reaction method, co-precipitation and auto-combustion methods are shown in Figure 1(a – c).

In the FTIR spectrum of Nickel ferrite, NiFe_2O_4 , prepared by solid state reaction method, three normal modes of vibrations were found in the spectrum. The line at 401 cm^{-1} indicates the stretching vibration of B atoms on octahedral sites (assigned as ν_2 -mode) of molecules.

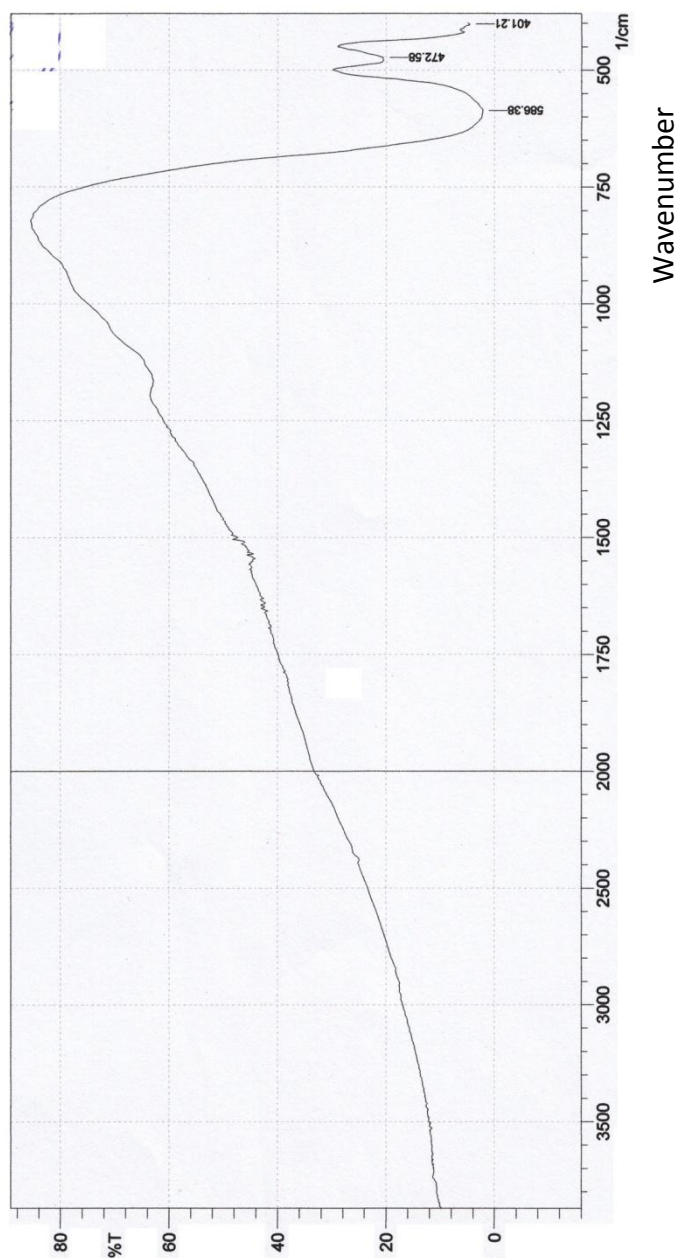


Figure 1. (a) FTIR spectrum of NiFe_2O_4 prepared by solid state reaction

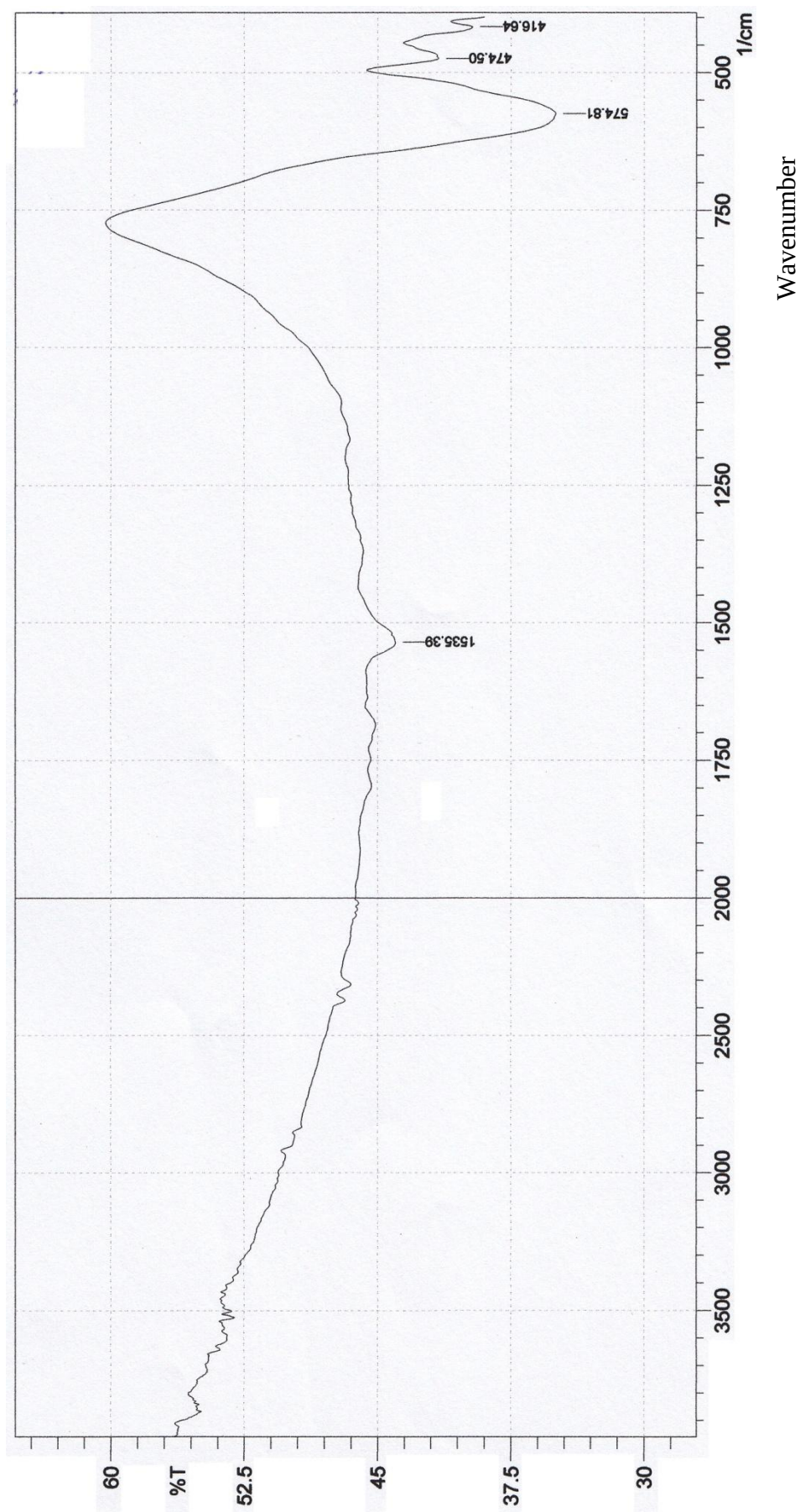


Figure1.(b) FTIR spectrum of NiFe_2O_4 prepared by co-precipitation method

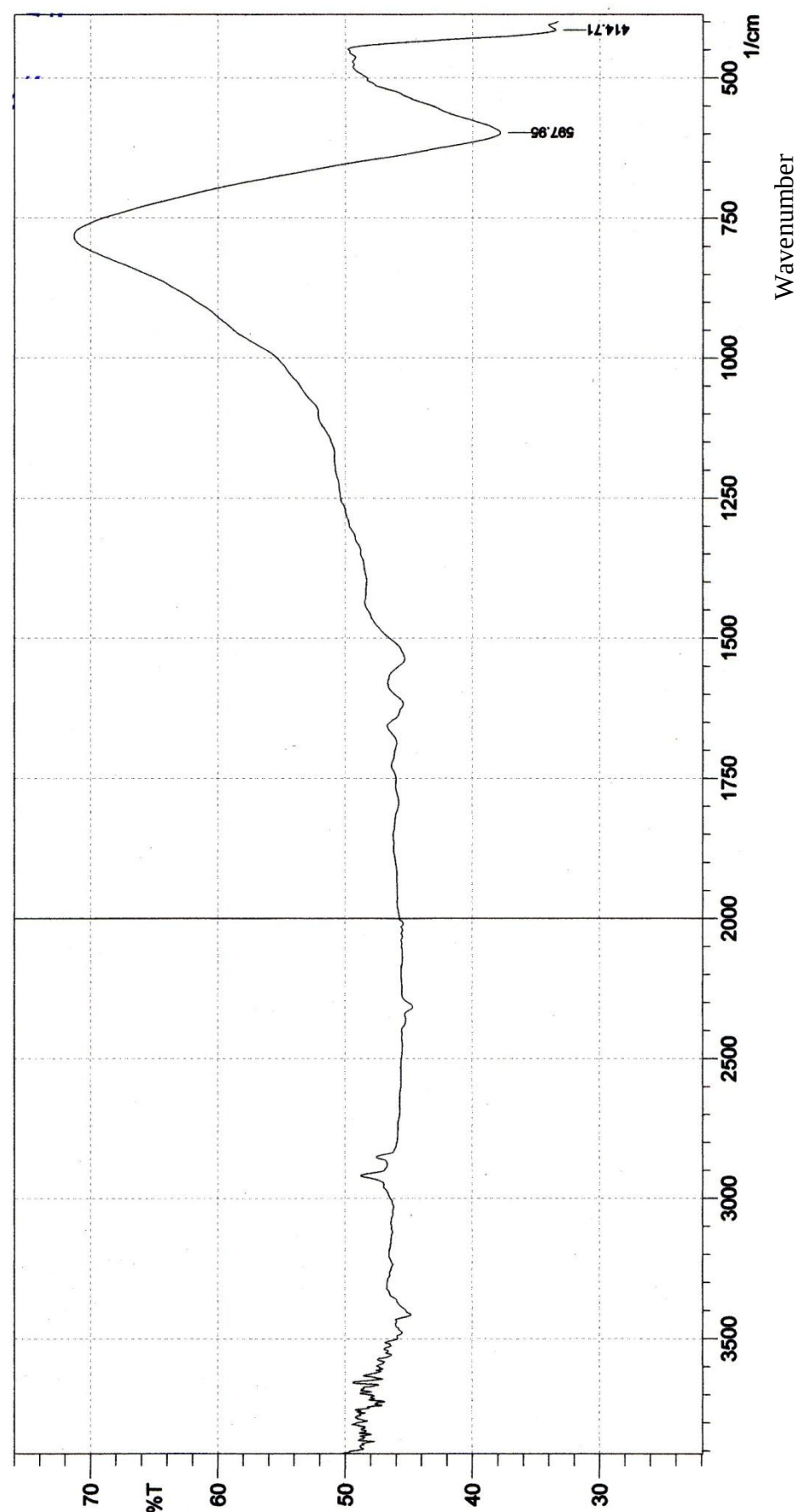


Figure1.(c) FTIR spectrum of NiFe₂O₄ prepared by auto-combustion method

The lines at 473 cm^{-1} and 586 cm^{-1} indicate the stretching vibration of A atoms on tetrahedral sites (assigned asv_1 -mode) of molecules. Also, in the FTIR spectrum of NiFe_2O_4 , prepared by co-precipitation method, three normal modes of vibrations were found in the spectrum. The line at 417 cm^{-1} indicates the stretching vibration of B atoms on octahedral sites (assigned asv_2 -mode) of molecules. The absorption lines at 475 cm^{-1} and 575 cm^{-1} indicate the stretching vibration of A atoms on tetrahedral sites (assigned asv_1 -mode) of molecules. The line at 1535 cm^{-1} indicates the bending vibration of water (H_2O) molecule due to KBrpellet method. As shown in the FTIR spectrum of NiFe_2O_4 , prepared by auto-combustion method, two normal modes of vibrations were found in the spectrum. The line at 415 cm^{-1} indicates the stretching vibration of B atoms on octahedral sites (assigned as v_2 -mode) of molecules. The line at 598 cm^{-1} indicates the stretching vibration of A atoms on tetrahedral sites (assigned asv_1 -mode) of molecules. As shown in the FTIR spectra, the observed wavenumbers were found to be shifted due to the different sample preparation conditions and the appearance of the absorption lines indicated the normal vibrational modes of tetrahedral and octahedral site molecules of the samples. It can be taken as the phase formation of the samples valid from the results of XRD because the observed vibrational wavenumbers represent the normal vibrational characteristics of spinel type materials. Infrared (IR) refers to that part of the electromagnetic spectrum between the visible and microwave regions. The electromagnetic spectrum can be considered as a wave or particle traveling at the speed of light. These waves differ from each other in the length and frequency. Energy is related to wavelength and frequency by the formulas: $E = h\nu = \frac{hc}{\lambda}$, where h is Planck's constant ($6.625 \times 10^{-34}\text{ J s}$). Moreover, the energy of electromagnetic waves is directly proportional to the reciprocal wavelength. In particular in vibrational spectroscopy, the reciprocal wavelength is used and denoted as wave number $\bar{\nu}$: $E = hc\bar{\nu}$. Usually, the wave number $\bar{\nu}$ is written in the form: $\bar{\nu}(\text{cm}^{-1}) = \frac{10000}{\lambda(\mu\text{m})}$. The wavenumber can also be described as the number of wave per centimeter. The obtained data (observed wavenumbers) are found experimentally that the tetrahedral site and octahedral site molecular networks in the sample emitted frequencies with $\bar{\lambda} = \bar{\nu} = \text{wave numbers}$. The collected wave numbers and their corresponding wavelength, frequency, oscillation time and energy of the samples are as tabulated in Table 1(a – c). As presented in tables, the obtained frequencies indicated that the samples composed of high frequency oscillators.

Conclusion

Nickel ferrites, NiFe_2O_4 , have been prepared by using three different sample preparation methods of solid state reaction, co-precipitation and auto-combustion. The as-prepared samples were investigated by FTIR spectroscopic method to examine the vibrational characteristics and to confirm the phase formation of the samples. The observed spectral lines confirmed the presence of spinel phase materials of the as-prepared samples. The observed wavenumbers were agreement with standard values and some of the lines were found to be shifted due to the different sample preparation methods. The observed wavenumbers and their corresponding wavelengths, frequencies, oscillation times and energies of the molecules were also evaluated and they indicated that the samples composed of high frequency oscillators. Furthermore, it can be said that the vibrational wavenumbers of the molecules depend on the preparation technique of the desired materials.

Table 1.(a) Wavenumbers and corresponding frequencies, wavelengths, oscillation times and energies of NiFe₂O₄ prepared by solid state reaction method

$\bar{\nu}$ (1/cm)	ν (nm)	ν (Hz)	ν (s)	E(eV)
401	24938	1.202E+13	8.318E-14	0.0498
473	21142	1.418E+13	7.052E-14	0.0587
586	17065	1.757E+13	5.692E-14	0.0727

Table 1.(b) Wavenumbers and corresponding frequencies, wavelengths, oscillation times and energies of NiFe₂O₄ prepared by co-precipitation method

$\bar{\nu}$ (1/cm)	ν (nm)	ν (Hz)	ν (s)	E(eV)
417	23981	1.250E+13	7.999E-14	0.0518
475	21053	1.424E+13	7.022E-14	0.0590
575	17391	1.724E+13	5.801E-14	0.0714

Table 1.(c) Wavenumbers and corresponding frequencies, wavelengths, oscillation times and energies of NiFe₂O₄ prepared by auto-combustion method

$\bar{\nu}$ (1/cm)	ν (nm)	ν (Hz)	ν (s)	E(eV)
415	24096	1.244E+13	8.038E-14	0.0515
598	16722	1.793E+13	5.578E-14	0.0742

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Fabrication and Characterization of Cuprous Oxide, Cu₂O Solar Cell

Lwin Maung¹, Hla Hla Oo², Pho Kaung³

Abstract

Cuprous oxide solar cell, Cu₂O is the one of the promising candidate of Photovoltaic Technology to challenge the energy crisis of our century and to innovate the renewable energy due to its cheap production cost. The Cu₂O solar cell comprises the semi-conducting photo-working electrode, agar electrolyte medium and the metallic counter-electrode. Cu₂O - semiconducting layer was formed on the copper plate by the thermal oxidation method to serve as the photo-electrode and was optimized the concentration of sodium chloride, NaCl for the agar electrolyte medium. The material components of Cu₂O were characterized X-ray diffraction (XRD), Scanning Electron microscopy (SEM). The photovoltaic characteristic of Cu₂O solar cell was investigated by the current-voltage (I-V) measurement.

Introduction

Cuprous oxide is a semiconductor material. In a semiconductor, there is a gap, called a bandgap between the electrons that are bound tightly to the atom, bound electrons and the electrons that are farther from the atom, free electron which can move freely and conduct electricity.

When sunlight hits the electrons in the cuprous oxide, some of the electrons gain enough energy from the sunlight to jump the bandgap and become free to conduct electricity. The photo sensitive reactions of the Cu₂O-photovoltaic cell are as follow;



By using the energy of the photon of the light, the free electrons of the cuprous oxide jumps to the conduction band and increased electricity flows. In Cu₂O-photovoltaic cell, the charge moves through the gelatin electrolyte medium through the external circuit. Using the gelatin electrolyte, the internal resistance of the solar cell can be reduced and enhance the power output of solar cell.

Experimental

Copper preparation

In the preparation of good-quality Cu₂O the condition of the original copper surface is important. Prior to oxidation, industrial-grade copper sheets (0.1mm thickness and 99.99% purity) were cleaned in 30% nitric acid for 20 s and cut into standard sizes of 5 cm by 2 cm. The samples were then repeatedly rinsed in Deionized water and dried with tissue paper.

Thermal Oxidation

The thermal oxidation process was carried out under atmospheric pressure. The procedure involves the oxidation of high purity copper at an elevated temperature (100 – 500 °C) for times ranging from few minutes to half hour depending on the thickness of the

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starting material (for total oxidation) and the desired thickness of Cu_2O (for partial oxidation).

The oxidation process can be carried out either in pure oxygen or in laboratory air. Cu_2O has been identified to be stable at limited ranges of temperatures and oxygen pressure. It has been indicated that during oxidation, Cu_2O is formed first and after a sufficiently long oxidation time, CuO is formed. However, at temperatures below 1000°C under atmospheric pressure, mixed oxides of Cu_2O and CuO can be formed:



The unwanted CuO can be removed by the pop off CuO flakes. The oxidation process is followed by annealing the sample at 500°C and then stopping the process by quenching in cold water. The thermal oxidation process copper electrode is shown in **Fig-1 (a), (b) and (c)**.



Figure (1)(a)- Copper before heating.



Figure (1) (b)- copper coated with cupric oxide.



Figure (1) (c)- scraped black cupric oxide revealing cuprous oxide underneath.

Agar salt bridge

The electrolyte gelatin medium was prepared by mixing the 10 g of agar powder and various concentration salt solutions. This electrolyte was heated until clearly dissolved and pour the gelatin on to a sheet of tissue paper to create agar salt bridge.

Fabrication of Cu_2O solar cell

Firstly, cut a 5cm x 2cm U shaped conductor from a new piece of copper tape and soldered a wire to one corner of the U shaped electrode to form copper counter electrode and the objective of U-shape for firmly contact with the electrolyte medium.

To form photo-sensitive electrode, clean a corner with sandpaper and soldered another wire to one corner of copper oxidized strip. A piece of 7.62cm x 5cm of rigid plastic sheet was used for the package of cuprous oxide solar cell and attach the strip or U shaped electrode of new copper to the rigid plastic using the adhesive on the back of the copper.

The tissue paper gelatin electrolyte medium was placed on the copper counter U-shape electrode and placed the oxidized copper photo electrode on top of the gelatin electrolyte making sure that it is completely separated from the copper counter electrode by the electrolyte gelatin layer. Take another single piece of plastic packing tape and carefully cover the electrode and gel sandwich so that the tape seals to the plastic sheet on all sides. This prevents the gelatin from drying out and helps keep the electrodes in contact with the electrolyte medium. The assembly structure of the cuprous oxide solar cell is as **Fig-2** and the package of solar cell is exhibited as in **Fig-3**.

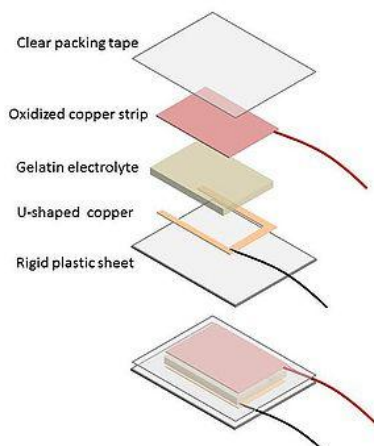


Figure (2) Assembly structure of cuprous oxide solar cell.



Figure (3) The package of cuprous oxide solar cell.

Material Characterization

The characterization techniques of the material characterization are the X-ray diffraction (XRD) to confirm the formation of Cu_2O and the Scanning Electron Microscopy (SEM) to investigate the morphology of copper oxide semiconductor film photo electrode.

Device Characterization

The photovoltaic performance of the Cu_2O solar cell was evaluated by the current-voltage (I-V) measurement under the regional standard annual mean incoming solar radiation, 240 Wm^{-2} to optimize the concentration of NaCl electrolyte. The results of the I-V characterization are exhibited in **Fig-6** and **Table (1)**. The photovoltaic performance of the Cu_2O solar cell was investigated by the following equations.

Maximum power, P_{max} :

$$P_{\text{max}} = I_{\text{max}} V_{\text{max}} \quad (5)$$

Current density, J:

$$J = \frac{I}{A} \quad (6)$$

Fill-factor, FF:

$$FF = \frac{I_{\text{max}} V_{\text{max}}}{I_{\text{sc}} V_{\text{oc}}} \quad (7)$$

Efficiency, η :

$$\eta = \frac{J_{\text{max}} V_{\text{max}}}{P_{\text{in}}} \times 100\% \quad (8)$$

Results and Discussion

The results of X-ray diffraction (XRD) analysis shown in **Fig-4**. The crystalline size are calculated by the use of Scherrer's equation and the crystalline size of copper oxide of the photo electrode is about $1 \mu\text{m}$. The composite of semiconductor film photo-electrodes was confirmed by the use of the XRD-patterns. It was found that polycrystalline structure and show the traces of Cu_2O , and Cu. The SEM photo of the copper oxide photo electrodes was shown in the **Fig-5** and the SEM micrograph exhibit polycrystalline structure of copper oxide. The grains of oxides are very similar to each other in size and shape and are $1 \mu\text{m}$ and less in size on the copper plate. The device characterization was examined by the use of current-voltage (I-V) characterization to optimize the concentration of NaCl electrolyte. The results of the I-V characterization are exhibited in **Fig-6** and **Table (1)**. The electrolyte agar medium having the concentration of NaCl 20g/L was optimized to harvest maximum power.

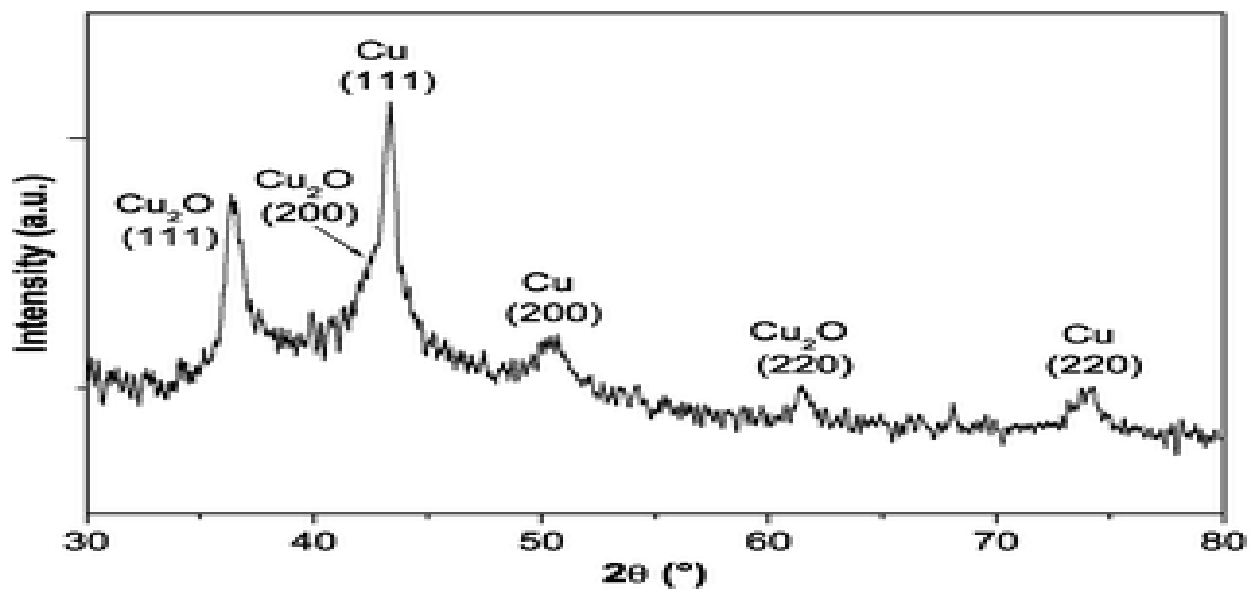


Figure (4) XRD-patterns of the Cu₂O on the copper plate

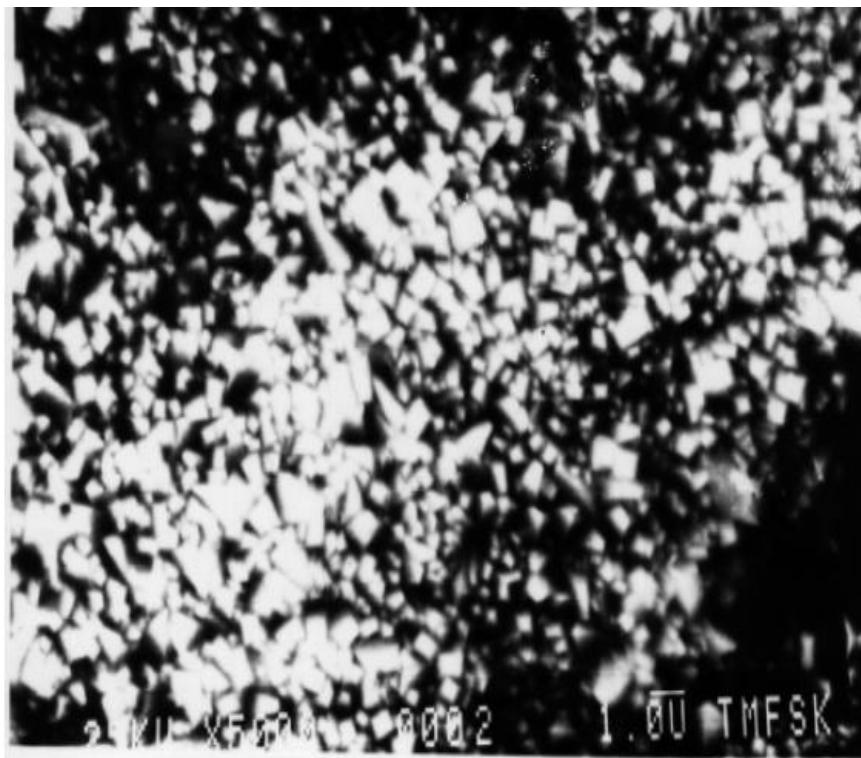


Figure (5) SEM- micrograph of the Cu₂O on the copper plate.

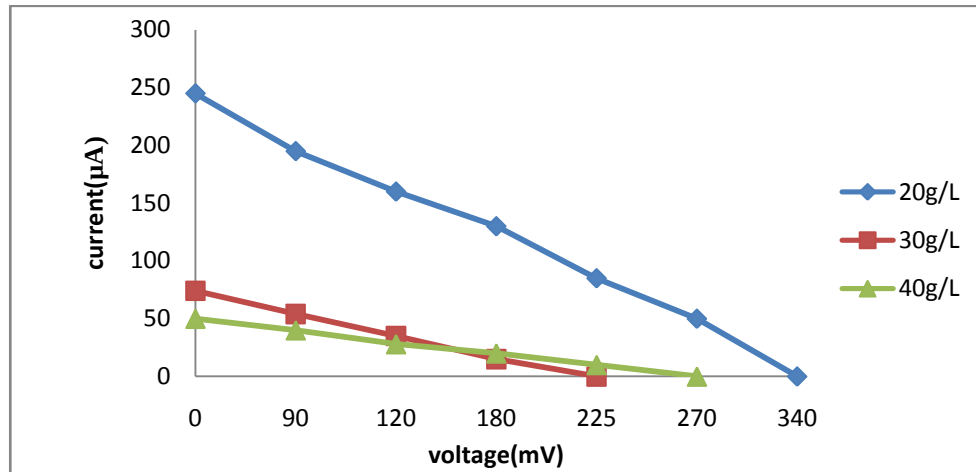


Figure (6) Current-Voltage characteristic curves of Cu₂O solar cell.

Table (1) Photovoltaic performance of Cuprous oxide solar cell.

No	NaCl concentration(g/L)	I _{sc} (μA)	V _{oc} (mV)	P _{max} (μW)	FF(%)	η(%)
1	20	245	340	23.4	28	2.37
2	30	74	225	4.14	25	0.41
3	40	50	270	3.36	24	0.7

Conclusion

The main objective of this research was to fabricate Cu₂O solar cell and to investigate the performance of Cu₂O solar cell depend on the concentration of NaCl electrolyte agar medium. In this research, 20g/L of NaCl concentration was optimized for the harvesting of maximum power 23.4μW. Although the efficiency of the Cu₂O solar cell is lower than the commercial solar cell; it is suitable as the teaching aid to study the photovoltaic performance of semiconducting material for the academic purpose due the low cost and simple experimental procedure.

Acknowledgements

The authors would like to thank the researchers of Department of Physics, Pathein University and the Universities' Research Centre, University of Yangon for their help and suggestions to carry out this research work.

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Burrow Morphology of Red Ghost Crab *Ocypoda ceratophthalma* (PALLAS, 1772) in Chaungtha Beach, Ayeyawady Region

Thida Soe¹

Abstract

Burrow morphology of red ghost crab *Ocypoda ceratophthalma* was observed in foreshore, backshore and dune subenvironment in Chaungtha beach, northwestern part of Pathein Township in Ayeyawady Region of Myanmar. Four types of burrow patterns were observed like 'I', 'J', 'semi-U' and 'V' type with different sizes as revealed by POP casting. Four types of burrows morphology character were measure (burrow number, depth, length, and diameter of the burrow opening). Most small burrows were found close to the sea, while larger burrows were mostly found in places higher up the beach. The observed burrow diameter or mean diameter varied from 27.7 ± 6.2 in upper foreshore, 49.2 ± 17.34 in backshore and 73 ± 21.14 in lower dune respectively. Burrow depth or mean depth (TBD) of burrows were 215 ± 43.01 in upper foreshore, 250 ± 34.64 in back shore and 307 ± 24.52 in lower dune respectively. Comparison with the total burrow length (TBL) or mean length between upper foreshores, back shore and lower dune area showed 239 ± 49.1 , 284.5 ± 32.2 , and 337 ± 39.92 .

Keywords: Burrow, Chaungtha beach, *Ocypoda ceratophthalma*, POP Casting

Introduction

The sandy beach environment is not an easy place for organism to live there is no solid materials on which to attach. Animals have to deal with crashing waves, changing tides, a beach that change seasonally and marine and terrestrial predators. The animals that live in sandy environment buried in the sand. They all have adaptations that help them survive in the sandy beach ecosystem (David Taus, 2007).

Ghost crab, Ocypode species are common in tropical to subtropical sandy shore. Ocypode are nocturnal hiding in burrows during the daytime and coming out to feed on animals and plant materials at night (Weinstern, 1995, Chan *et al.*, 2006). The burrow are essential and serve several purposes. Ghost crabs use their burrows as refuges from physical stresses during daytime and also from predators such as shore birds (Chakrabarti, 1981, Chan *et al.*, 2006).

The burrow openings of ghost crabs are circular with accumulated sand mounds and are often surrounded by radiating feeding lines left by the crabs (Takahashi, 1932; Chakrabarti, 1981, Chan *et al.*, 2006). The structure of burrows plays a significant role and provides a morphological window in the life of an organism. Burrows may also be of different shape and size, simple or complex, having many branches or a single opening depending upon the nature of the animals (Shipra Sinha, 2013).

Burrow size vary, depending on season and carapace size of the crab. Burrows provide crabs with protection from particularly high temperature, desiccation and predators while maintaining tolerable conditions with respect to other essential parameters. It has functional attributes and is associated with reproduction, behavioural, or physiological characteristic of the species (Shipra Sinha, 2013). As a crab always enters its burrow sideways, carapace lengths have been used to study the relationship between resident crabs and their burrow diameters (Lim & Diong, 2003).

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Further their burrowing habit aids in aeration and free circulation of water which promotes the growth of seedlings in mangroves. The burrowing members are of immense use in recycling nutrients by “ploughing”. Grapsid and Ocypodide crabs are normally considered to be of no economic value but they assist breakdown of particulate organic material by exposing them to microbes. Their burrowing habit assists oxidizing the sulphides that build up, due to high rates of organic decomposition in mangrove swamps (Diemont and Van Wijngarden, 1975).

Material and methods

Observation of burrow structure

Burrow morphology of red ghost crab *Ocypoda ceratophthalma* was observed in foreshore, backshore and dune area in sandy shore of Chaungtha beach. A total of 30 casts were made for the species of ghost crab during the study period. Burrow casting was made by pouring Plaster of Paris (POP) slurry (2:1 volume ratio of Plaster of Paris to water) into each burrow entrance until the burrows were totally filled, and randomly selected burrows within 100m² quadrat and were allowed to dry for 30 minutes as described by Chan *et al.*, (2006), and Qureshi and Saher (2012). Dried casts were carefully excavated with the help of spade from all sides and measurement of burrow diameter (BD). Total burrow length (TBL) and total burrow depth (TBD) were recorded using measuring tape. Burrow casting pattern and shape were demonstrated through visual observation.

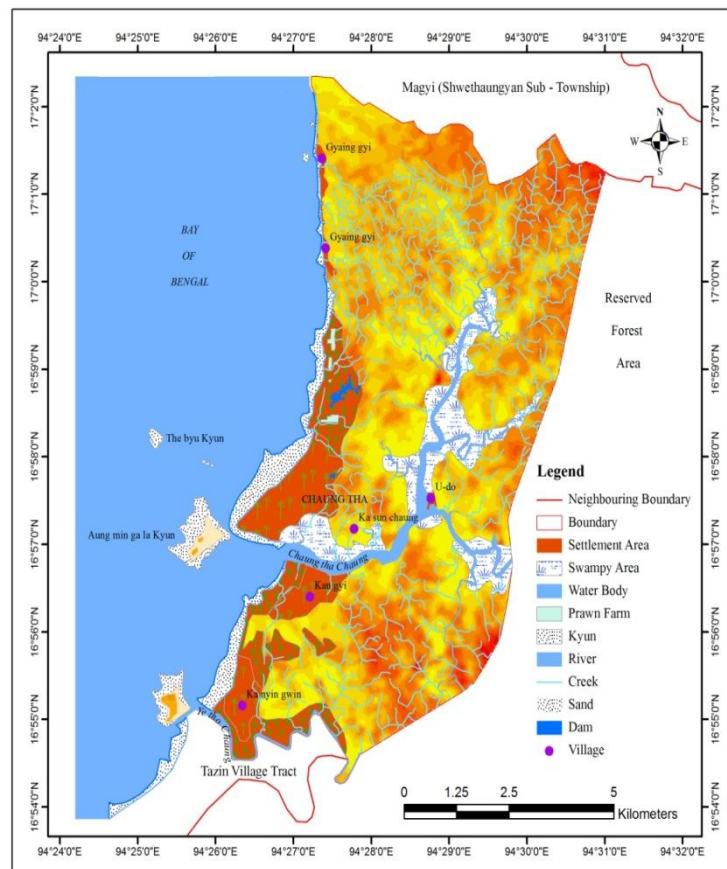


Fig. 1 Map of Chaungtha coastal area

Source: Geography Department, Pathein University

Results

Burrowing habitat of ghost crab, *Ocypoda ceratophthalma*

Most small burrows were found upper foreshore of the sea, while larger burrows were mostly found in lower dune area of sandy shore in Chaungtha beach.

Burrow casts generally varied in length and in the shape of closed ends (forming I, J, V, and semi U shaped) in vertical morphologies with a single entrance.

The observed burrow diameter or mean diameter was varied from 27.7 ± 6.2 in upper foreshore, 49.2 ± 17.34 in backshore and 73 ± 21.14 in lower dune respectively.

Burrow depth or mean depth (TBD) of burrows were 215 ± 43.01 in upper foreshore, 250 ± 34.64 in back shore and 307 ± 24.52 in lower dune respectively.

Comparison with the total burrow length (TBL) or mean length between upper foreshores, back shore and lower dune area showed 239 ± 49.1 , 284.5 ± 32.2 , and 337 ± 39.92 (Plate.1.2, Table .1.1).



(A) Adult of *Ocypoda ceratophthalma*



(B) *Ocypoda ceratophthalma* enters its burrow



(C) Burrow group of *Ocypoda ceratophthalma*



(D) Burrows with signal opening



(E) Close up view of burrow opening



(F) Burrow fills with POP casting

Plate .1.1 Burrows of *Ocypoda ceratophthalma*



(A) I-shape burrow



(B) J-shape burrow



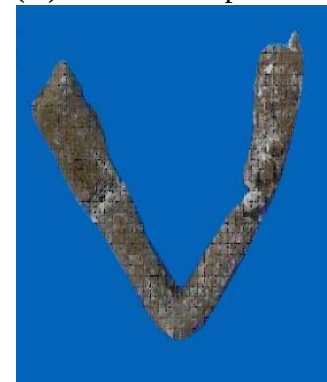
(C) Semi U-shape burrow



(D) Semi U- shape burrow



(E) Semi U-shape burrow



(F) V-shape burrow

Plate.1.2 Burrowing types of *Ocypoda ceratophthalma*

Table .1.1 Measurement of burrows of ghost crab *Ocypoda ceratophthalma*, from the foreshore, back shore and dune environment

Table. 1.2 Burrow shapes found in three habitat types

Habitat type	N	Mean diameter	Mean depth	Mean length	BD(mm)		TBD (mm)		TBL(mm)	
		BD(mm)	TBD(mm)	TBL(mm)	Mini	Maxi	Mini	Maxi	Mini	Maxi
Upper foreshore	10	27.7±6.2	215±43.01	239±49.1	20	40	150	280	170	300
Back shore	10	49.2±17.34	250±34.64	284.5±32.2	40	70	20	30	220	325
Lower dune	10	73±21.24	307±24.52	337±39.72	50	110	280	330	300	400

BD = Burrow diameter

TBD = Total burrow depth

TBL= Total burrow length

Habitat type	I shaped	J-shaped	Semi U shape	V shaped
Upper foreshore	✓	✓		
Back shore		✓	✓	
Lower dune			✓	✓

Discussion

Burrow morphology of ghost crab *Ocypoda ceratophthalma* was observed in foreshore, backshore and dune area of sandy shore in Chaungtha beach. The burrows of *Ocypoda ceratophthalma* inhabits from the upper foreshore to the lower dune sub environment. It agrees with KojiSeike and Masakazu Nora, (2008) who they observed burrow morphologies of the ghost crabs *Ocypode ceratophthalma* and *O. sinensis* in foreshore, backshore, and dune sub environmental sandy beach in Japan.

Most small burrows were found close to the sea, while larger burrows were mostly found in places higher up the beach (Tureliet *al.*,2009).It agrees with the present study, small burrows were found upper foreshore and while larger burrows were found in lower dune area of sandy shore in Changtha beach. Ghost crabs are nocturnal and observation of activity pattern showed that crabs are more activity during night than day time(Tureli *et al.*, 2009). It agree with the present study

In upper foreshore, the observed diameter of burrow opening, total burrow depth and total burrow length were 27.7 ± 6.2 , 215 ± 43 and 239 ± 49.1 respectively. In back shore, the observed diameter of burrow opening, total burrow depth and total burrow length were 49.2 ± 17.34 , 250 ± 34.64 and 284.5 ± 32.2 respectively. In lower dune, the observed diameter of burrow opening, total burrow depth and total burrow length were from 73 ± 21.14 , 307 ± 24.52 and 337 ± 39.92 respectively (Table 1).

In the present study, four types of burrow patterns were observed like I, 'J', V and 'semi-U' type with different sizes as revealed by POP casting. Burrows of *Ocypoda* species were varied in I, J, Y, V, semi-U, spiral and single tube shapes (Chan *et al*, 2006, Sourachet *al*, 2013, Koji and Masakazu, 2008, Tureliet *al.*, 2009).

Burrows are J-, U- or Y-shaped in *Scylla serrata* (Nandi and Dev Roy, 1991). L or J-shaped in *Ocypode cursor* (Tureli *et al.*, 2009). C, L, J, U, V and Y shaped in *Uca sp* (Lim and Diong, 2003).

Chaungtha beach is one of the most popular beaches in Myanmar tourist resorts and many visitors come and visit the beach for recreation. Human disturbances along the beach may interfere with the development of ghost crab *Ocypoda ceratophthalma*. So educational talk concerning conservation of crabs and their natural habitats should be given the local people and fishermen for the sustainability of crab species along Chaungtha beach.

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Isolation of Agricultural Effective Endophytic Microorganisms and Preliminary Studies for the Effect of Microorganisms on Growth of Roselle and Germination of Rice

Htar Htar¹

Abstract

In the course of screening of endophytic microorganism, nine kinds of plants were employed. In this study fourteen endophytic microorganisms were isolated from these nine kinds of plants. In the investigation for biological properties of endophytic microorganisms, fourteen bacteria were isolated from nine kinds of plant sources. Among these isolated endophytic bacteria, HB-02, HB-06, HB-09 and HB-12 exhibited highly effective on Roselle. According to the result of microbial growth kinetics, growth phase were between 36-48 hrs. Therefore, 48 hrs culture were used as biofertilizers in the field.

Introduction

The soil conditions nowadays become acidic and unfertile in the crop vegetable fields because the chemical fertilizers are used over. Chemical residues which remain in crops and vegetables cause uncomfortable health and toxic side effects to men and animals. (Henery, 1978).

At present time, in the field crops and vegetable forms, the chemical fertilizers are being used for the growth and seed fertilization. Therefore, the soil fertility and crop-vegetable qualities become decreased (Bolgare *et al.*, 1990).

Biofertilizer is different from other chemical fertilizers, which contain organic compounds that increase soil fertility either directly or as a result of their decay.

The typical materials for microbial sources are soil, living and fallen leaves, leaf litters, dung, insects, fresh water, and marine water. (Harayama & Isono, 2002). Therefore the screening of endophytes was investigated.

Family- mimosaceae is the smallest family among families of the order leguminales. Mostly trees or shrubs, rarely herbs; leaves bi-pinnately compound; stipulate, axillary racemose, head or spike inflorescence; bisexual, hypogynous flower; fruits is legume; endospermic seeds.

Family-verbenaceae is almost entirely tropical or subtropical regions. The plants may be herbs, shrubs or trees; the leaves are opposite or whorled, exstipulate, racemose or cymose inflorescence; petamerous; bisexual, hypogynous flower; fruit is drupe; exalbuminous seeds.

Materials and Methods

Sample collection

Nine species of two families of plant samples were collected from road side of Monywa area. Plant samples were immediately kept in precleaned polythene bags, which were sealed and kept in an ice box until further analysis in the laboratory.

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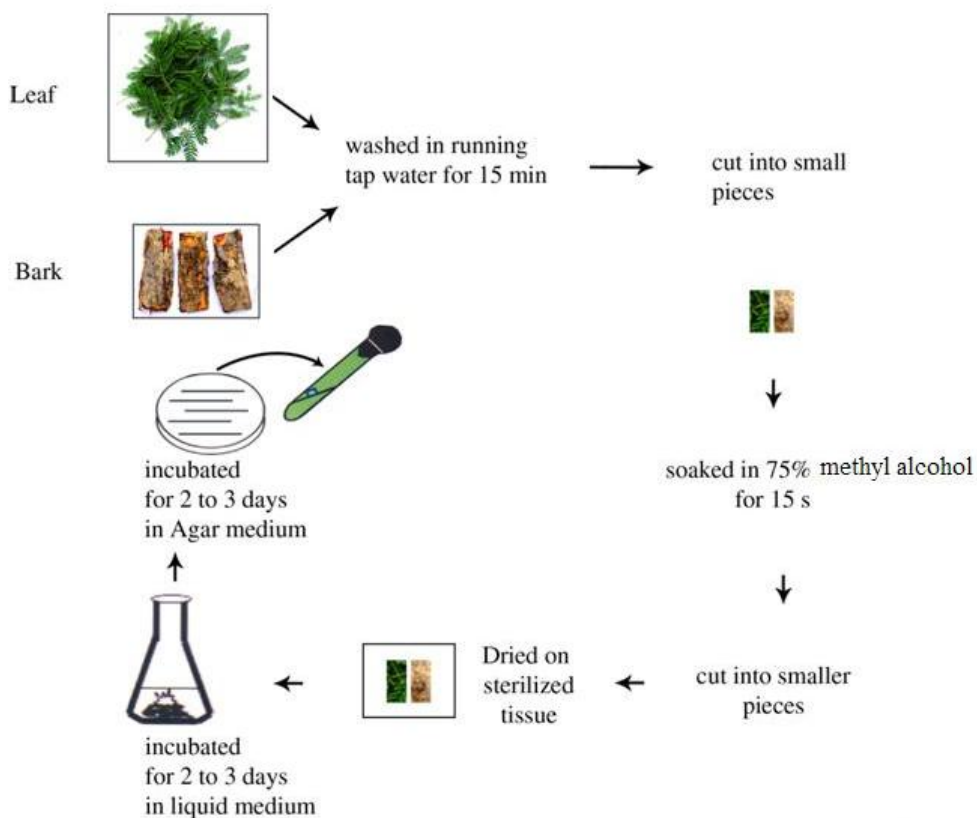
Isolation of Endophytic Bacteria

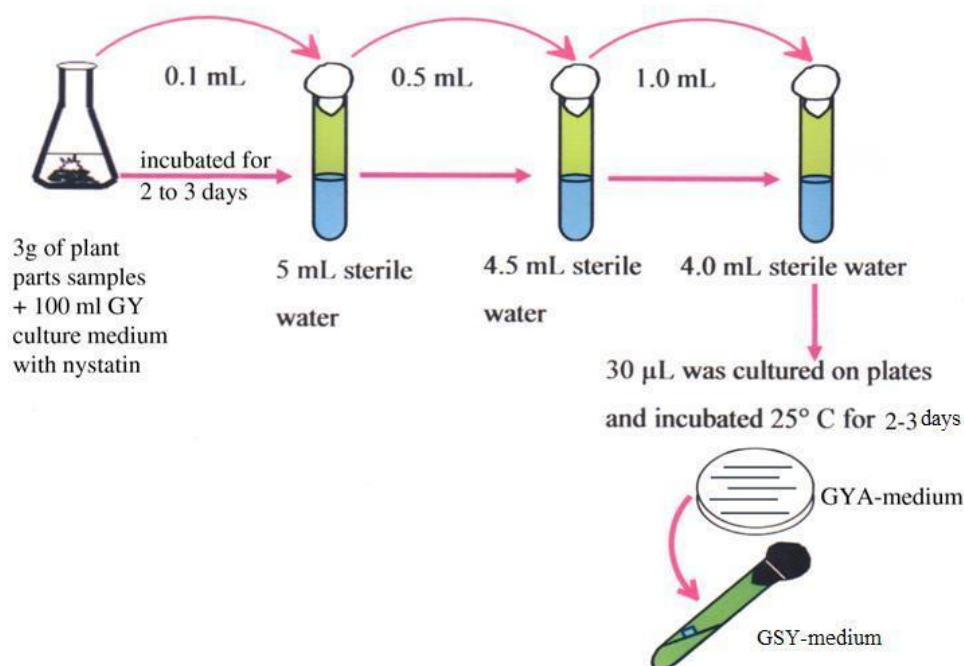
The leaves/barks were washed in the running water for 15 mins. The leaf/bark parts were cut into small pieces. The small pieces were sterilized by soaking in 75% methyl alcohol for 15s. Then, cut into smaller pieces. The samples were dried on sterilized paper. Incubate in liquid medium about 3 days. Serial diluted by sterile water. Incubates on solid medium about 3 days to one weeks at 27°C in clean chamber.

Table 1. Plants utilized for the isolation of microorganisms

(Collected site is Monywa)

Sr	Scientific name	Myanmar Name	Family
1	<i>Acacia Senegal</i> (L.) Willd, DC.	Sha-Phyu	Mimosaceae
2	<i>Acacia nilotica</i> (L.) Delile, FL-Aegypt	Su-phyu	
3	<i>Acacia leucophloea</i> (Roxb) Willd.	Hta-naung	
4	<i>Acacia farnesiana</i> (L.) Willd, DC.	Nan-lone-kyaing	
5	<i>Leucaena leucocephala</i> (Lmk) DC Wit.	Baw-zagaing	
6	<i>Acacia catechu</i> Willd.	Sha-nyo	
7	<i>Pithecellobium dulce</i> (Roxb)	Ta-yoke-ma-gyi	
8	<i>Prosopis juliflora</i> (Swartz) DC.	Kan-da-ya	
9	<i>Tectonahamiltoniana</i> Wall.	Dahat	Verbenaceae





Preliminary study on the Effects of Endophytes on the Growth of Roselle.

Soil used for cultivation of plants was sterilized at 121°C for 15mins before the preparation in pots. 25 mL of samples containing microorganisms (bacteria) were prepared as soil basal in pots. Roselle was employed for the investigation of the growth of plants in pot-cultivation.

Preliminary study on the effect of selected endophytic microorganisms on the germination of rice *Oryzastiva* L.

The selected endophytic microorganisms HB-02, HB-06, HB-09, HB-12, HB-02+06, HB-02+09, HB-02+12, HB-06+09, HB-06+12, HB-09+12, HB-02+06+09, HB-02+06+12, HB-02+09+12, HB-06+09+12, HB-02+06+09+12 were inoculated in 50 ml capacity conical flasks containing 25 ml liquid medium. 1 day old liquid culture was used to test germination on rice.

The rice grains (10 seeds) were placed in samples of 1 day old liquid culture.

After 24 hour cultivation, the rice grains were packed up from the samples and placed in the petri-dishes (8 inches in diameter), respectively.

In three days of germination, how the microorganisms affect to the germination of rice was investigated.

Results**Table 2. Isolated bacteria from 9 different plant samples**

Sr.	Scientific name	Isolated bacteria
1	<i>Acacia Senegal</i> (L.) Willd, DC.	HB-01, HB-02
2	<i>Acacia nilotica</i> (L.) Delile, ft. Aegypt	HB-03, HB-04
3	<i>Acacia leucophloea</i> (Roxb) Willd.	HB-05
4	<i>Acacia farnesiana</i> (L.) Willd, DC.	HB-06, HB-07
5	<i>Leucaenaleucocephala</i> (Lmk.) De, wit.	HB-08, HB-09
6	<i>Acacia catechu</i> Willd.	HB-10, HB-11
7	<i>Pithecellobiumdulcis</i> (Roxb)	HB-12
8	<i>Prosopisjuliflora</i> (Swartz) Dc.	HB-13
9	<i>Tectonahamiltoniana</i> Wall	HB-14

Table 3. The Effects of Endophytic bacteria on Growth of Roselle

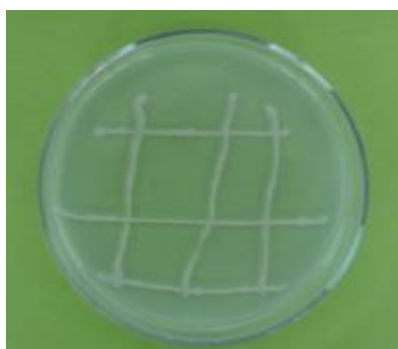
Endophyte	Dry weight of Roselle
Negative control	79.5
Positive control	73.7
HB-01	94.1
HB-02	112.9
HB-03	86.3
HB-04	97.7
HB-05	95.6
HB-06	112.1
HB-07	93.6
HB-08	86.2
HB-09	101.1
HB-10	93.0
HB-11	84.8
HB-12	109.0
HB-13	82.1
HB-14	80.1

Table 4. The Effects of selected endophytic bacteria on germination of Rice

Selected endophytic bacteria	% of germination
Negative control	80%
Positive control	80%
HB-02	100%
HB-06	100%
HB-09	100%
HB-12	100%
HB-02+06	100%
HB-02+09	90%
HB-02+12	100%
HB-06+09	100%
HB-06+12	100%
HB-09+12	100%
HB-02+06+09	90%
HB-02+06+12	100%
HB-02+09+12	90%
HB-06+09+12	100%
HB-02+06+09+12	100%



Morphology of HB-01 bacteria isolated from leaf of *Acacia Senegal* (L.)



Morphology of HB-02 bacteria isolated from bark of *Acacia senegal* (L.)

Figure 3. Habit and Morphologies of isolated endophytic bacteria

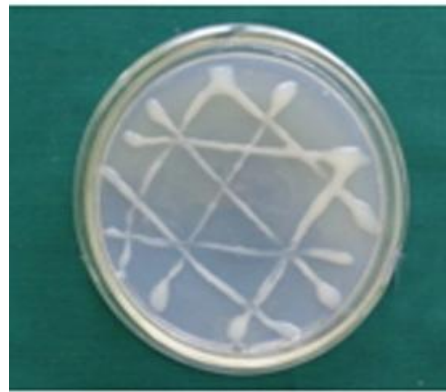


Morphology of HB-03 bacteria isolated from leaf of *Acacia nilotica* (L.)



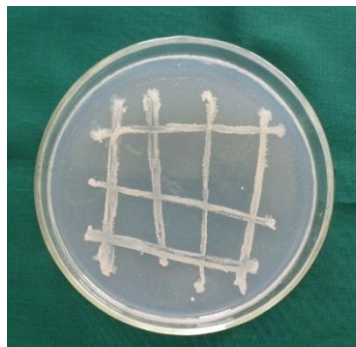
Morphology of HB-04 bacteria isolated from bark of *Acacia nilotica* (L.)

Figure 4. Habit and Morphologies of isolated endophytic bacteria

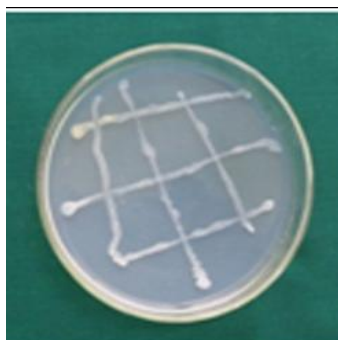


Morphology of HB-05 bacteria isolated from the bark of *Acacia leucophloea* (Roxb)

Figure 4. Habit and Morphology of isolated endophytic bacteria



Morphology of HB-06 bacteria isolated from leaf of *Acacia farnesiana* (L.)

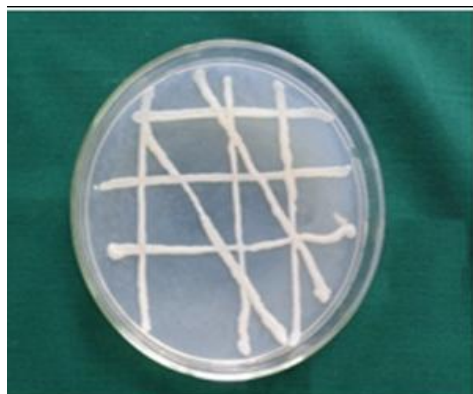


Morphology of HB-07 bacteria isolated from bark of *Acacia farnesiana* (L.)

Figure 5. Habit and Morphologies of isolated endophytic bacteria



Morphology of HB-08 bacteria isolated from leaf of *Leucaenaleucocephala* (Lmk)

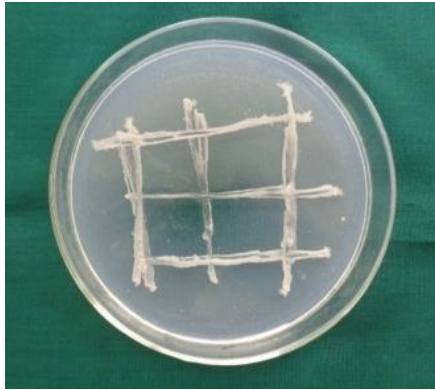


Morphology of HB-09 bacteria isolated from bark of *Leucaenaleucocephala* (Lmk)

Figure 6. Habit and Morphologies of isolated endophytic bacteria



Morphology of HB-10 bacteria isolated from leaf of *Acacia catechu* Willd



Morphology of HB-11 bacteria isolated from bark of *Acacia farnesiana* (L.)

Figure 7. Habit and Morphologies of isolated endophytic bacteria

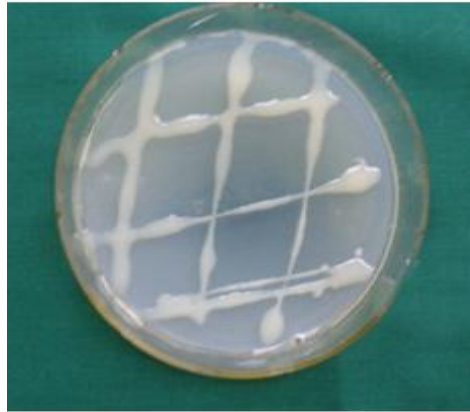


Morphology of HB-12 bacteria isolated from the bark of *Pithecellobium dulce* (Roxb)



Morphology of HB-13 bacteria isolated from bark of *Prosopis juliflora* (Swartz)

Figure 8. Habit and Morphologies of isolated endophytic bacteria



Morphology of HB-14 bacteria isolated from bark of *Tectonahamiltoniana* Wall.

Figure 9. Habit and Morphologies of isolated endophytic bacteria

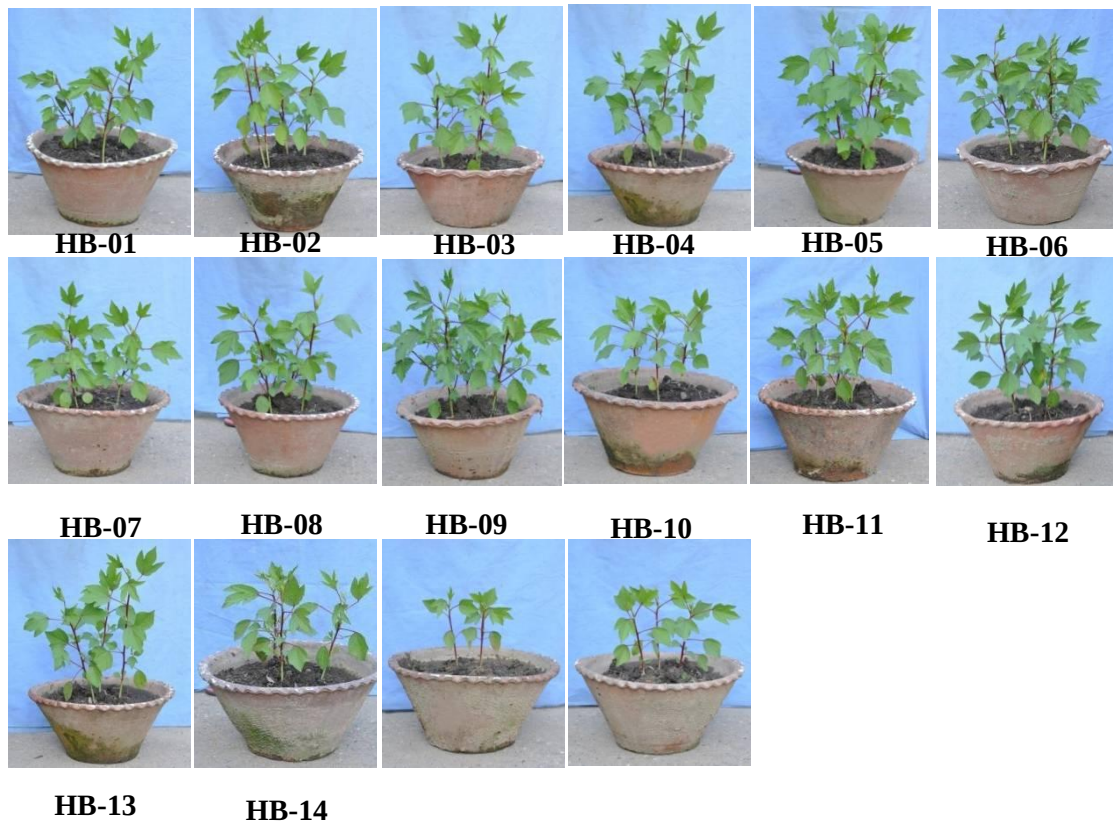


Figure 10. Growth of Roselle by applying isolated bacteria (30 Days Old)

**Negative Control****Positive Control****HB-01****Figure 11. Growth of Roselle by applying isolated bacteria(60 days old)****HB-02****HB-03****HB-04****Figure 12. Growth of Roselle by applying isolated bacteria (60 days old)****HB-05****HB-06****HB-07****Figure 13. Growth of Roselle by applying isolated bacteria (60 days old)**



HB-08



HB-09



HB-10

Figure 14. Growth of Roselle by applying isolated bacteria (60 days old)



HB-11



HB-12



HB-13

Figure 15. Growth of Roselle by applying isolated bacteria (60 days old)



HB-14

Figure 16. Growth of Roselle by applying isolated bacteria (60 days old)

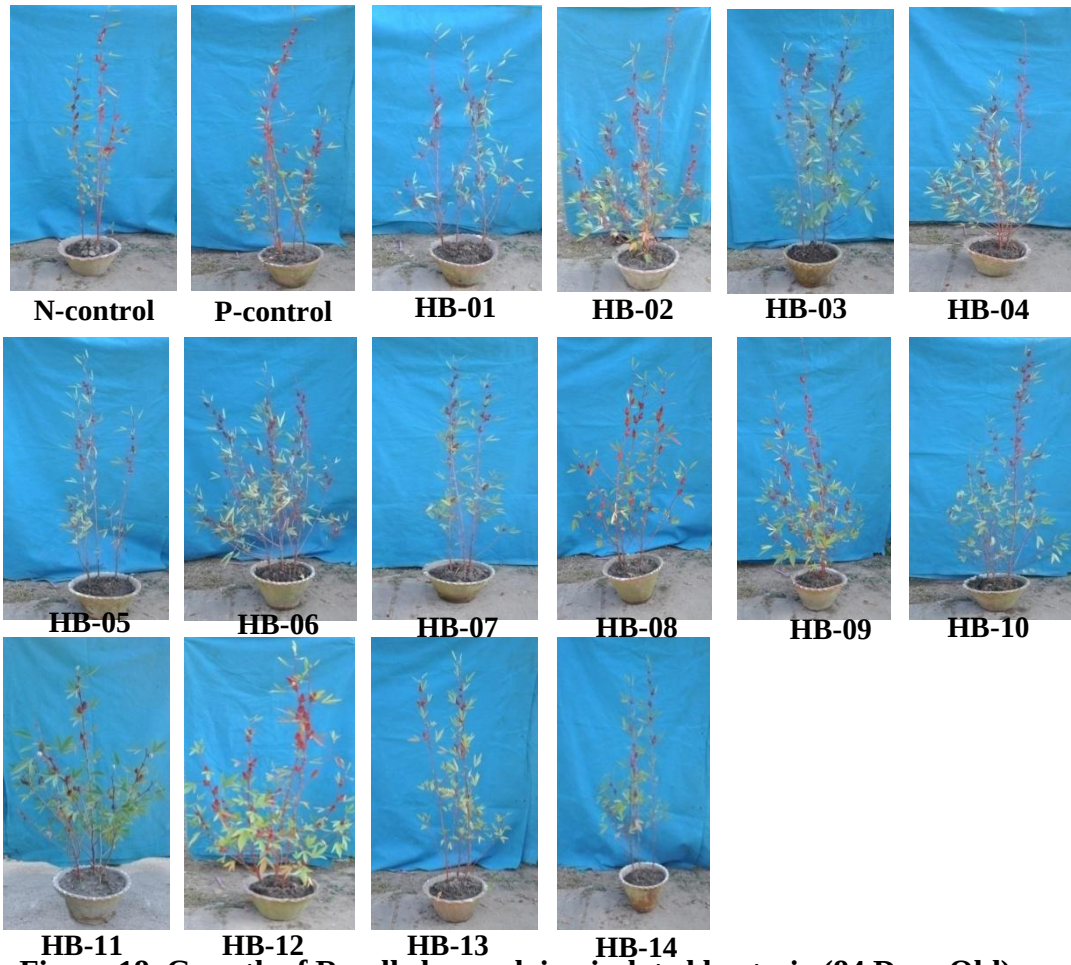


Figure 18. Growth of Roselle by applying isolated bacteria (84 Days Old)

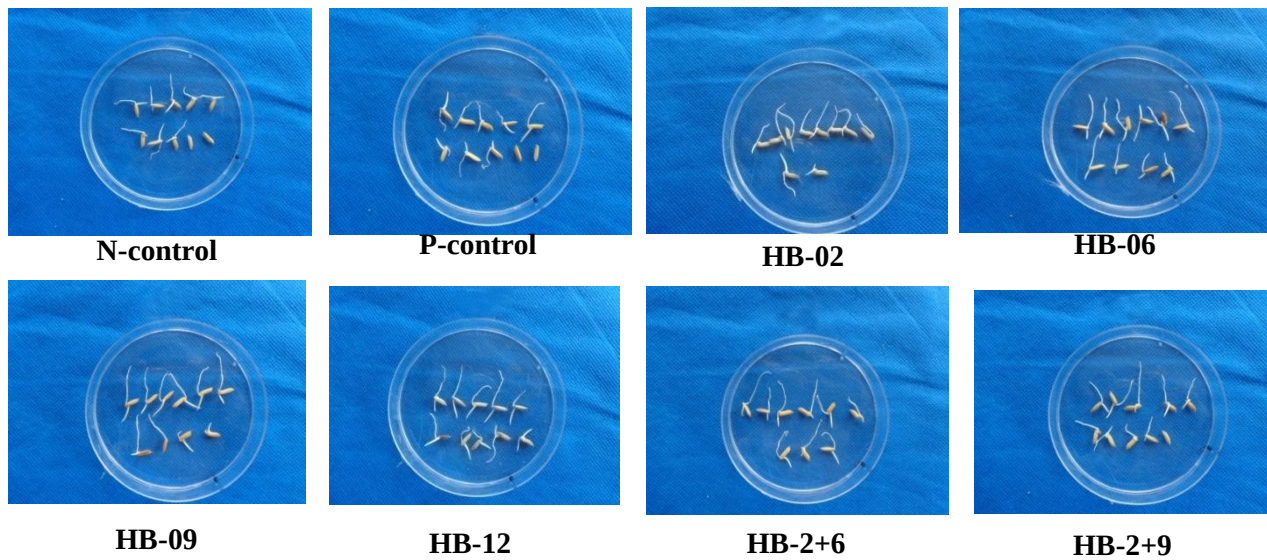


Figure 19. Germination test on the Rice by selected endophytic bacteria

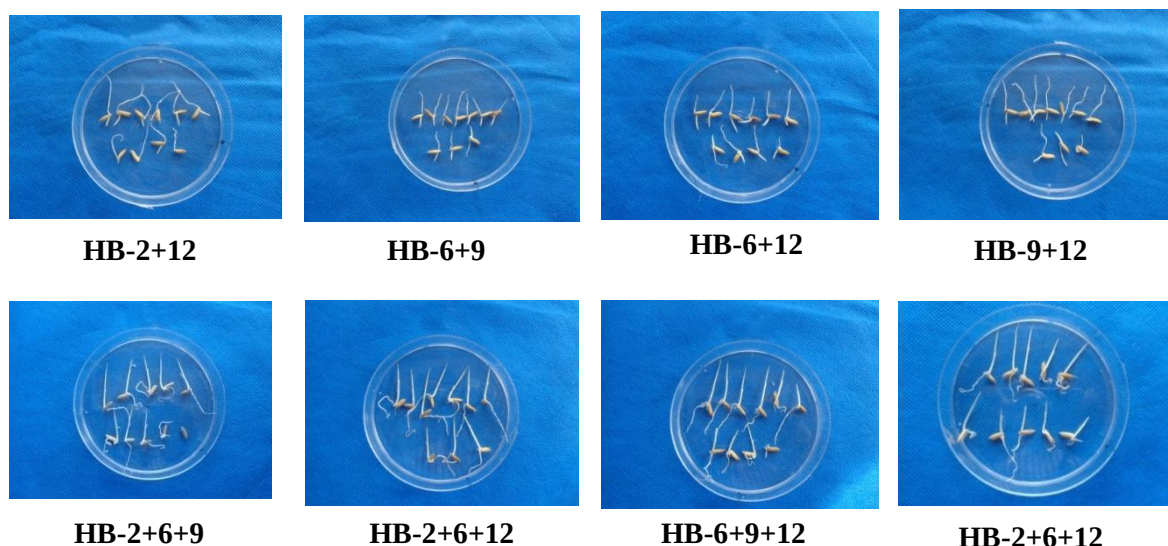


Figure 20. Germination test on the Rice by selected endophytic bacteria

Discussion and Conclusion

In the course of collection of samples, nine kinds of plants were collected from Monywa Area. In the investigation for biological properties of endophytic microorganisms, fourteen bacteria were isolated from nine kinds of plant sources. Among these isolated endophytic bacteria, HB-02, HB-06, HB-09 and HB-12 exhibited highly effective on Roselle. When these effective bacteria were also utilized in Rice Grains germination, they showed effects in seeds germination.

The microbial growth kinetics of effective bacteria were being observed. In the agriculture effects of the growth of Roselle using with pots, the total dry weight of Roselle were 112.9 g (HB-02), 112.1 g (HB-06), 101.1 g (HB-09) and 109.0 g (HB-12) comparison with 73.7 g of positive control and 79.5 of negative ones.

In the investigation of their microbial growth kinetics, their growth phases were observed at 36-48 hrs. This time is suitable for the use of biofertilizer in the field.

Therefore, this investigation should be continuously undertaken in the field trails of local needs as microbial fertilizer.

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A Study on Antifungal Activity of Soil Fungi and Endophytic Fungi on Pathogenic Fungi from Sunflower Seeds

Taik Paing¹

Abstract

In the isolation procedure of soil fungi, soil samples were collected from 8 different places of Monywa Area. Two methods of direct inoculation and serial dilution were used and 18 kinds of soil fungi were isolated. For the antifungal activities, the pathogenic fungi were isolated from the seeds of sunflower grown in Hinthada Area. Three kinds of pathogenic fungi (PF-1, PF-2, PF-3) were isolated by direct inoculation and serial dilution methods. In the antifungal activity, only one soil fungus (TP-05) showed 16 mm of inhibitory zone on the pathogenic fungus (PF-3) of sunflower seeds. Other 17 kinds of soil fungi did not show the antifungal activities on all three kinds of pathogenic fungi. In the isolation of endophytic fungi, 5 different plant sources were collected in Pathein Area and 10 kinds of endophytic fungi were isolated. Among them, 4 kinds of endophytic fungi (TP-19, 26, 27, 28) showed the antifungal activities (14 mm, 15 mm, 18 mm and 20 mm of inhibitory zones) on pathogenic fungus (PF-3) of sunflower seeds. According to these inhibitory zones, the biggest zone (20 mm) of endophytic fungus from *Polygonum barbatum* L. (suzat-pan) belonging to the family of Polygonaceae was selected for future investigation. Selected endophytic fungus (TP-28) and pathogenic fungus (PF-3) were identified by using reference keys. These selected fungi were important for all living especially farmers. Because of the seed-borne fungi were deterioration in sunflower oil and lost yield.

Key words: isolation of fungi, antifungal activities, identification of fungi

Introduction

The deterioration in sunflower oil due to seed-borne fungi is of a great importance. Sunflower (*Helianthus annuus* L.), considered a commercial oil crop all over the world, the crop is widely cultivated in Egypt and in many countries all over the world. Sunflower is particularly used for production of edible oils as well as for seed consumption. The crop is attacked by numerous seed mycoflora and these pathogens may affect the crop resulting in a reduction of the seed quantity and quality. The direct impact of storage fungi on the economical part of the plant (seed) need further studies for studying the different effects of storage fungi on sunflower oil in order to increase oil yield and crop quality for human consumption and food industries (El-Wakil, 2014).

Bacterial diseases caused by sunflower seed pathogens are apical chlorosis, bacterial leaf spot, bacterial wilt, crown gall and *Erwinia* stalk rot and head rot. There is undoubtedly worldwide contamination of the seeds with a variety of mycotoxin producing fungi and that mycotoxins are a probable source of naturally occurring carcinogens in humans. Damages of seeds such as seed death, seedling and plant abnormalities or decreased seed vigor caused by seed-borne pathogens, harmful fungi as toxigenic are important for their detection and identification (Nahar, 2005).

In continuation of our screening programme for biological activities of the higher plants, we have studied *Polygonum barbatum* L. *Polygonum barbatum* L. is called joint weed, smartweed and knotgrass in Philippine. Its young leaves and shoots are cooked as vegetables. In medicinal properties, the sap of pounded leaves applied to wounds is

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considered an effective cicatrizant. Seeds are used to relieve colic pains. Roots are used as astringent. In China, leaves and stems are used to wash wounds and ulcers. The sap is applied to wounds as antiseptic. The paste of roots is used for treatment of scabies (Mao, 2012). The leaves of *Polygonum barbatum* L. were used for isolation of endophytic fungi for the antifungal activity.

Aims And Objectives

- To isolate the soil fungi from different places.
- To isolate the endophytic fungi from different plant sources.
- To study the isolation of pathogenic fungi from the infected seeds that cause the diseases.
- To investigate the antifungal activities of soil fungi and endophytic fungi on pathogenic fungi.
- To know the identification of selected endophytic and pathogenic fungi.

Materials And Methods

Isolation of Soil Fungi (Omura, 1985)

Eight different soil samples collected from Monywa Area were utilized for the isolation of soil fungi (Table 1). In the isolation procedure, soil fungi were isolated by serial dilution and direct inoculation methods. In serial dilution method, the soil samples were suspended in 10 ml of sterile water. These soil suspensions were vigorously agitated. The 1 ml of supernatant was diluted in 9 ml of sterile water respectively. After the dilution series, 1 ml of the sample was incubated on potato dextrose agar medium (PDA medium) at room temperature for 7 days. After 7 days incubation, the pure colonies were recultured and stored for further use.

Isolation of Pathogenic Fungi from dried seeds of *Helianthus annuus* L.

Seeds may carry spores of some pathogenic fungi. In such cases, a sedimentation or seed-washing test is useful for detecting spores. Seeds with spore samples were placed in test tube containing 10 ml of 0.85% saline. The aqueous suspension (0.5 ml) was transferred into other test tube containing 4.5 ml of distilled water and then 0.5 ml suspension into 4.5 ml distilled water tube after that 1 ml suspension into 4 ml distilled water. After serial dilution for spores suspension, 1 ml suspension was inoculated onto the nutrient agar plates (glucose 1%, peptone 0.3%, agar 1.8%) at three points equidistant from the center and incubated for 7 days at room temperature (Omura, 1985) and direct inoculation method.

Isolation of Endophytic Fungi

In the isolation of endophytic fungi, 5 different sources of plants were utilized and collected from Pathein Area (Table 2). In the isolation procedure of endophytic fungi, the leaves were washed in running tap water for 10 minutes and sterilized by soaking in 95% alcohol for 15 seconds. Then, the leaves were cut into small pieces and dried on the sterilized tissue paper. After that, the leaves of cut pieces were incubated on nutrient agar plate (PDA medium) for 3 days to 1 week at room temperature.

Table 1 Soil samples collected from Monywa Area

Soil sample No.	Collected places		Soil type	Collection date
S-1	Monywa University Playground	N 22° 08.288′ E 095° 10.019′	Silt-clay	15.6.2013
S-2	Monywa University Pagoda	N 22° 08.546′ E 095° 10.036′	Sandy loam	15.6.2013
S-3	Traditional Hospital	N 22° 07.940′ E 095° 10.056′	Silt-clay	15.6.2013
S-4	Zay Ta Win Monastery	N 22° 06.514′ E 095° 07.983′	Sandy loam	15.6.2013
S-5	ShweSegon Pagoda	N 22° 06.887′ E 095° 07.765′	Sandy loam	15.6.2013
S-6	MPT Monywa	N 22° 07.035′ E 095° 07.515′	Silt-clay	15.6.2013
S-7	ZayyarShweMyae Playground	N 22° 07.184′ E 095° 07.605′	Sand	15.6.2013
S-8	Monywa Hospital	N 22° 07.264′ E 095° 07.848′	sand	15.6.2013

Table 2 Plantsamples used for screening of endophytic fungi

No.	Scientific Name	Myanmar name	Family
1	<i>Premnacorymbosa</i> Rottl. & Willd.	Pyasone	Verbenaceae
2	<i>Desmodium triquetrum</i> DC.	Laukthay	Papilionaceae
3	<i>Cissus repens</i> Lamk.	Tabin-tai-mya-nan	Vitaceae
4	<i>Gynura procumbens</i> (Lour.) Merr.	Py-me-swae	Asteraceae
5	<i>Polygonum barbatum</i> L.	Suzat pan	Polygonaceae

Preliminary Study of the Activities of Isolated Fungi

The isolated fungi were inoculated into the preculture medium (glucose 1%, potato dextrose broth 10%, at pH 7.0) for 3 days at room temperature. After three days, the preculture (1%) was transferred into the fermentation medium (glucose 1%, yeast extract 0.3%, peptone 0.3%, at pH 7.0) and carried out for 17 days by static culture. Then, the fermented broth was used to check the antifungal activity by paper disc diffusion assay method (Suto, 1999). Paper disc having 8 mm in diameter (Advance, Tokyo Rashi Kaisha Co.,Ltd., Japan) were utilized for antifungal activity. The paper discs were soaked in fermented broth each and allowed to dry.

Paper disc diffusion assay method

This method was used for the antifungal activity by the pathogenic fungi. The assay medium (glucose 1%, peptone 0.3%, agar 1.8% at pH 7.0) was utilized for these fungi. The pathogenic fungi were inoculated in assay broth for 3 days at room temperature. One percent of pathogenic fungi was added to assay medium and then poured into petridishes. After solidification, the paper discs impregnated with fermented broth samples were applied on the agar plates and the plates were incubated for 24-36 hrs. Clear zones (inhibitory zones) surrounding the paper discs indicate the presence of bioactive compounds which inhibit the growth of the pathogenic fungi.

Fermentation studies for the production of antifungal metabolites.

Fermentation is one of the distinct phases of biotechnology. Optimal fermentation conditions are very important for maximal productivity of metabolites. The proper cultivation and transfer of inoculum are crucial for the production of primary and secondary metabolites.

Outstanding Characters for Selected Plants

The distinguishing characters of selected plants including *Polygonum barbatum* L. and *Helianthus annuus* L. were studied for the isolation of endophytic fungi and pathogenic fungi according to their antifungal activities. (Backer, 1963), (Hooker, 1897)

Preliminary identification of selected endophytic fungus and pathogenic fungus

The morphological and microscopical characters were observed by the methods of :

- ✓ Ando and Inaba (2004): Taxonomy of Fungi.
- ✓ Barnett, H.L. (1956): Fungi Imperfecti.

Results

Table-3, Isolated Soil fungi from soil samples of Monywa Area

Soil sample	Collected places (Monywa Area)	Soil pH	Isolated soil fungi	Total No.
S-1	Monywa University Playground	7.61	TP-01,02,03	3
S-2	Monywa University Pagoda	7.68	TP-04,05	2
S-3	Traditional Hospital	7.50	TP-06,07	2
S-4	Zay Ta Win Monestery	7.16	TP-08,09,10	3

S-5	ShweSegon Pagoda	7.67	TP-11,12	2
S-6	MPT Monywa	8.08	TP-13,14	2
S-7	ZayyarShweMyae Playground	8.50	TP-15,16	2
S-8	Monywa Hospital	8.17	TP-17,18	2
	Total Isolated Fungi			18

Table-4, Antifungal Activities of Isolated Soil Fungi

Isolated soil fungi	Activities on three pathogenic fungi		
	PF-1	PF-2	PF-3
TP-01	-	-	-
TP-02	-	-	-
TP-03	-	-	-
TP-04	-	-	-
TP-05	-	-	+(16mm clear zone)
TP-06	-	-	-
TP-07	-	-	-
TP-08	-	-	-
TP-09	-	-	-
TP-10	-	-	-
TP-11	-	-	-
TP-12	-	-	-
TP-13	-	-	-
TP-14	-	-	-
TP-15	-	-	-
TP-16	-	-	-
TP-17	-	-	-
TP-18	-	-	-

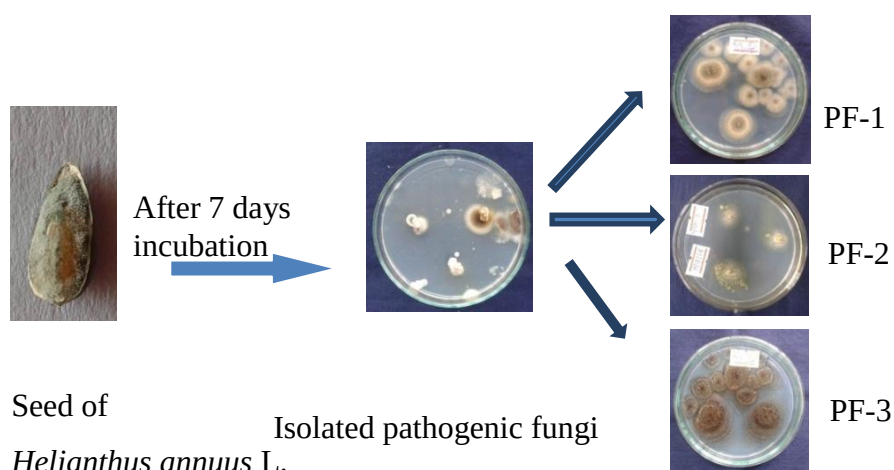


Fig.1 isolated pathogenic fungi from sunflower seeds

Table -5, Isolated endophytic fungi from plant sources

No.	Scientific Name	Myanmar name	No. of isolates	Isolated endophytic fungi
1	<i>Premnacorymbosa</i> Rottle & Willd	Pyaitstone	1	TP-19
2	<i>Desmodium triquetrum</i> DC.	Laukthay	2	TP-20, 21
3	<i>Cissus repens</i> Lamk.	Tabin-tai-myan-nan	3	TP-22,23,24
4	<i>Gynura procumbens</i> (Lour.) Merr.	Py-me-swae	1	TP-25
5	<i>Polygonum barbatum</i> L.	Suzat pan	3	TP-26,27,28
	Total isolates		10	

Table-6, Antifungal Activities of Isolated Endophytic Fungi

Isolated endophyticfungi	Activities on three pathogenic fungi		
	PF-1	PF-2	PF-3
TP-19	-	-	+(18mm clear zone)
TP-20	-	-	-
TP-21	-	-	-
TP-22	-	-	-
TP-23	-	-	-
TP-24	-	-	-
TP-25	-	-	-
TP-26	-	-	+(14mm clear zone)
TP-27	-	-	+(15mm clear zone)
TP-28	-	-	+(20mm clear zone)

PF-1,PF-2 and PF-3 are pathogenic fungi isolated from sunflower seeds

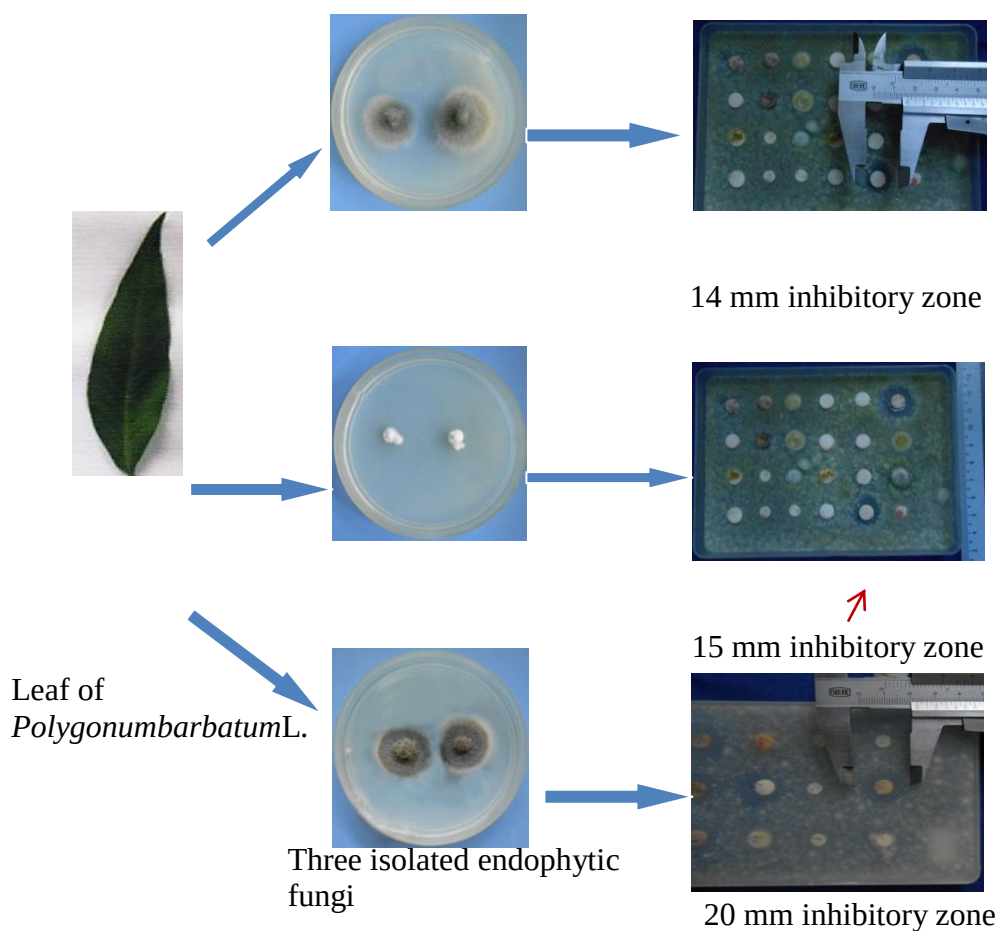


Fig.2 The antifungal activities of endophytic fungi on pathogenic fungus (PF- 3)

Morphological and Microscopical Characters Of Selected Endophytic Fungus

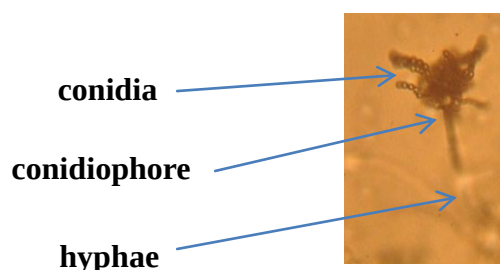


Photomicrograph X 100

Fig-3 Morphological and Microscopical Characters of Selected Endophytic Fungus

After 3 days of cultivation, it was observed that dark brown colonies were reached 2.5cm diameter at room temperature on PGA medium.

Distinctive character of selected endophytic fungus, *Aspergillus* spp.



Photomicrograph X 100

Distinctive character of selected endophytic fungus was found that hyphae are hyaline, septate and branched; conidiophore brown, unbranched, hyaline at the base, bearing clusters of multi-phialides; conidia hyaline, lacking septum, one-celled, asexual, globose, conidial chain long with many conidia (6-10), borne at the apex of the short phialide.

According to the morphological and microscopical characteristics features and based on the references keys of Ando and Inaba (2004), Barnett, H.L., (1956), this endophytic fungus was grouped as the fungi imperfecti may be *Aspergillus* spp.

Kingdom - Fungi

Division – Ascomycota

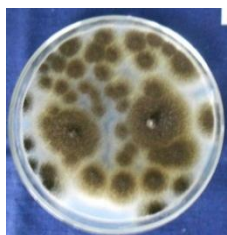
Class – Plactomycetes

Order –Eurotiales

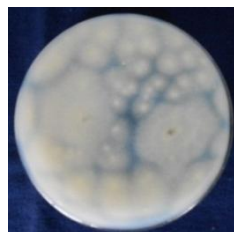
Family – Eurotiaceae

Genus - *Aspergillus*

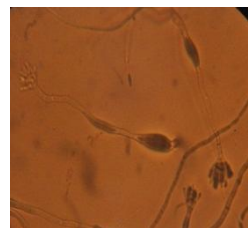
Morphological and Microscopical Characters of Pathogenic Fungus



Front colour



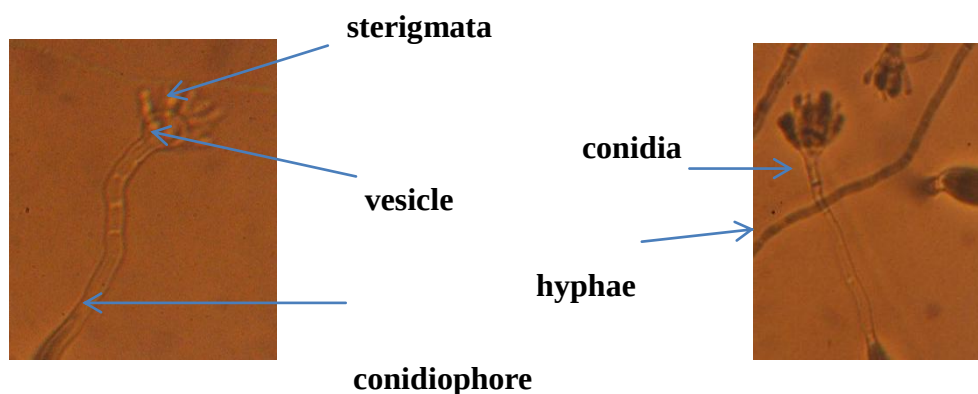
Back colour



Photomicrograph X 100

Fig-4 Morphological and Microscopical Characters of Pathogenic Fungus

Distinctive character of selected pathogenic fungus, *Aspergillus* spp.



Distinctive character of pathogenic fungus was found that hyphae are septate and hyaline; conidiophore with septum and hyaline, simple, long and ends in a dome-shaped multinucleate head called the vesicle, subglobose, club-shaped; sterigmata are tubular outgrowths from the vesicle, bearing cluster of 4-6 phialides; conidia hyaline, one celled, asexual spore, globose.

According to the morphological and microscopical characteristics features and based on the references keys of Ando and Inaba (2004), Barnett, H.L., (1956), this endophytic fungus was grouped as the fungi imperfecti may be *Aspergillus* spp.

Kingdom - Fungi

Division – Ascomycota

Class – Eurotiomycetes

Order – Eurotiales

Family – Trichocomaceae

Genus – *Aspergillus*

Discussion and Conclusion

In biological activities of *Polygonum barbatum* L., the dichloromethane extract showed brine shrimp toxicity and spasmolytic activity. An ethanol extract showed the cholinergic activity (Chaudhry, 2003). In antimicrobial activities of *Polygonum barbatum* L., an ethanolic leaf extract showed broad spectrum activity against gram positive, gram negative and fungal organisms. An ethanolic extract of *Polygonum barbatum* L. showed the

significant antioxidant activity and a better source of natural antioxidants (Mao, 2012). Soil samples were collected from 8 different places of Monywa Area. Two methods of direct inoculation and serial dilution were used and 18 kinds of soil fungi were isolated. For the antifungal activities, the pathogenic fungi were isolated from the seeds of sunflower (*Helianthus annuus* L. belonging to Asteraceae) grown in Hinthada Area. Three kinds of pathogenic fungi (PF-1, PF-2, PF-3) were isolated by direct inoculation and serial dilution methods. In the antifungal activity, only one soil fungus (TP-05) showed 16 mm of inhibitory zone on the pathogenic fungus (PF-3) of sunflower seeds. Other 17 kinds of soil fungi did not show the antifungal activity on all three kinds of pathogenic fungi. In the isolation of endophytic fungi, 5 different plant sources were collected in Pathein Area and 10 kinds of endophytic fungi were isolated. Among them, 4 kinds of endophytic fungi

(TP-19, 26, 27, 28) were showed of the antifungal activities (14 mm, 15 mm, 18 mm and 20 mm of inhibitory zones) on pathogenic fungus (PF-3) of sunflower seeds. According to these inhibitory zones, the biggest zone (20 mm) of endophytic fungus from *Polygonum barbatum* L. (suzat-pan) belongs to the family of Polygonaceae. Based on the best antifungal activity, the (PF-3) of pathogenic fungus will be identified according to macroscopical and microscopical characters. Based on the result of morphological - microscopical characters and references keys, selected endophytic fungus (TP-28) and pathogenic fungus (PF-3) were genus *Aspergillus* spp. These selected fungi benefit for the against of infected seed-borne fungi. These investigations clearly indicate that the selected fungus, the genus *Aspergillus* spp. is useful for the production of antifungal substances. The type of antifungal agents produced by these research will be investigated as well.

Acknowledgements

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Sedimentology and Depositional Environment of Undifferentiated Molassic Unit Exposed in Myodaung Chaung, Ingabu Township, Ayeyawady Region

Hnin Sandar Tun¹, Saw Ngwe Khaing²

Abstract

The study area is situated in the northwestern part of the Hinthada District, Ayeyawady Region and also it is the eastern flank of the southern part of Indo-Myanmar Ranges. Topographically, the western part is mountainous and the eastern part is flat lowland. The age of the Undifferentiated Molassic Unit is Eocene to Early Oligocene. The present investigation is mainly concerned with the sedimentology and paleoenvironment of Undifferentiated Molassic Unit in this region. Petrographically, the sandstone of Undifferentiated Molassic Unit can be designated as lithic greywacke. The measured section was taken out along the Myodaung Chaung. Undifferentiated Molassic Unit can be divided into nine lithofacies and four lithofacies associations. On the basis of facies associations, the depositional environment of Undifferentiated Molassic Unit is considered as shallow marine prodelta and tidal environment.

Key words: Undifferentiated Molassic Unit, lithic greywacke, Lithofacies, Lithofacies association, Myodaung Chaung, shallow marine, prodelta and tidal environment,

Introduction

The study area is located on the southeastern portion of the Western Ranges and in the northwestern part of the Hinthada District (Figure. 1) and it is also situated about 6.5 km from the northwestern part of Kwingauk Village. The study area is lying in one inch topographic map no. 85/O1.

Topographically, the study area can be divided into three different topographic units; they are (1) mountainous terrain -western part, (2) rolling and hilly terrain -middle portion and (3) flat lowland -eastern part.

Angular dendritic pattern with short tributaries and steep-sided, narrow V-shaped gullies are the most obvious drainage system of the western part of the study area.

Methods of study

Geological field traverses were carried out along the whole area, especially along the Myodaung Chaung for detailed measure section. For petrological analysis, thin sections were made from the various rock samples and the photomicrographs were taken by using binocular microscope.

Purpose of study

The aim of the present study is to describe the sedimentology and paleoenvironment of Paunggyi Formation in the study area.

Previous Works

Stuart (1912) stated that the Henzada District was characterized by a mountainous series of indurated sandstones and shales, with frequent cherry beds, and contains the Nagrais rocks.

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According to Clegg (1941), it is considered that in the Henzada District there is no evidence as to the age of the rocks which compose the western region.

Brunnschweiler (1966) studied the geology of the Indo-Burman Ranges. He stated that the formations of the RakhineYoma are of Eocene and, at the latest Early Oligocene age, and are of typical flyschfacies.

Aung Khin and Kyaw Win (1969) describe the individual basins and geological units of the Burma Tertiary geosyncline.

Win Swe (1981) proposed sequence of depositional and tectonic events of the Western Ranges.

Ohn Myint and Kyu Kyu Win (1992) compiled the geological information about the geology and correlations of the lithostratigraphic units of the Ayeyawady Region.

Hla Htay (2002) carried out at Ledi area in Padaung Township, between RakhineYoma in the west and Central Cenozoic Belt in the east.

Saw Ngwe Khaing (2007) conduct a detailed geological investigation with a particular emphasis on the structural deformation, and apply the results thus obtained in a broader interpretation and implications on the regional tectonics.

Lin Thu Aung (2008) studied the geology and sedimentology of the Yenandaung-Letpangwin area, Hinthada District.

Htun Lin Kyaw (2013) studied on the geology and structural analysis of the southern part of the Kwingauk area, Hinthada District.

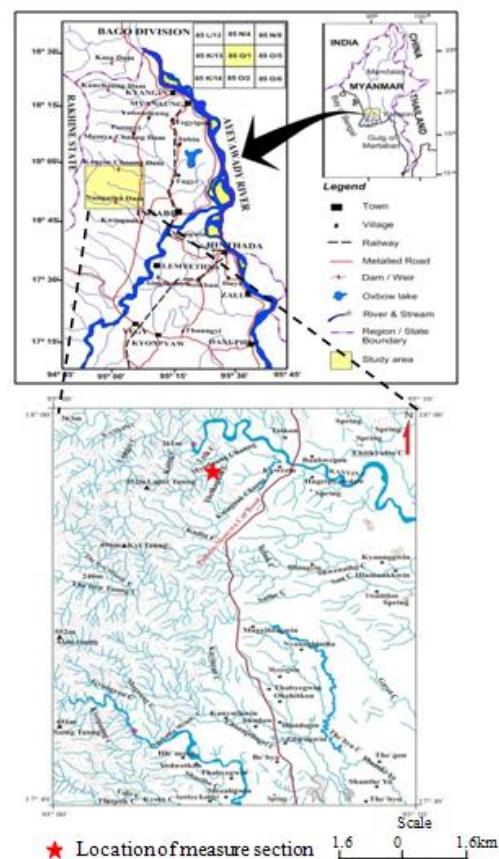


Figure (1) Location map of the study area

REGIONAL GEOLOGIC SETTING

Regional geology

The Western Ranges can be divided into two parallel belts; the western belt consists of flysch type sediments, largely of early Eocene age, all folded and thrust, and the eastern belt of largely much older rocks (Mitchell, 1993). Uplift of the Western Ranges probably began in the late Eocene or early Oligocene (Mitchell, 1993).

Regional structures

Regionally, three major lineaments are recognized. The most prominent major lineament is running NNW-SSE from the 18° N to 21° N. This major lineament occurs as a major strike-slip fault in Western Ranges and it is also known as Kabaw Fault (HlaMaung, 1987). The Kabaw Fault forms a major tectonic break between the Western Ranges and the Central Basin.

Rock Sequence

Late Mesozoic to Cenozoic rocks is exposed in the Western Myanmar Region. The regional geological trends are running nearly N-S direction in the country. The rock units are cropping out with the older rock is at the axis of Western Ranges and that is younger to the flanks. The sequence of the major Rock types in RakhineYoma can be noted as in following succession (Table .1).

Table (1) The sequence of the major rock types in RakhineYoma

Sedimentary rocks

Succession	Rock unit	Age
Alluvium	Coarse sandy gravels & clay and shale deposits sand	Quaternary
~~~~~unconformity~~~~~		
Irrawaddy Formation	Sand and gravel	Miocene-Pliocene
~~~~~unconformity~~~~~		
Upper Pegu Group	Sand/shale of Obogon Fm. Kyaukkok Sandstone Pyawbwe Clay	Miocene
~~~~~unconformity~~~~~		
Lower Pegu Group	Okhmintaung sandstone Padaung sandstone Shwezettaw shale	Oligocene
Molassic-type	Undifferentiated Molassic Unit	Eocene
Flysch-type	Paunggyi Conglomerate	Late Middle Paleocene to early Early Eocene
~~~~~unconformity~~~~~		

Flysch-type	<i>Globotruncana</i> -bearing limestone	Cretaceous
	<i>Orbitolina</i> -bearing limestone	
	Kabaw Shale	
Igneous rock		
Ultrabasic & basic intrusion	Mainly peridotite&serpentinite	Cretaceous-Eocene

PETROGRAPHY OF UNDIFFERENTIATED MOLASSIC UNIT

Macroscopic Study

Undifferentiated molassic unit consists of light grey to dark grey color thin laminated shale, mudstone and clay stone with the medium- to very coarse-grained, grey color sandstone, gritty sandstone and dark color mud pebble conglomerate. Reddish grey and greenish grey colors are common on weathered surface and light grey on the fresh surface in sandstone. In some places, alternation of sandstone and shale is thickening and coarsening upward. Locally metamorphosed slate, calc-phyllite and schist are also present. Sandstone is medium- to coarse-grained, and shows granulose texture. It is mainly composed of quartz, feldspar, mica and matrix are observed on hand specimen.

Microscopic Study

It is composed largely of detrital grain, feldspar, unstable fine-grained fragments, matrix and cement.

Quartz is about 47% of the total component. The shape is angular to sub-angular and sub-rounded grains are poorly sorted with first order yellow, brown, grey and light blue color between X.N.

About 15% of the feldspar contains from the total components. Feldspar grains are finer than quartz grains and also observed as minute feldspar laths. They are poorly sorted, euhedral and angular grains.

Mica contains the little amount. Biotite mica has about 5% of total components and muscovite has about 10% of the total component. The opaque minerals are scattered in thin section. It has about 5% of the total component. They are greenish black color of iron ore.

Matrix materials contain about 19% of total components. It composed of the finer particles of numerous mafic materials. Between the larger sediments are filling with the matrix materials as the cementing agent.

According to Gilbert (1954), sandstone of Undifferentiated Molassic Unit can be defined as "lithic wacke", and also noted as "lithic greywacke" according to Pettijohn (1954) (Figure 2).

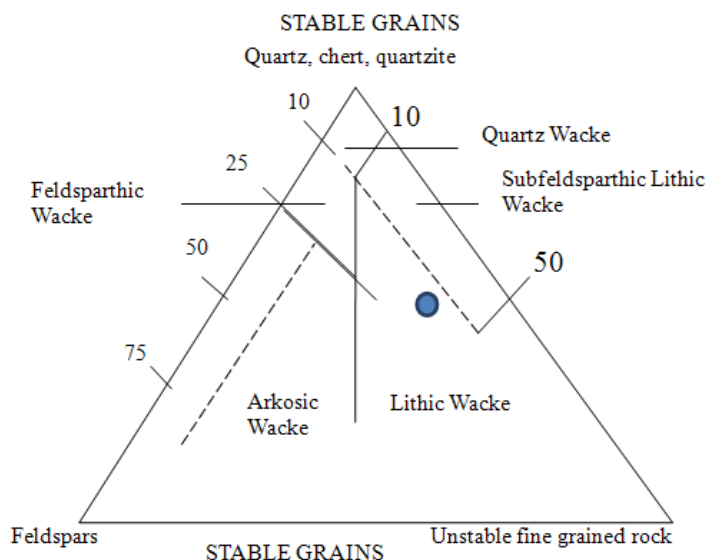


Figure (2) Triangle plot of the constituents (according to C.M. Gilbert, 1954)

SEDIMENTOLOGY AND PALEOENVIRONMENT

Lithofacies of Undifferentiated Molassic Unit

There are nine lithofacies recognized in Undifferentiated Molassic Unit. The measured section of Undifferentiated Molassic Unit in the study area is shown in figures (3).

Lithofacies-1 Alternation of muddy sand and mud shale facies

Lithofacies-2 Sandstone facies

Lithofacies-3 Alternation of calc-slate (phyllite), shale and limestone facies

Lithofacies-4 Intercalation with sandy limestone (limy sand) and calc-slate (phyllite) or shale facies

Lithofacies-5 Alternation of calc-slate (phyllite) or shale with fine to medium grain sandstone facies

Lithofacies-6 Thinly bedded calc-slate (phyllite) or shale facies

Lithofacies-7 Sandy limestone facies

Lithofacies-8 Intercalated fine sand within calc-slate (phyllite) or shale facies

Lithofacies-9 Gritty sandstone and mud pebble, poly lithic conglomerate facies

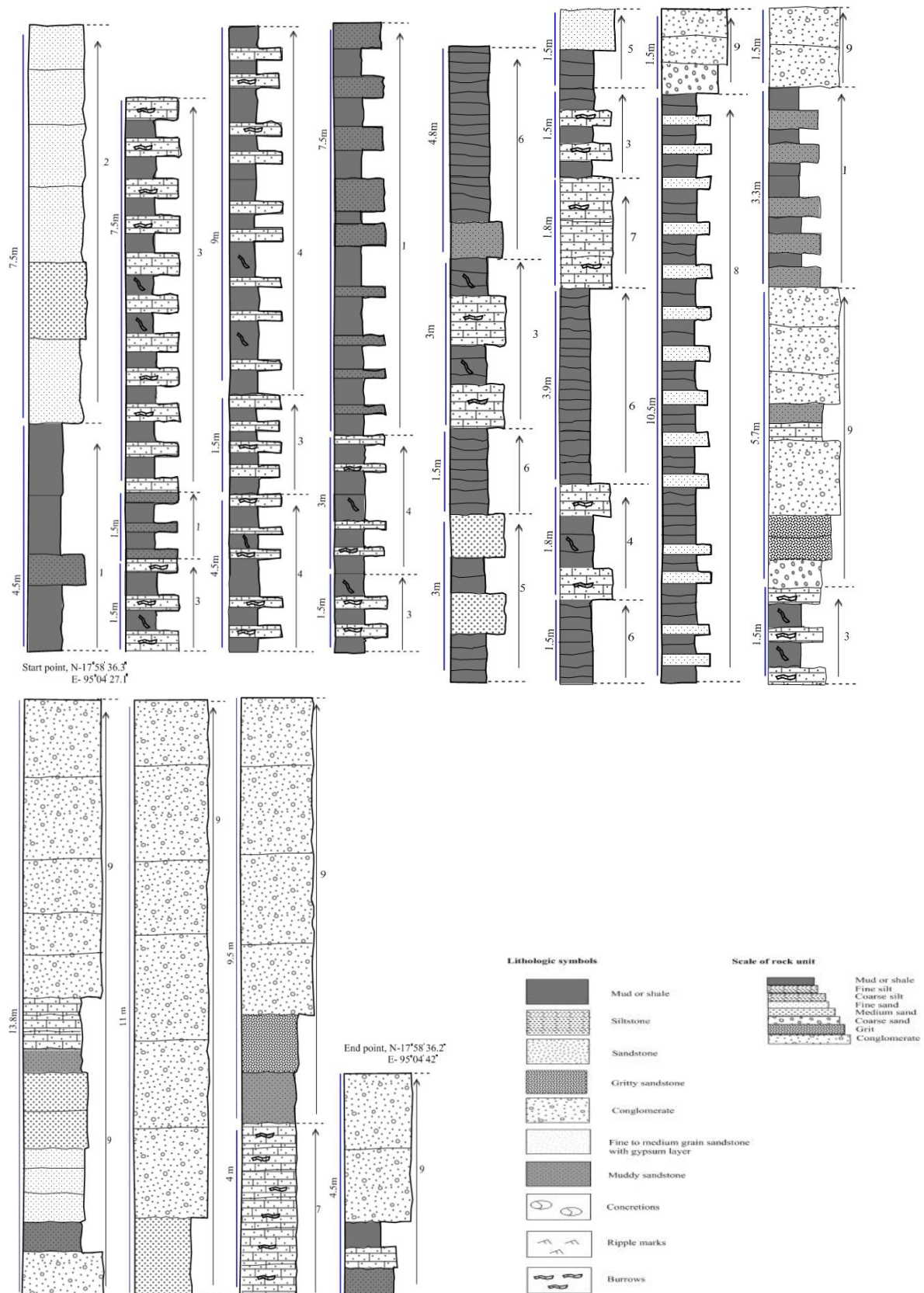


Figure (3). Columnar section for the Undifferentiated Molassic Unit along the Myodaung Chaung Section near Kanyin Dam area.

Lithofacies-1: Alternation of muddy sand and mud shale facies

Description

Thin to medium bedded muddy sandstone are intercalated within calc-slate (phyllite) or shale which are grey to bluish grey colored as lamination of clay and marl are formed in this facies. They consist of alternation thin to medium beds of fine sand or muddy sand, shale or siltstone (Figure 4).

Interpretation

They belong to lower flow regime and may be assigned to have been deposited in subaqueous levees, distributary bar deposits. The contacts are commonly sharp and non-erosional.

Lithofacies-2: Sandstone facies

Description

Fine- to medium-grained sandstone is grey colored, medium bedded, well-jointed. This facies is developed in fine- to medium-grained sandstone and it is characterized by the presence of horizontal laminations or bedding (Figure 5). The contact is sharp, either flat or slightly concave.

Interpretation

It may be interpreted to have been formed in lower and upper flow regime (Reineck & Singh, 1980). Deposition of the sandstone bed is believed to be the product of a turbidity underflow- a slurry of sand laden muddy water which behaves as a heavy liquid and which is capable of flowing beneath clear water. These materials, originally deposited in shallow water are dislodged by a slump and the turbidity flow generated moves downslope for long distances into relatively deepwater (Pettijohn, 1984).

Lithofacies-3: Alternation with calc-slate (phyllite), shale or muddy sand and sandy limestone or limy sandstone facies

Description

Thin to medium bedded, fine grain sandy limestone and thinly bedded, grey to bluish grey colored calc-slate (phyllite), shale or muddy sand are alternation. This facies is found together with abundant burrows and mud clasts (Figure 6, 7&8).

Interpretation

This facies is inferred to indicate a nutrient-rich, sediment-starved, low-energy environment with low rates of sedimentation, representing a marine deepening event that marks the top of a sand body and the sand supply (Mellere, 1994). The land-ward transition to finer grained deposits overlying this facies also supports this interpretation and may reflect a transitional, wide, marine-influenced mouth of an estuary (Reineck, 1972; Reineck and Singh, 1980; Hettinger et al., 1992). The close association of the bioturbated sand and mud intercalations along with sandy limestone band suggest tidal environment. Burrows structures in the lower part of this facies indicate that these were deposited to the lee of swash tidal bars.

Lithofacies-4: Intercalation with sandy limestone (limy sand) and calc-slate (phyllite) or shale facies

Description

Thinly bedded, dark grey to yellowish grey colored sandy limestone or limy sandstone are intercalated within the thin to medium bedded calc-slate (phyllite) or shale with little quartz. It is occurred about 9m thick and in some place 3m thick.

Interpretation

This facies is similar to the Lithofacies-3. Thinly bedded sandy limestone and thin bedded shale are intercalation each other which is indicated that the mixed intertidal flats.

Lithofacies-5: Alternation of calc-slate (phyllite) or shale with fine to medium grain sandstone facies

Description

Medium to thin bedded, fine- to medium-grained sandstone are alternation with thin to medium bedded, light grey colored, fine to medium grain, well-jointed weathering of calc-slate (phyllite) or shale (Figure 9).

Interpretation

The genesis of this facies requires conditions where the deposition and preservation of both sand and mud are possible (Reineck & Singh, 1980). This facies may be assigned to have been deposited in environments of subaqueous levee deposits of delta. This facies may also be interpreted to have been deposited in prodelta and distributary channel.



Figure (4)



Figure (5)



Figure (7)



Figure (6)



Figure (8)



Figure (9)

- Figure (4) Exposure nature of the Undifferentiated Molassic Unit in MyodaungChaung near Kanyin Dam.
- Figure (5) Thinly lamination, yellowish brown colored sandstone and grey colored sand mud of Undifferentiated Molassic Unit in MyodaungChaung near Kanyin Dam
- Figure (6) Sandstone and shale interbedded unit of Undifferentiated Molassic Unit exposed in below southwestern part of Nankathu Dam Spill Way.
- Figure (7) Horizontal burrow on the bedding plane surface below southwestern part of Nankathu Dam Spill Way.
- Figure (8) Vertical burrow at the wall of outcrop, below southwestern part of Nankathu Dam Spill Way.
- Figure (9) Calc-slate (phyllite) or shale with thin-bedded sandstone facies of Undifferentiated Molassic Unit in the KyeinChaung near Nankathu Dam area.

Lithofacies-6: Thinly bedded calc-slate (phyllite) or shale facies**Description**

Thinly bedded, very fine-grained, bluish grey colored calc-slate, calc-phyllite or shale with clay and marls are found. In this facies, internally laminated silt and silty clay are present. Its contact is sharp and gradational.

Interpretation

This facies may also be interpreted to have been deposited in prodelta and distributary channel.

Lithofacies-7: Sandy limestone facies**Description**

It is mainly composed of medium bedded, medium- to coarse-grained sandy limestone (limy sandstone) with quartz veins.

Interpretation

This facies is similar to the Lithofacies-3. The close association of the bioturbated sand and mud intercalations along with sandy limestone band suggests tidal environment (Reinson, 1992; Hettinger et al., 1992; Rossetti, 1998).

Lithofacies-8: Intercalated fine sand within calc-slate (phyllite) or shale facies**Description**

Thin to medium bedded and thinly bedded fine-grained sandstone are intercalated within the grey to bluish grey colored calc-slate (phyllite) or shale.

Interpretation

They belong to lower flow regime and may be assigned to have been deposited in subaqueous levees, distributary mouth bar deposits. The contacts are commonly sharp and non-erosional.

Lithofacies-9: Coarse-grained to gritty sandstone and mud pebble, polyolithic conglomerate facies**Description**

Thin layer of coarse-grained sandstone and gritty sandstone are occurred at the base. Medium to thick bedded grey colored, mud pebbles and quartz pebble, polyolithic conglomerate are found at the upper. In some places some layers of muddy sandstone and limy sandstone are found as intercalated.

Interpretation

In the gritty sandstone, sub-rounded to rounded gravelly clasts in a sandy matrix are simple in composition, sorted and faintly imbricated. It is assigned to have deposited in distributary mouth bar and channel fill.

In mud pebble intraformational polyolithic conglomerate, clasts also show faint imbrications and are set in a sandy matrix. It may be interpreted as the base of distributary channel deposits or lag deposits (Reading, 1996). Intraformational mud pebble layers can be interpreted as the axial portion of estuary bay or inter-estuary channel areas (Mellere, 1994; Emery & Myers, 1996).

Lithofacies associations of Undifferentiated Molassic Unit

Four Lithofacies associations are determined in Undifferentiated Molassic Unit.

Lithofacies association - I

Lithofacies association- I consists of Lithofacies -1, 2 & 6.

According to the composition of lithofacies-1, belong to lower flow regime and may be assigned to have been deposited in subaqueous levees, distributary bar deposits.

According to composition of lithofacies -2, originally deposited in shallow water are dislodged by a slump and the turbidity flow generated moves downslope for long distances into relatively deepwater (Pettijohn, 1984).

According to the composition of lithofacies -6, may also be interpreted to have been deposited in prodelta and distributary channel.

Lithofacies association - II

Lithofacies association- II consists of Lithofacies-3,4& 7. According to the composition of lithofacies -3,4& 7, the depositional environment of this lithofacies association -II may be interpreted as subaqueous levees are the submarine ridges bordering the distributary channel, formed in response to broadening and shoaling of the channel. Locally combined current and wave action produce complex type of cross-bedding (Reineck& Singh,1980). The presents of burrows in (Facies, 3,4,7) point out the characteristic features of subaqueous levees.

Lithofacies association - III

Facies association - III is made up of Lithofacies - 5 & 8. The genesis of lithofacies -5 requires conditions where the deposition and preservation of both sand and mud are possible (Reineck& Singh, 1980). This facies may be assigned to have been deposited in environments of subaqueous levee deposits of delta, interpreted as prodelta and distributary channel.

Lithofacies- 8 may belong to lower flow regime (Reineck& Singh, 1980) and may be assigned to have been deposited in subaqueous levees, distributary mouth bar deposits.

Lithofacies association - IV

Facies association - IV contains lithofacies-9. According to composition of this facies, the depositional environment is may be interpreted as follow.

More tectonic uplift caused the sea to retreat one final time and between 16 and 5 million years ago (during the Serravallian, Tortonian and Messinian/Pontian ages), the basin was in a continental facies again. The fluviatile sands and clays and fan conglomerates of this time form the Upper Freshwater Molasse, the topmost molasse formation. Around 5 million years ago a phase of uplift occurred in the Alps. During this phase the Molasse basin caused to be an area of net sedimentation. (http://en.wikipedia.org/wiki/Molasse_basin)

Proximal or inner- fan channel fill is mainly composed of conglomerate, pebble sandstone facies and thick bedded to massive sandstone with minor thin interlayer of siltyshales, calcareous siltstones and bioclastic wackestone (Kyaw Lin Oo, 2002). So, paleodepositional condition is proximal or inner fan channel environment. A brief description of the nine different lithofacies is shown in table (2).

PALEOENVIRONMENTAL CONDITION

Thin to medium bedded and thinly bedded fine-grained sandstone are intercalated within the grey to bluish grey colored calc-slate (phyllite) or shale. They belong to lower flow regime (Reineck & Singh, 1980) and may be assigned to have been deposited in subaqueous levees, distributary bar deposits lower and upper flow regime. Low-energy environment with low rates of sedimentation wide, marine-influenced mouth of an estuary, distributary mouth bar deposits, tidal channel fill, prodelta and distributary channel, estuary bay or inter-estuary channel areas.

The close association of the bioturbated sand and mud intercalations along with a coralline sandy limestone band suggest tidal environment (Reinson, 1992; Hettinger et al., 1992; Rossetti, 1998).

Intraformational mud pebble layers can be interpreted as the axial portion of estuary bay or inter-estuary channel areas (Mellere, 1994; Emery and Myers, 1996). Facies descriptive features and depositional environmental interpretation is shown in table (3).

Table (2) Brief descriptions of nine different lithofacies in Undifferentiated Molassic Unit

Lithofacies	Occurrences	Total thickness	Lithology	Primary structures
1	Base -4.5m 13.5- 15m 42.0 – 49.5m 94.0 – 97.3m	16.8m	Muddy sand and mud shale alternation	Lamination clay and marls
2	4.5 – 12.0m	7.5m	Fine to medium-grained sandstone	Medium bedded and medium to thick bedded
3	12.0 – 13.5m 15.0 – 22.5m 27.0 – 28.5m 37.5 – 39.0m 54.0 – 57.0m 70.8 – 72.3m 86.8 – 88.3m	18.0m	Calc-slate (phyllite) and sandy limestone or limy sandstone (alternation)	Thin to medium bedded and thinly bedded or lamination
4	22.5 – 27.0m 28.5 – 37.5m 39.0 – 42.0m 63.3 – 65.1m	18.3m	(Intercalation) sandy limestone or limy sandstone and calc-slate (phyllite) or shale	Thinly bedded and thin to medium bedded
5	49.5 – 52.5m 72.3 – 74.8m	4.5m	Fine to medium-grained sandstone and calc-slate (phyllite) or shale	Thin to medium bedded
6	52.5 – 54.0m	11.7m	Calc-slate (phyllite)	Thinly bedded or

Lithofacies	Occurrences	Total thickness	Lithology	Primary structures
	57.0 – 61.8m 61.8 – 63.3m 65.1 – 69.0m		or shale	lamination
7	69.0 – 70.8m 123.6–27.6m	5.8m	Sandy limestone	Medium bedded
8	74.8 – 85.3m	10.5m	Fine-sand and calc-slate (phyllite) or shale intercalated	Thin to medium bedded and thinly bedded
9	85.3 – 86.8m 88.3 – 94.0m 97.3 – 98.8m 98.8–112.6m 112.6–23.6m 127.6–37.1m 137.1–42.0m	46.5m	Coarse-grained to gritty sand, mud pebble conglomerate	Thin layers and medium to thick bedded mud pebbles poly lithic conglomerate

Table (3) Facies descriptive features and depositional environmental interpretation of Undifferentiated Molassic Unit

Facies No.	Facies	Facies Characteristics	Possible Depositional Environmental setting
1.	Alternation of muddy sand and mud shale facies	Intercalated and alternation of sand and shale (siltstone) lamination or clay and marl.	(Subaqueous levees, distributary bar) Shallow marine
2.	Fine to medium-grained sandstone facies	Fine to medium grain sandstone is medium-bedded (horizontal lamination or bedding)	Shallow marine
3.	Alternation with calc-slate (phyllite) and sandy limestone (limy sandstone) facies	Sandy limestone and thinly bedded calc-slate (phyllite) are alternation. Bioturbated sand and mud intercalations along with sandy limestone band.	(tidal reworking) Lower Freshwater
4.	Intercalation with sandy limestone (limy sand) and calc-slate (phyllite) or shale	Thinly bedded sandy limestone and thinly bedded shale are intercalation each other.	Mixed-intertidal flats, Lower Freshwater

facies

- | | | | |
|----|--|--|--|
| 5. | Alternation of calc-slate (phyllite) or shale with sandstone facies | Alternation with sand and mud (shale) | (intertidal)
Shallow marine |
| 6. | Thinly-bedded calc-slate (phyllite) or shale facies | Thinly-bedded calc-slate (phyllite) or shale. Laminated silt and silty clay are present. | (Prodelta & distributary channel), Shallow marine |
| 7. | Sandy limestone facies | Close association of the bioturbated sand and mud intercalations along with sandy limestone band. | (tidal reworking)
Lower Freshwater |
| 8. | Intercalated fine sand within calc-slate (phyllite) or shale facies | Thin to medium bedded and thinly bedded fine-grained sandstone are intercalated within the calc-slate (phyllite) or shale. They belong to lower flow regime | (intertidal)
(Subaqueous levees, distributary bar)
Shallow marine |
| 9. | Coarse-grained to gritty sandstone and mud pebble, polyolithic conglomerate facies | -Gritty sandstone, sub-rounded to rounded gravelly clasts in a sandy matrix are simple in composition, sorted and faintly imbricated

-Mud pebble intraformational polyolithic conglomerate, clasts also show faint imbrications and are set in a sandy matrix | Distributary mouth bar, channel fill, distributary channel

Upper Freshwater/continental |

Conclusion

The study area is lying on the eastern foot part of the Rakhine Yoma which is the southeastern portion of the Western Ranges (Indo-Burman Ranges). The aim of the present study is to conduct the sedimentology and depositional environment of Undifferentiated Molassic Unit. The undifferentiated molassic unit is distributed along the middle part of Kyein Chaung and Thèbyu Chaung, middle portion of Myodung Chaung. It consists of sandstone bearing vertical and horizontal burrows, shale and mudstone.

Petrographically, the sandstone of Undifferentiated Molassic Unit is named as “lithic wacke” and “lithic greywacke”. The Undifferentiated Molassic Unit contains nine lithofacies that can be grouped into four facies associations. According to these facies associations, the depositional environment of Undifferentiated Molassic Unit is interpreted as shallow marine prodelta and tidal environment.

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Surface Deformation Structures of the Sagaing Dextral Shear Zone, West of Mingun, Myanmar

Kaung Sithu¹, Saw Ngwe Khaing²

Abstract

The Sagaing Fault is a continental transform fault that separates the Burma Plate and Asia plate, parallel to the plate boundary and has significant major tectonic structure of Southeast Asia. This area is located in the 12 km north of Sagaing, west of Mingun. Earthquake history along the fault trace and fault valley indicate that the area is unlocking segment. This paper attempts to interpret the surface deformation structures along the fault zone by the integration of various methods such as geological, geomorphological and satellite image interpretations. Structural features are developed in different crustal level that structures indicate the ductile, brittle-ductile and brittle deformation pattern. Older deformation structures are mostly observed at the eastern part of the main fault trace and their maximum shear stress ranged from NE in direction. The later deformation structures nearly NS in direction are mostly related to the Dextral shearing of Sagaing Fault. Right lateral motion of the Sagaing Fault at right steeping features can be well explained by presence of subsidence zone, normal faults and pull apart basin development.

Key Words: Sagaing Fault, dextral shear, deformation structures

Introduction

The study area is located about 12 km from north of Sagaing and 4 km west of Mingun (Figure 1). The fault system is younger, initiated probably in late Oligocene or Miocene (Curry, 2005). The present work aims to interpret the geomorphic features and surface deformation structures along the strike slip fault system. The first description and nomenclature of the Sagaing Fault was named by Win Shwe (1970). He mapped a major right lateral Strike Slip Fault between Sagaing and Yelamaw Village for a distance of 36 miles and described it differentiate from Shan Scarp Fault. Hla Maung (1987) suggested that the Sagaing Fault formed as one of a series of block faults downthrown into the Middle Triassic rift. Myint Thein et al., (1991) conducted geological mapping along the Sagaing Fault from south of Mandalay to Tagaung during 1980s and proposed a 203 km of total displacement and rate of motion along the fault at 20mm yr⁻¹.

Khin Maung Latt (1991) proposed a Megasequence Tectonic model for the region between the Sagaing and Shan Scarp fault Area. Thura Aung (2005) suggested that the Sagaing Fault Zone between Pyu and Wundwin area that exhibits sequential deformation of structural features: semi-brittle deformation and brittle deformation. Tsutsumi & Sato (2009) investigated along the southernmost 120 km long stretch of the fault zone that ruptured during the M 7.3 1930 Pegu (Bago) earthquake. Wang et al., (2011) investigate at an ancient fortress wall of Payagyi, Bago Region in southern Myanmar reveal an offset of ~ 6m across the Sagaing Fault. Saw Ngwe Khaing (2014) investigated the Geomorphology, Structural Geology, and Paleoseismology of Sagaing fault between Singu and Wundwin area.

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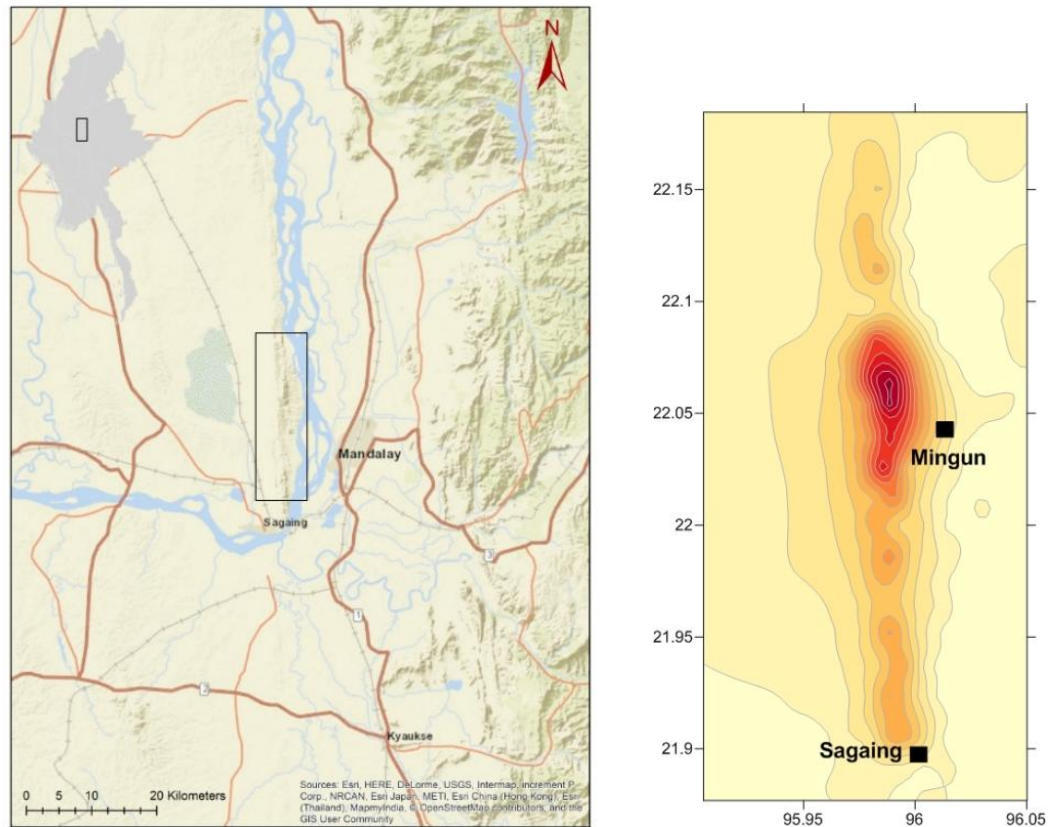


Figure (1) Location map of the Study Area

Methods of Study

Before the field investigation, study of satellite imagery and literature survey are known to the important previous works and tectonic setting of the area. Geomorphic investigations and fault traces were based on both of the Satellite Imagery from Google Earth Pro, latest version and the field survey along the fault zone whereas used SRTM and Aster GDEM imagery for regional tectonic features. In the field, ground data are direct plotting on the printed georeference satellite map and also focused the current landforms and fault trace. Deformation structures along the fault zone are carefully measured to understand the kinematic of active fault. For software uses, there were applied Surfer 12 for contour and 3D surface mapping whereas Orient used for structural data plotting.

Topography and Drainage

Average elevation ranges from 73 m to 158 and topographic trends are nearly NS direction (Figure 2). The Central part of area is mountainous terrain area whereas eastern and western of the area is low lying terrain region mainly covered by Tertiary deposits. The eastern part and western part of the area is partly covered by the Alluvial Fan. The eastern part of the area is floodplains associated with Ayeyarwaddy River. Most of the drainage system follows the dendritic pattern.

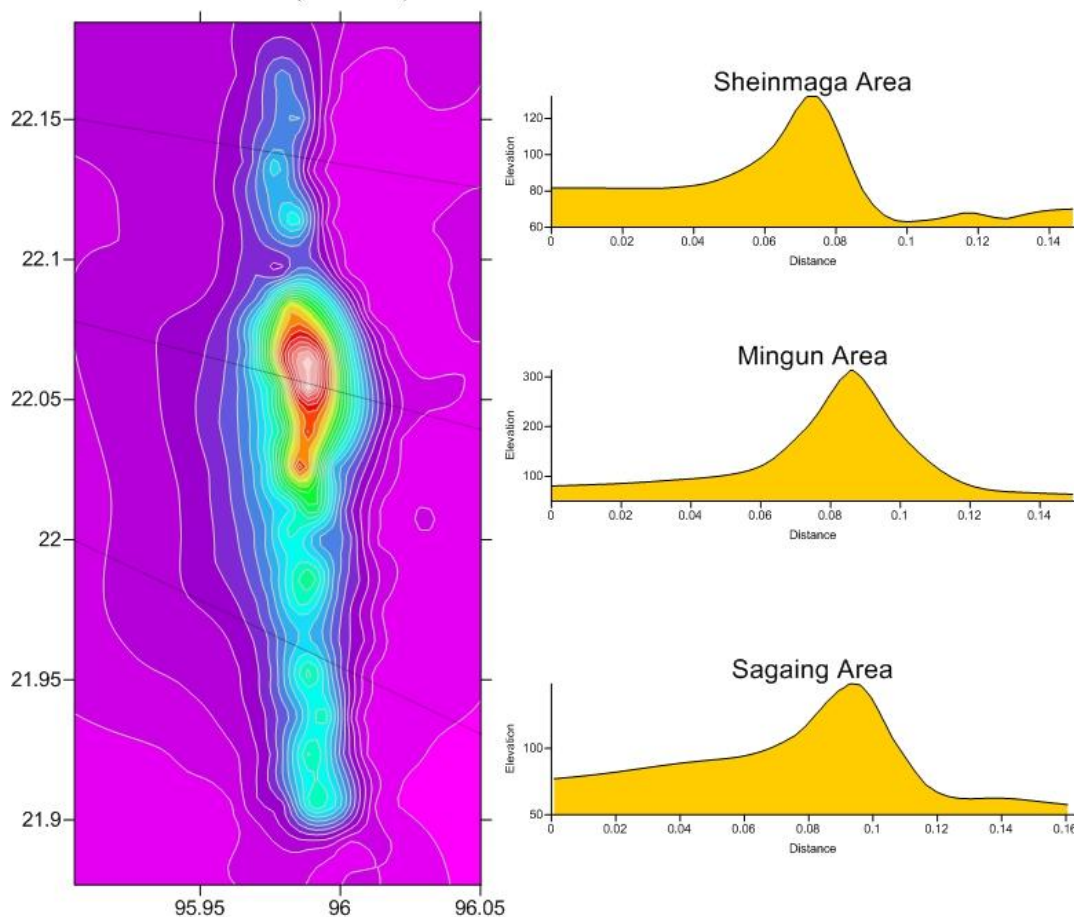


Figure (2) Generate Contour Map and Elevation Profile of the Area

Geomorphology of Strike Slip Fault Zone

Zones of Major Strike-slip tectonics are characterized by active seismicity on strike parallel (Philip A. Allen and John R. Allen 2005). Focal mechanism solutions in strike-slip zones are commonly highly variable, with mixtures of strike-slip, extension, and compression (Taymaz et al. 1991). Oversteps are important in determining the subsidence region location and uplift along the strike slip fault. Right lateral motion of Sagaing Fault at right steeping features can interpret characterized by subsidence zone, pull apart basin development, 4km north of Yega Inn (figure 4) and triangular facets along the Fault (Figure 2). The next surface depression of the area is mainly characterized by Yega Inn that is result from a step-over to the right .

Deformation Structures

The plate convergence between India and Asia during Eocene-Oligocene set up E-W compressional forces and resulting in N-S extension especially in the west of Sedagyi-Myogyi area (Khin Maung Latt, 1991). During Oligocene to Mid Miocene, these plate convergence has been changed to a hyperoblique nature and consequently, the stress situation slightly changed and NNW-SSE extension prevailed (Bertrand et al, 2001; GIAC, 2002). Sagaing Fault displacement has been estimated: 300 km by Mitchell (1976) based on the poorly known regional geology of northern Myanmar, and 460 km by Curray et al (1979) on the basis of spreading rate (3.72cm/yr) of the opening of Central Andaman Basin since Late Miocene time (see also Myint Thien, 1991).



Figure (3) Triangular Facets, 4 km north of Yega Inn (Photo looking – East)

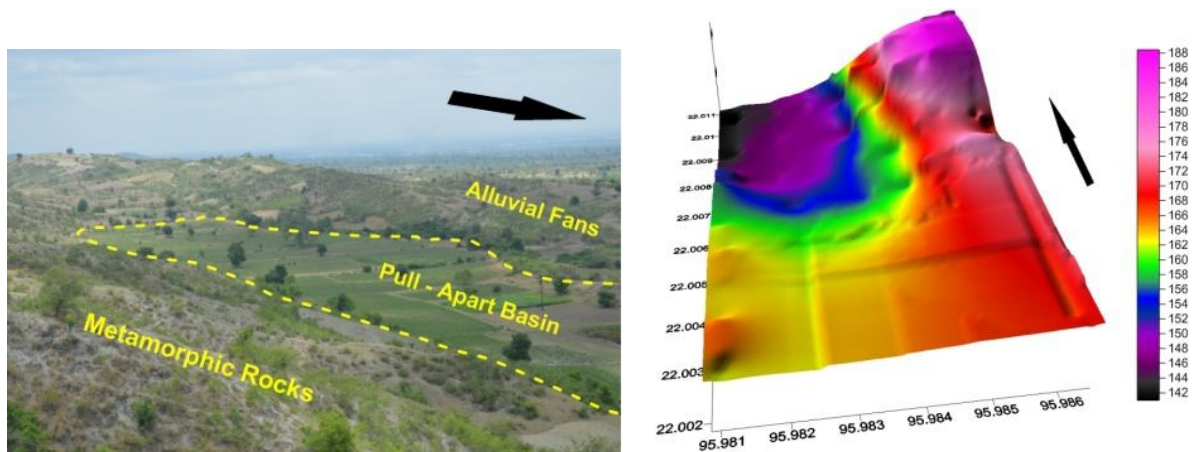


Figure (4) Pull-apart Basin (left) and its 3D Surface (right), 4km north of Yega Inn

Dinstinctive structural features along the Sagaing Fault, between Pyu and Wundwin area, related to the progressive deformation processes suggest that the two deformation types, brittle amd semibrittle, are taking place (Thura Aung, 2005). The laminated Limestone unit along the fault, from Sagaing to Tigyaung, is decorated with structures formed by compressional, ductile, extensional, brittle-ductile and brittle deformations (Myint Thien, 2011). The structural deforamtion behaviours between Singu and Wundwin area indicates that the rocks are deformaed into three different behavviors, semi-brittle, brittle ductile and brittle behaviors (Saw Ngwe Khaing 2014).

The structural deforamtion of the area normally indicates the ductile, brittle-ductile and brittle deformations behaviors. The development of metamorphic rock foliations in area is affected by ductile flow. Shear bands indicate the high shear strain that crosscut the foliation within the main shear zone (Figure 8c). These S-C fabrics may be useful for shear sense indicator of the area under ductile shear zone. Coarse porphyroclasts are commoly observed in the banded gneiss. Sigma type porphyroclast in these gneissic rocks indicate the dextral shear (Figure 8a). That wing formation indicates the deformation at low temperature and high strain rates (Passchier, 1994).

Brittle-Ductile deformation patterns are well characterized by boundins, rock fractures and porphyroclasts in the area (Figure 6c, 7a). This deformation types are well obseved at the eastern part of main fault trace especially in stream section. Abundant minor structures, numerous E-W cross cut veins and rock fractures are main brittle-ductile deformation structures in the area (Figure 6b, 7b, 7c). Z shaped drag folding, pinch-and-swell structure and mionor displacement structures of the area may be representative the shear sense that reflects the dextral simple shear zone (Figure 6a). The sagaing fault related brittle deformation structures are well developed along the fault zone. This deformation structures include the nearly N-S trending minor faulting, reverse faulting and jointing (Figure b). Because of the later deformation, older structures and E-W crosscutting veins are displacement parallel to sagaing dextral shear zone. The joint patterns along the fault mostly suggest the NNW – SSE compressional features (Figure 5).

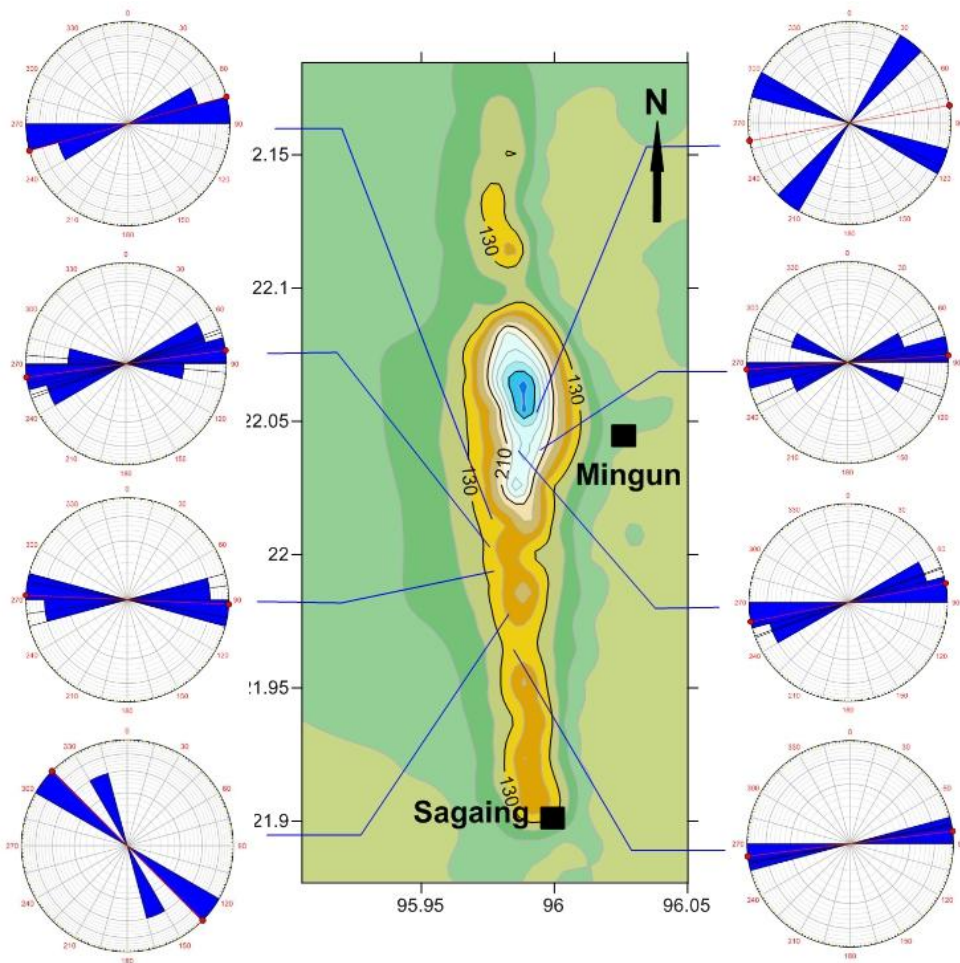


Figure (5) Strike Rose Diagrams along the western and eastern part of the Sagaing Ridge

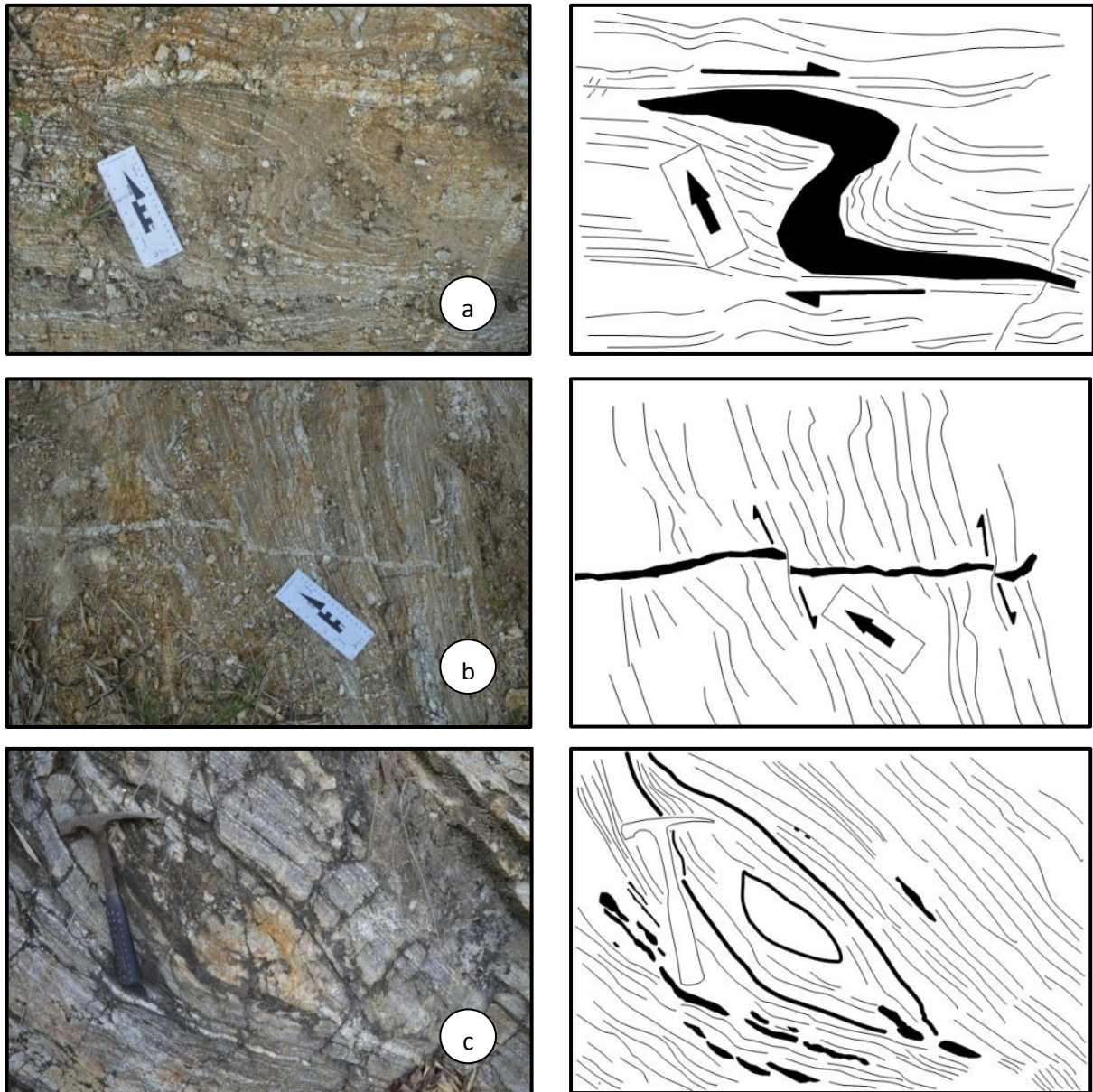


Figure (6) Surface deformation structures from 1.68 km west of Mingun (a) Z Shaped Drag Fold that form result from clockwise internal rotation and reflects the right-handed shear, Arrow at North, Plan View, N 22° 02' 37.8" E 96° 00' 01.6" (b) Right lateral minor displacement (1.2 cm), Vein Trend 115°, Arrow at North, Plan View, N 22° 02' 39.1" E 96° 00' 00.9". (c) Boudinage Structure, Foliation Plane is 61° inclination and dipping toward 55°, Photo Looking 182°, N 22° 02' 40.5" E 95° 59' 57.3".

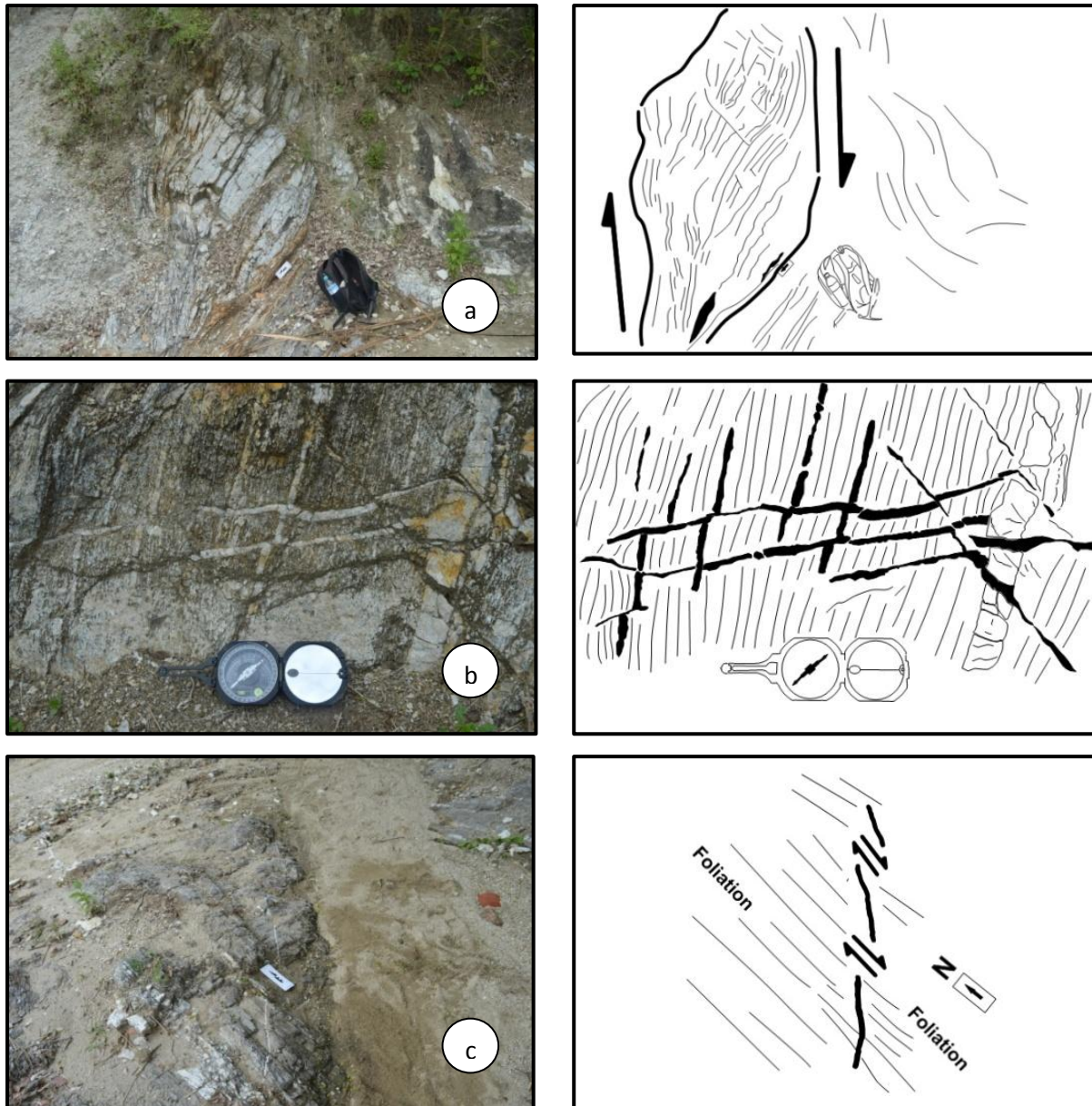


Figure (7) Brittle-Ductile Deformation structures (a) Layer parallel shearing structure, Photo Looking, North. (b) E-W cross cut vein in steeply dipping metamorphic rock, Photo Looking, North. (c) Minor Vein Displacement (Vein trend 30°), that minor displacement structures may be representative of the shear sense that reflects the dextral simple shear zone and related to Sagaing Dextral Shear, Vein Thickness – 0.8- 1cm, Arrow at North, Photo looking NE, N 22° 02' 04.8" E 95° 59' 44.9".

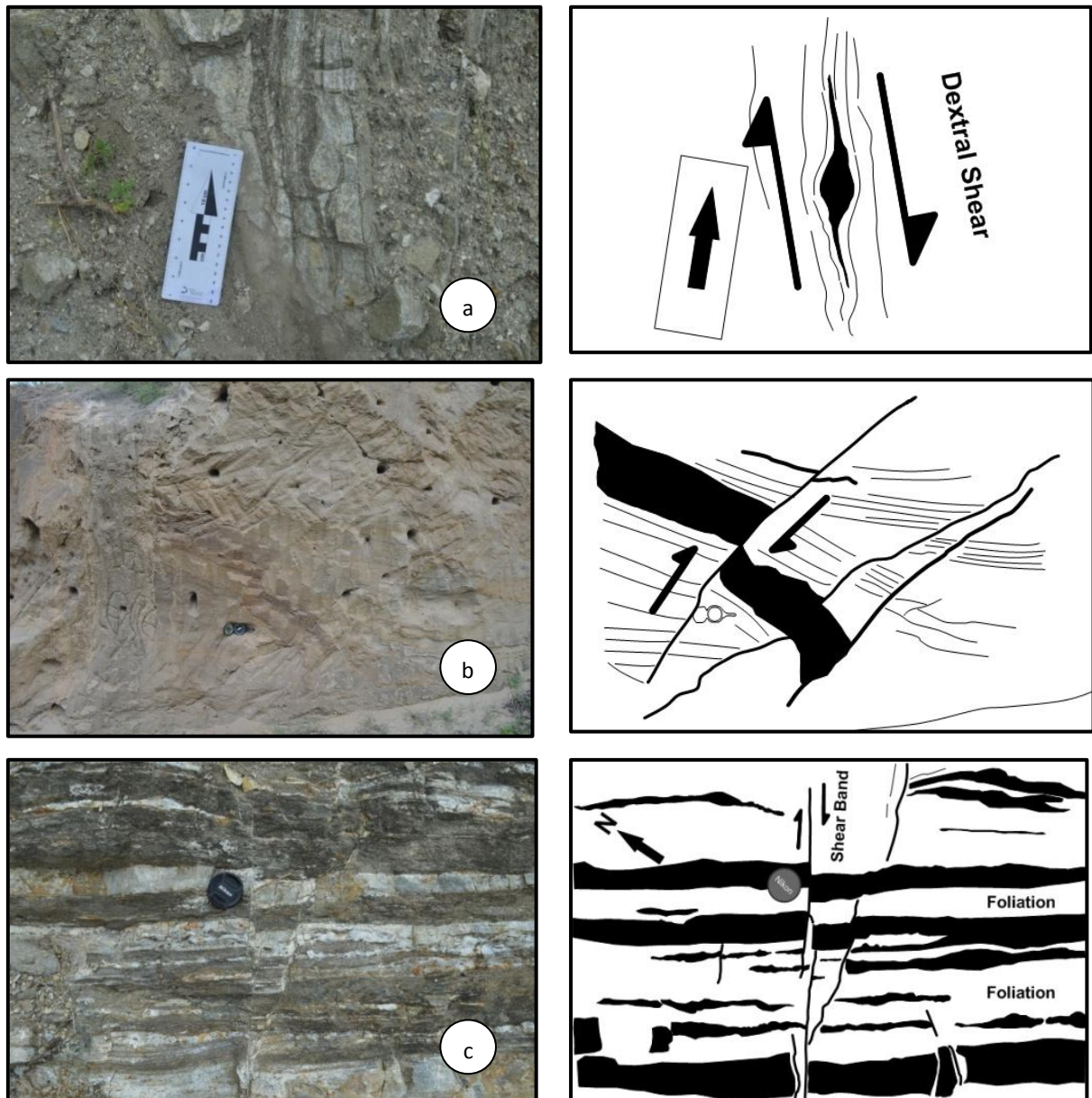


Figure (8) (a) Shear sense indicator, Sigma type porphyroclast in these gneissic rocks indicate the dextral shear, Photo Looking, N. (b) Reverse fault indicate the horizontal compressive stress of the area, Photo Looking, NW, N 22° 02' 42.2" E 96° 00' 16.1". (c) Mionr Conjugate Fault with Small shear bands, Photo looking NE, Plan View, N 22° 02' 08.2" E 95° 59' 56.7".

Conclusion

The steep dipping of the metamorphic rock, foliation and their deformation structure may be directly related to the India-Asia Collision during the Eocene-Oligocene time. Older deformation structures are mostly observed at the eastern part of the main fault trace with slightly stress changes and their maximum shear stress ranged from NE in direction. The later deformation structures nearly NS in direction are closely related to the Dextral shearing of Sagaing Fault. The surface structure deformation of the area can be concluded as; first N-S extension with ductile flow under ductile deformation, second is progressively deformed under brittle-ductile condition and later Sagaing fault related brittle deformation pattern.

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We would like to express our sincere gratitude to Dr Nyunt phay, Rector of Patheingyi University, for his encouragement for this manuscript. Special thanks also go to Professor Dr. Thet Naing, Head of Department of Geology, Patheingyi University, for her kind review and valuable suggestion of this work. We are also indebted to the editors of the Patheingyi University Research Journal, for their critical reading that greatly helped in improving the draft manuscript. Finally, but not least, we are very grateful to our colleagues in the Department of Geology, Patheingyi University, for their kindness and help while preparing this manuscript.

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A Study on the Status of Mud Crab Fisheries in Mon and Taninthayi Coastal Areas

Nyunt Sandar Aung¹

Abstract

The status of mud crab fisheries was studied at Mon coastal areas (Belukyune, Setse, Tarokpi, Kalegauk, Kaudut and Zeephyuthaung) and Taninthayi (Myeik) from June 2012 to April 2015. Five types of gears are used for crab fisheries in the study areas. Among those, collapsible crab traps were the most effective gear type in catching mud crabs and are commonly used in Myeik area. Catch weight, catch per unit effort (CPUE), using number of boats and fishermen were higher in Myeik than Mon coastal areas. In Mon coastal areas, Zeephyuthaung station is using in high number of boats and fishermen which is more than those of other areas. The rate of production, fluctuations and status of normal trade in Mon area were also noticed in yearly. The productions rate with related to exported amount exhibit a downward trend in 2012. The production rate of crabs in Myeik area was declined in 2013-2014 and thereafter 2014- 2015, the production rate was increased.

Key words: mud crab fisheries, gears, catch weight, catch per unit effort (CPUE), production.

Introduction

Mon and Taninthayi Coast is situated at the southern most part of Myanmar and have the long coastline more than thousand kilometers. The regions provide many mangroves and coastal habitats, and also serve as the breeding sites and the development of shrimps, prawns, crabs and fish culture. Many species of mollusks, crustaceans and fishes etc. are rich in the mangrove areas. Crab fishery is one of the most valuable products in coastal area. In Mon and Myeik coastal area, the crab fisheries and processing were conducted for commercial scale. The crab fisheries in Myeik have been developing since 1996. All sectors involved in the fishery, such as boat and gear manufacturing shrimp processing, distribution and marketing, which greatly enhanced the production. The coastal fishery is permitted to catch within 10.61 km from the shore.

The mud crab fishing in Mon coastal areas, are conducted with simple gear designs and by the local anglers. The craft used in mud crab fishery is generally a small wooden boat, 6-7 m long operated by at least two persons. Mud crab fishery takes place mainly in the intertidal zone along the coastline such as seashores, estuaries, lagoons and riverbanks of mangrove and coastal areas. To capture berried female crabs, should have to know the knowledge of their migration route. Most of the female crabs swam out to the sea to breed. Generally female crabs with developing gonads are more expensive than males.

Mud crab *Scylla serrata* is an important fishery product in Myanmar and Indo-Pacific region. Mud crab *Scylla serrata* has been subjected to increase exploitation during recent years. It is regarded as evaluable commodity, with high quality meat content (Le Vay, 2001). The crabs are freshly consumed by the local people and deep frozen or Hamburg, after boiling, fiesh picked and packed are exported. Some crabs are good in export market price with limit on the body size. Mud crabs are highly appreciated in wide range of dishes in China. It is an economically important species of mangrove areas and normally found in coastal regions. Crabs are exported to Singapore and China by road. Since mud crab must

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arrive alive at their final destination, the trading network should be well organized. Economically important crabs are caught for exported production and local foods.

So, continued pressure on the species could lead to ultimate extinction. For proper conservation and management of mud crab, a proper knowledge on its biology is crucial. Conflict arises between utilization of the resources to earn a living and conservation practices as sustainable use for future generation. Mud crab stocks and population may also be affected by water quality and loss of habitat due to coastal development. As mangrove forest are valuable biologically and economically, there is a need for stock management in some mud crabs fisheries, especially in collection of juveniles and mature crabs.

The mangrove mud crabs *Scylla* spp. is the largest crabs belonging to the phylum Arthropoda under order Decapoda. They are also commonly called serrated swimming crabs or giant mud crab or edible crab. They include in the family Portunidae and are also the largest one in Portunids. They are black crabs of body fun-shaped, the carapace are smooth, with sharp teeth of about equal size at the fronto-lateral broader of the carapace. The claws of the male are very large. They are almost either entirely black or grayish green or purplish brown in colour. They have a gonochoristic (having male and female individuals in the same population) nature and most of the life cycle is spent in inshore waters especially estuaries; the female crabs migrate offshore with the fertilized eggs attached to the pleopods, where they hatch in a few weeks (Hill, 1996). The females can give birth to a million offsprings. The present study has been undertaken emphasizing the mud crab *Scylla* spp. fisheries to reveal commercial catch status in Mon and Tanintharyi regions; and to analyze the relative performances of the different gears and fishing methods in the study areas.

Materials and Methods

The present study was carried out along the mangrove areas of Mon and Taninthayi coast within the period from June 2012 to April 2015. In Mon coastal area, all of the six study sites including Belukyun (Sabelar) (Lat. 16° 14'N, Long. 97° 32' E), Setse (Lat. 15° 54'N, Long. 97° 35' E), Tarokpi (Lat. 15° 55'N, Long. 97° 34' E), Kaudut (Lat. 16° 29'N, Long. 97° 23' E), Kalegawk (Lat. 15° 31'N, Long. 97° 51' E), Zeephyuthaung (Lat. 15° 11'N, Long. 97° 47' E) were conducted and in Taninthayi (Myeik) (Lat. 12° 26'N, Long. 98° 30' E) were selected to carry out to estimate the catch weight. The locations of study areas were shown in Fig1.

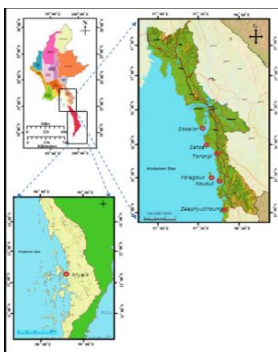


Fig 1. Map showing the species collecting sites: Belukyune (Sabelar); Setse; Tarokpi; Kaudut; Kalegawk; Zeephyuthaung and Myeik.

In each field work, included collection of data on total catches, catches by species, measurement of length and weight of sub-sampled crabs were recorded. Both interviewing and surveying work of it had been carried out from local fishermen. Types of gear, measurements of length width, depth of the respective gear types were recorded. The fishing methods were also recorded and were presented with respective photographs.

Monthly sample collection (watching and collecting from the study mangrove areas) in each station was carried out. Monthly catch data of *Scylla* spp. in Mon and Myeik were collected from the fish depots and local fishermen. Number of boats and crews operated in mud crabs fisheries were also recorded. For production data, this work was carried out with the help of DoF (Mon and Myeik) and estimated amount of those were recorded from 2012 to 2015. Catch per unit effort (CPUE) was computed the total catch weight kg per month of crabs to total number of boats participated in the activities in that month. This is estimated amount and these would be variations from months after month due to weather condition and other physical factors in the study areas.

Result

Craft and gear used in crab fisheries

The study sites in Mon (Belukyun, Setse, Tarokpi, Kaudut, Kalegauk, Zeephyuthaung) and Myeik, mud crab fishing is carried out with simple gear designs and by the local anglers. The fishermen's choice of gear for operation in different areas and different seasons depends on the nature of the catch and to a large extent, on their financial condition. Five types of gears are used in the study areas such as matted bamboo basket trap (Bone), crab lift net (Yo ban), Long line (Myartann), Fishing hook ('Kunn'), and Collapsible crab trap. Trap used for mud crab catching is made of a steel frame and nylon nets. It has rectangular shape. Trap methods are commonly used by local fisherman in Mon and Myeik Areas. The dimension of trap have 1.75 length; inches, width; 11 inches and height; 5.5 inches. Thin ropes were tied to the frame and a float is attached to the other end of rope. Fish meat is preferred to be used as bait. The pieces of bait are tied to the net inside the trap. Trap is set in creeks near the edge of water. Mud crabs would be attracted by the bait and enters the trap. Crabs are then successfully collected when the trap was pulled out of the water while the crabs are concentrated in browsing the meat. Each trap collected two mud crab or at least one mud crab. According to fishermen mentioned that crab catch is more effective while tide rises during spring tides. Fishing hooks and other design are also used but rare in number. Gears used in crab fisheries were showed in (Fig.2).

Catch weight (kg) and catch per unit effort (CPUE kg/boat)

The catch weight (kg) of crabs were recorded monthly with the help of local fishermen in respective study areas and catch per unit effort CPUE value was estimated by the total weight of crab caught per month of total numbers of boats operating in the catch. Catch weight (kg) and catch per unit effort (CPUE kg/boat) of *Scylla* spp. from study areas of Mon and Myeik were showed in (Table 1, Table 2 and Fig.3).

In mud crab *Scylla* spp. fisheries, the number of boats and fishermen were higher in Myeik area which was one of the major crabs landing center in Myanmar. The follower after Myeik area was Zeephyuthaung which is one of the major crab landing sites in Mon coastal area. Number of boats and fishermen operated in mud crab (*Scylla* spp) fisheries in respective study areas were presented in Table.3. In Belukyune, the catch weight was high in almost all month. Among them, the lowest weight was noted in April and the highest catch weight was found in December. In CPUE value for those two months were 19.23 kg/boat and 46.82 kg/boat respectively.

In Setse, the catch weight in each month approximately round 30 kg to 70 kg per month. Of these, the highest amount was found in July and the lowest amount was recorded in November. The CPUE values for those two months were 16.73 kg/boat and 7.73 kg/boat respectively.

In Tarokpi, the catch weight in each month approximately round 79 kg to 155 kg per month. Among them, the lowest weight was noted in January and the highest catch weight was found in October. In CPUE value for those two months were 2.65 kg/boat and 5.16 kg/boat respectively.

In Kalegaug, the catch weight in each month approximately round 59 kg to 188 kg per month. Of these, the highest amount was found in October and the lowest amount was recorded in June. The CPUE values for those two months were 6.27 kg/boat and 1.99 kg/boat respectively.

In Kaudut, the catch weight was high in almost all month. Among them, the lowest weight was noted in September and the highest catch weight was found in January. In CPUE value for those two months were 15.44 kg/boat and 37.13 kg/boat respectively.

In Zeephyuthaung, the catch weight in each month approximately round 2196 kg to 9230 kg per month. Of these, the highest amount was found in January and the lowest amount was recorded in July. The CPUE values for those two months were 87.08 kg/boat and 20.72 kg/boat respectively.

In Myeik, the catch weight in each month approximately round 90100 kg to 11200 kg per month. Of these, the highest amount was found in April and the lowest amount was recorded in September. The CPUE values for those two months were 153.61 kg/boat and 121.18 kg/boat respectively.

Production of crabs in study areas

Monthly production and exported weight of crabs by normal trade during 2012-2015 in Mon coastal area was presented in Table.4 and comparison of their year wise production and exported weight was shown in Fig.4.

According to data, in 2012-2013, crab production is moderately good in the year round (except August and May), with average amount round from 11 to 30 metric tons and approximately round over 10 metric tons every month. The export weight for those months were round 10 metric tons and total export weight of the crabs was approximately 180 metric tons (178.89 ton) during 2012-2013. (Fig.5)

In 2013-2014, the production rate decreased in the months of August, September and May accounted round 8 metric tons in those three months. In the rest months, the production rate was good round over 10 metric tons per month and with a total production rate of this year was round 130 metric tons (39.46 ton). The good export weight was found in the months from October 2013 to January 2014. In the other months, the exported tons were declined in numbers. (Fig.5)

In 2014-2015, except August and September, the production rate was good in all the rest months, accounted to round over 10 metric tons per month with total estimated amount of production in 2014-2015 was round 170 metric tons (174.32 tons). The exported rate was good in the months from October to April accounted from 10 to 20 metric tons. (Fig.5)

In the case of crabs production rate in Myeik, the rate was increased from 2012-2015 of the metric ton round from 1700 to 2400 with export value of from US\$ 6.6 to 7.5. Annual exported amount of crabs with related to value US\$ was shown in (Table.5 and Fig.6).

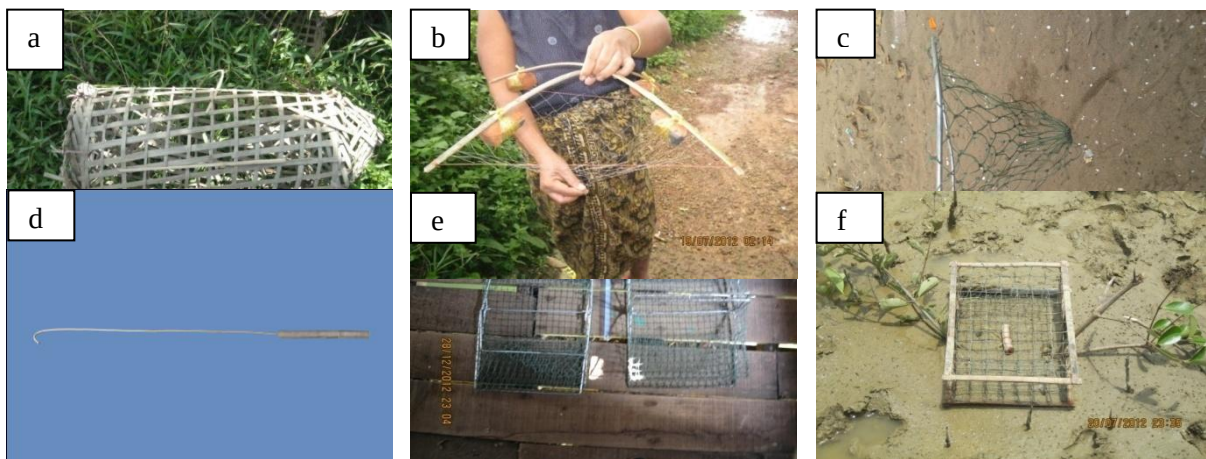


Fig.2.Fishing gears: a). Basket trap (bone); b). Crab net (yo ban); c). Long line (myar tann); d). Fishing hook; e). Steel collapsible crab trap; f).Bamboo trap with bait.

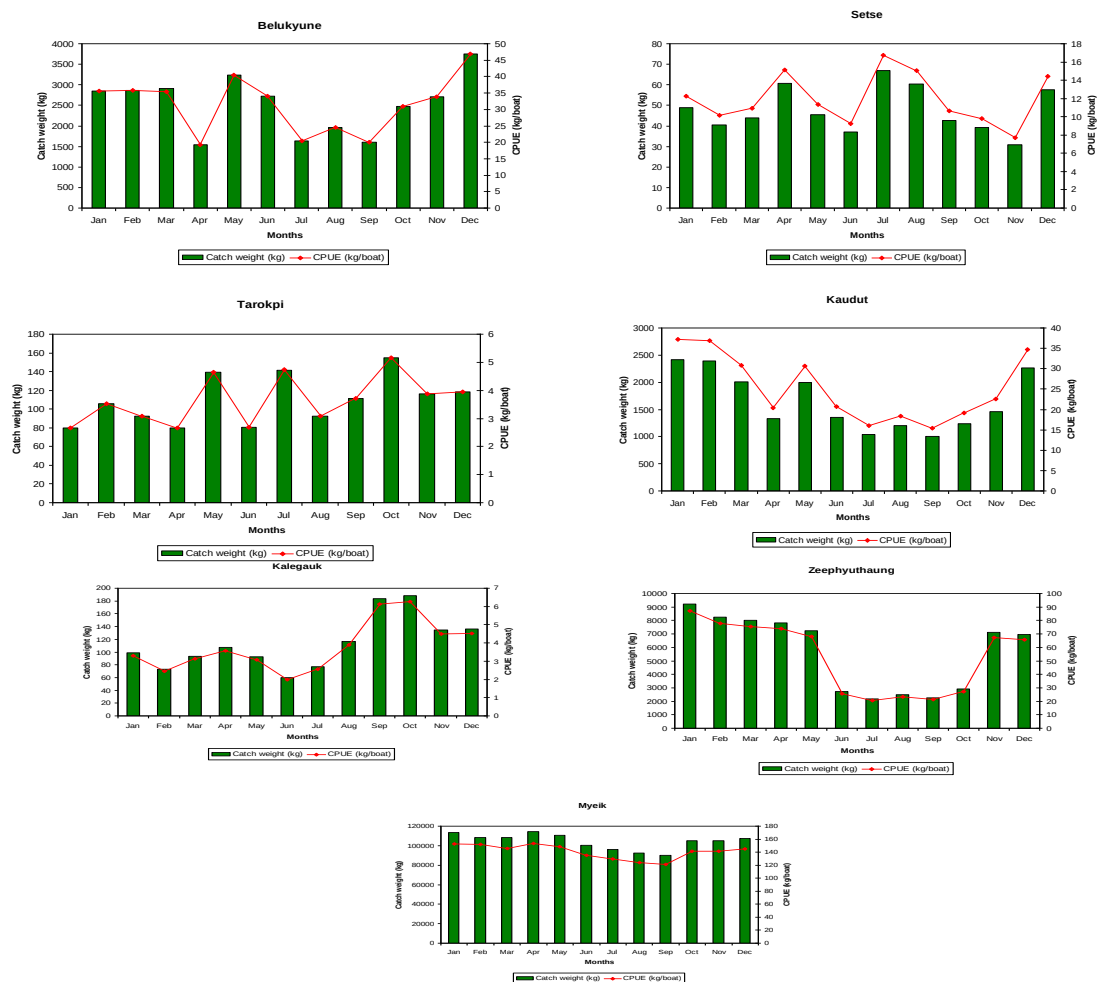


Fig 3. Catch weight (kg) and CPUE (kg/boat) of *Scylla* spp. in study areas.

Table 1. Catch weight of *Scylla* spp. in study areas.

Station	Catch weight (kg)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Belukyune	2855.2	2861.4	2909.2	1538.4	3233.2	2730.8	1640.6	1962.8	1599.6	2470.2	2714.6	3745.8	30261.8
Setse	48.9	40.5	43.8	60.6	45.3	36.9	66.9	60.3	42.6	39.3	30.9	57.6	573.6
Tarokpi	79.6	105.6	92.3	80	139.2	80.3	141.8	92.8	111.5	154.8	116.4	118.6	1312.9
Kaudut	2413.6	2397.2	2002.6	1326.8	1995.2	1348.6	1044.6	1196.8	1003.8	1240.6	1464.2	2259.2	19693.2
Kalegauk	99	73.2	93.6	107.2	92.4	59.6	77	116.8	183.6	188	135	136	1361.4
Zeephyutaung	9230.8	8243	8003.2	7817.4	7224.4	2717.4	2196.6	2481.6	2269.7	2902.8	7121.8	6954.6	67163.3
Myeik	113600	108400	108500	114200	110500	100500	96100	92300	90100	105200	105100	107600	1252100
Total	128327	122121	121645	125130	123230	107474	101268	98211.1	95310.8	112196	116683	120872	1372466

Table 2. Catch per unit effort (CPUE) of *Scylla* spp. in study areas

Station	CPUE (kg/boat)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Belukyune	35.69	35.768	36.365	19.23	40.415	34.135	20.508	24.535	19.995	30.878	33.933	46.823	378.275
Setse	12.23	10.13	10.95	15.15	11.33	9.23	16.73	15.08	10.65	9.83	7.73	14.4	143.44
Tarokpi	2.65	3.52	3.08	2.67	4.64	2.68	4.73	3.09	3.72	5.16	3.88	3.95	43.77
Kaudut	37.13	36.88	30.81	20.41	30.7	20.75	16.07	18.41	15.44	19.09	22.53	34.76	302.98
Kalegauk	3.3	2.44	3.12	3.57	3.08	1.99	2.57	3.89	6.12	6.27	4.5	4.53	45.38
Zeephyutaung	87.08	77.76	75.5	73.75	68.15	25.64	20.72	23.41	21.41	27.38	67.19	65.61	633.6
Myeik	152.73	151.65	145.96	153.61	148.61	135.21	129.24	124.06	121.18	141.17	141.37	144.66	1689.45
Total	330.81	318.148	305.785	288.39	306.925	229.635	210.568	212.475	198.515	239.778	281.133	314.733	3236.9

Table 3. Number of boats and fishers of catching *Scylla* spp. in the study areas.

Stations	No. of Boat	No. of fishers
Sabelar	80	240
Setse	4	8
Tarokpi	30	60
Kaudut	65	195
Kalegauk	20	60
Zeephyutaung	106	424
Myeik	1488	5952
Total	1793	6939



Fig 4. Yearwise production and export (tons) of crabs in Mon State

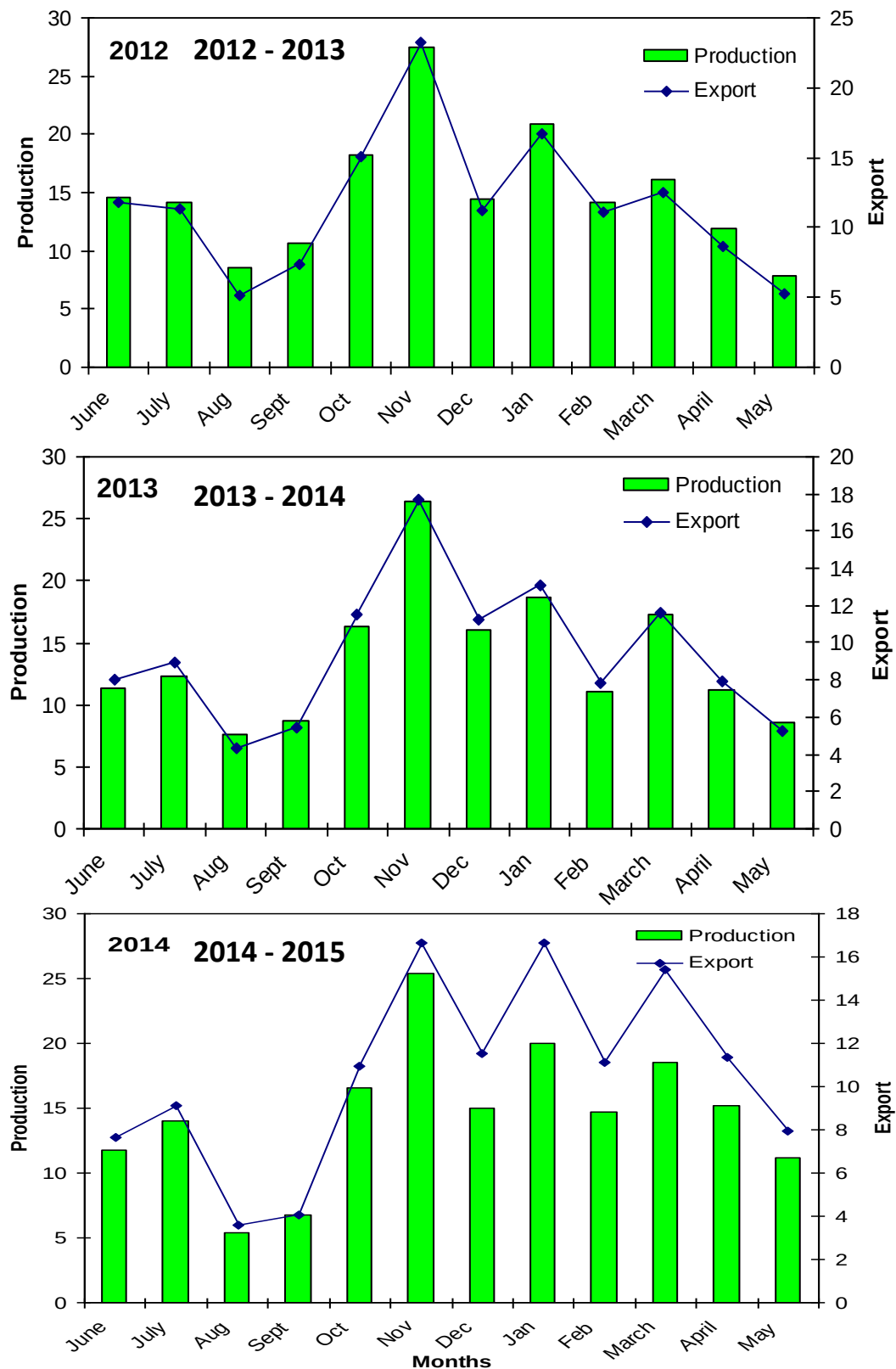


Fig 5. Crab production and export by normal trade in Mon State (2012-2015)

Table 4. Monthly production and export (ton) of crabs in Mon State

Months	2012-13		2013-14		2014-15	
	Production	Export	Production	Export	Production	Export
June	14.59	11.76	11.37	8.06	11.74	7.66
July	14.11	11.39	12.27	8.96	13.98	9.13
Aug	8.57	5.17	7.61	4.29	5.37	3.6
Sept	10.65	7.41	8.74	5.43	6.74	4.06
Oct	18.27	15.11	16.33	11.48	16.55	10.93
Nov	27.43	23.19	26.41	17.71	25.35	16.65
Dec	14.38	11.23	15.97	11.21	14.96	11.53
Jan	20.93	16.67	18.73	13.11	19.98	16.66
Feb	14.1	11.14	11.12	7.8	14.71	11.14
March	16.07	12.45	17.23	11.61	18.57	15.4
April	11.96	8.65	11.23	7.91	15.15	11.36
May	7.83	5.29	8.55	5.23	11.22	7.96
Total	178.89	139.46	165.56	112.8	174.32	126.08

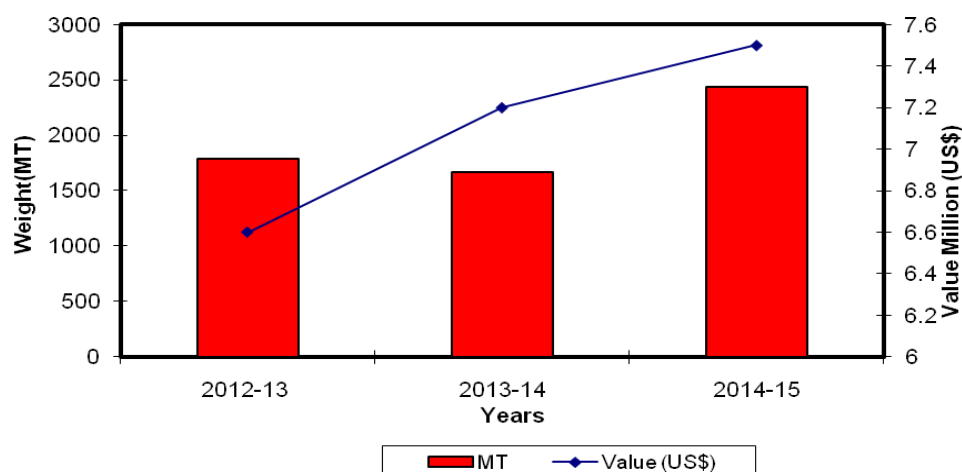


Fig. 6. Yearly exported weight of crabs and values of crabs from Myeik coastal area

Table 5. Yearly exported weight of crabs and values of crabs from Myeik coastal area.

	MT	Value Million (US\$)
2012-13	1790.14	6.6
2013-14	1666.58	7.3
2014-15	2439.40	7.5

Discussion and conclusion

The mud crab fisheries from the seven stations along the Mon and Myeik coastal areas have been carried out for four year period. Crab fisheries in study areas were generally artisanal ones and it stands in low levels of technology and equally is as traditional fisheries and making short fishing trips close to shore mainly for local consumption and possibly for export. Artisanal fishing boats used in crabs catching were usually smaller than 10 meters in length and practiced by two to four fishermen, operated near shore along the coast line. Most fishing boats were motorized. Numbers of boats and fishermen utilized in performing of *Scylla* spp. in Myeik areas were more than half of the total numbers of boat used in Mon coastal areas. In Mon coastal areas, numbers of boats and fishermen utilized in Zeephyuthaung was more than those of other study areas. In relation to catch weight and fishing effort, in Belukyune area, the catch weight and CPUE value were high in December. In Setse area, the catch weight and CPUE value were high in July, In Tarokpi and Kalegauk the highest catch weight and CPUE value were noticed in October that of in Zeephyuthaung was noted in January. In Kaudut, the catch and CPUE were high in almost all months.

Generally, the decline in CPUE indicates declining stock. Normally the increase in fishing effort measured as fishing boats during within the same periods (Warui, 2014). Regarding the crab production and normal trade in Mon areas, fluctuations have noticed in the crab landing year by year. Productions rate with related to exported amount exhibit a downward trend in 2012. In Myeik area, the production rate declined in 2013 and 2014. Thereafter, it increased in 2014 and 2015 during the study period of 2013-2015. These fluctuation occurred is due to fishery independent factors such as salinity, temperature and current and also fishery dependent factors such as rate of exploitation, season of exploitation and size of exploitation in study areas.

Mud crab from Mon and Myeik areas provide very good economic gains for local people. Occasionally, local people caught large number of mud crab because these crabs inhabited shallow estuaries which were easily accessible at low tide without a boat. So, the conservation and management work has to be needed for sustainable uses. According to the results, crabs particular commercially important species play an important role and stands parallel as fin fish in the aspect of notational economy and contributions as good earner to local people and export market. Therefore the conservation programme of it, educational talk etc., should be worked out for substainable utilization.

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Diversity and Similarity of the Intertidal Polychaetes around the Dawei Point

Hlaing Hlaing Htoon¹

Abstract

A total of 31 species of polychaete belonging to 23 genera and 21 families were identified from six studied sites around the Dawei Point; Kanetthiri, Sinphyubyin and Panyishuang from Thayetchaung Township; and Kyaukmatat, Kyaukwutpyin and Kampani from Launelone township (Between Lat. 13° 51'N -14° 05'N and long. 98° 15'E - 98° 05'E) within the period of 2013-2015. The species similarity index values showed the similarities of polychaetes structure of study areas were poor, most of the similarities were more than 30% of similarity value. The physical factors that control the community structure, such as slope and grain size were correlated with polychaetes density. Among the studied areas, the most diverse species was observed at Kampani. Polychaete species occurred more in soft substrate flat than on hard substrate. It is difficult to say that the present condition has been natural phenomenon and it has been changed due to human impact because there was no previous study describing the species-wise abundance, diversity indices and community structure.

Key words: Diversity of polychaetes, Dawei Point, Kanetthiri, Kampani, Kyaukmatat, Kyaukwutpyin, Panyishuang, Similarity, Sinphyubyin.

Introduction

Marine habitats frequently have more different phyla but fewer species than terrestrial habitats, i.e., higher taxonomic diversity but lower species diversity (Ormond 1996). The ocean is the home to 29 animal phyla, of which 14 are exclusively marine (Grassle 2001). Apart from the micro-organisms, about 98% of all species known to exist in oceans and coastal waters belong to the benthos (Peres 1982). Benthic ecosystem is the least known ecosystem on earth, because of its immensity and inaccessibility.

Being the dominant group, diversity indices were worked out separately for polychaetes. Diversity indices were also important in considering the entire fauna as specific groups. Three different terms of diversity indices with different ecological importance were used. They were species richness, species evenness and species diversity. The species richness (Margalef's index) is used to estimate the total number of species in a given area. The more the number of species, in a sample or the more species present in a species list of a given environment, the greater will be the species richness. The term evenness is used for the numerical percentage of composition. High evenness occurs, when the species present are virtually in equal abundance, which, is conventionally equated with high diversity. The less numerically equal the species are, the less diverse the sample is or, conversely, the greater dominance in the fauna (Sanders 1968). The term species diversity is used for the number of species per number of individuals. The highest species diversity is possible when only one individual represents every species and the lowest diversity possible is when community consists of only one species (Soetaert and Heip 1990). Species diversity measurements are often more informative than species counts alone because they take into account two factors, species richness and evenness (Magurran 1988).

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The present study was conducted to determine the distribution and abundance of the soft bottom polychaetes around the Dawei Point. Estimation of benthic abundance is necessary for the assessment of demersal fishery resources as benthos form an important source of food for demersal fishes. Macrobenthos has been extensively used for pollution studies. Polychaetes also accounted for most of the diversity and abundance of the in fauna communities at the sandy site, but were less numerically important at the muddy site.

According to the feeding habit, benthic animals are categorized as suspension feeders, selective deposit feeders, non-selective deposit feeders, predators, scavengers and grazers. Benthic production is of importance in assessing the biological productivity of an area. It is well recognized that the distribution and abundance of benthic animals of a region is directly related to the fisheries of that region. Coastal waters support a wide variety of marine organisms valued as food. The concept of indicator species is of great importance in biological monitoring and benthic invertebrates are recognized as useful tools. Ideally, indicator organisms are those species that have narrow and specific environmental tolerances.

The objectives of the present study were: 1) to reveal what kinds of polychaetes are abundance along the Dawei point, 2) to provide a general account of species composition of communities, 3) to find out number of species, diversity indices between communities, and 4) to establish baseline data for future benthic study.

Materials and Methods

Diversity and similarity of the polychaetes has been conducted on exposed soft sediment site, intertidal zones at selected locations along the coastal areas of Dawei Point, Dawei District during low tides. Data was subjected to statistical for making inferences depending on the species abundance. The species diversity was estimated bimonthly from June 2013 to March 2015. Three diversity indices were calculated for each Station and then similarity between Stations for polychaetes species were calculated using Chord distance (CRD) index formula and Jaccard similarity index.

Species diversity

Species diversity was determined the number of individuals of each species in the study areas. Species diversity (H') was calculated according to formula of Shannon and Weaver (1963).

$$H' = -\sum p_i \ln p_i$$

Where: p_i is the proportional abundance of the i^{th} species (n/N)

n is the number of individuals of the i^{th} species

N is the total number of individuals in a sample.

Species evenness

Species evenness (E') was measured the relative abundance of the various population present in the ecosystem. The calculated formula for the evenness (E') (Pielou 1966) is:

$$E' = H' / \ln S$$

Where: S is the number of species

Species richness

Richness used to measure the number of different species present in an ecosystem. Species richness index D' (Margalef 1968) was applied.

Species richness (D') are

$$D' = S - 1 / \ln N$$

Where: S is the number of species

N is the total number of individuals in a sample.

Dominance Index

The Dominance Index (D) of Soyer (1970) is used to calculate the abundance of species. The formula is as follow:

$$D = n \times 100 / N$$

Where, n = the total number of individuals of given species

N = the total number of individuals

Similarity index

To make comparisons between the Stations, similarity coefficients were calculated by using Chord distance (CRD) index formula (Legendre and Legendre, 1983) (Cited from Ludwig and Reynold, 1990). The calculation is based on number of species and species wise quantity.

$$CRD_{jk} = \sqrt{2(1 - c \cos_{jk})}$$

Where the Chord Cosine (CCOS) is computed from

$$CCOS_{jk} = \frac{\sum (X_{ij} X_{ik})}{\sqrt{\sum X_{ij}^2 \sum X_{ik}^2}}$$

The following matrix notation is used in this equation presented below:

X_{ij} = the abundance of the i^{th} species in the j^{th} SU

X_{jk} = the abundance of the i^{th} species in the k^{th} SU

The Jaccard's similarity index (JI) was used to identify potential similarities between communities (Southwood, 1978 as cited in Shamsudin 1996).

Jaccard's similarity index (JI)

$$JI = j / (a + b - j)$$

j = the number of species in common between two sites

a = the number of species in site A

b = the number of species in site B.

Results

The diversity indices of intertidal polychaetes for each different study areas, species diversity (H'), evenness (E') and richness (D') were calculated by using the formula of Shannon and Weaver (1963), Pielou (1966) and Margalef (1968). In analyzing and comparing the diversity indices of intertidal polychaetes in six different study areas, the resulted values were variable and indicating that many species occurred at different study areas, with number of species varied from one study area to another. The highest species diversity value (2.62) was observed in Kampani area, and the lowest species diversity value (1.83), recorded in Kanetthiri area. The highest evenness index value (0.88) was observed in Kanetthiri area and the lowest evenness index value (0.77), recorded in Kyaukmatat, Kyaukwutpyin, Sinphyupyin and Panyishau study areas. Species richness value of (6.16) was the highest value in Kampani while (2.33) was the lowest value in Kanetthiri study areas.

Species dominance index of polychaetes for the six different study areas were calculated by using the formula of Dominance Index (D) of Soyer (1970). The highest dominance index value for *Diopatra sp.*, *Glycera sp* and *Nereis spp* were found in Kanetthiri study area and also the maximum dominance index value for *Notomastus spp*, *Bogoea sp.* and *Nephtys sp.2* occurred in Kyaukwutpyin. Moreover, *Lumbrinereis spp* were observed in

Kanetthiri with the highest value. *Scalibregma* sp, was just only found in Pangyishaung and *Spiophanes* sp occurred in Kyaukwutpyin in the present study.

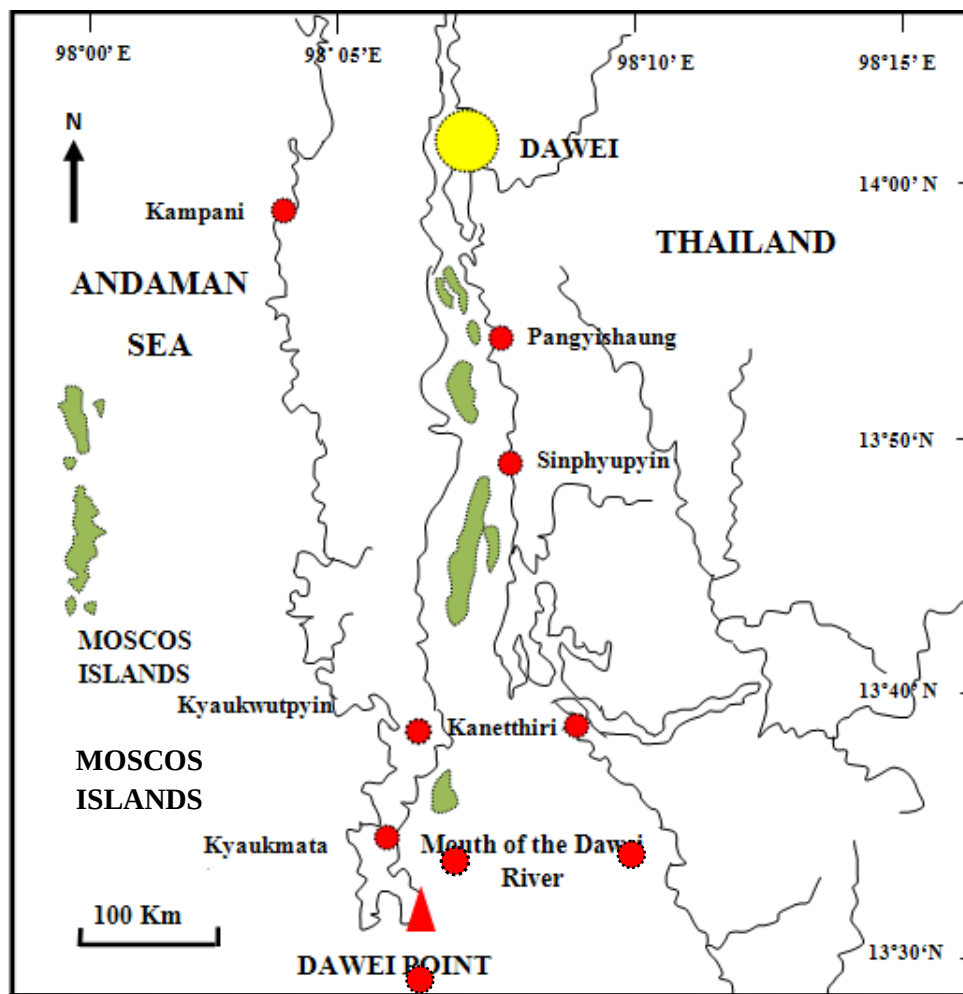


Fig. 1. Map showing the study areas, Kanetthiri, Kyaukmata, Kyaukwutpyin, Sinphyuypin, Pangyishaung, and Kampani around the Dawei Point.

1.1. Monthly variations of three diversity index of intertidal polychaetes at Kanetthiri

Table 1 gives the results of monthly variation of intertidal polychaetes diversity of Kanetthiri from June (2013) to May (2015) in the present study. There were nine species in this Station.

As regards observation for diversity, in 2013, December had the highest diversity (2) during the studied period. The second largest number was found in June with 1.98. Then come with October, July and September (1.9 for the first one, 1.84 for the second one, and 1.78 for the last one). The lowest diversity value was found in August with 1.75. For evenness (E'), the maximum value occurred in December with 0.96 and the lowest value was found in November (0.76). In species richness (D'), the highest value was observed in December (2.30) and the lowest value occurred in June (1.88).

In 2014, as can be seen from the table, April has the highest number with the diversity index 1.94. After that the number gradually decreased in the following months; May and June (1.84 for the first one and 1.75 for the last one). The lowest diversity value was found in March (1.1) in the present study. For evenness (E'), the maximum value occurred in January and April (0.93) and the lowest value was found in March (0.53). In species richness (D'), the highest value was observed in March (6.37) and the lowest value occurred in April (1.88).

In 2015, as can be seen from the table, April was the highest number with the diversity index 3.66. After that the number gradually decreased in the following months; February and March with (1.64 for the first one and 1.09 for the last one). For evenness (E'), the maximum value also occurred in April with 1.76 and the lowest value was found in March (0.52). In species richness (D'), the highest value was observed in March (2.65) and the lowest value occurred in May (1.94).

1.2. Monthly variations of three diversity index of intertidal polychaetes at Kyaukmatat

Table 2 gives the results of monthly variation of intertidal polychaetes diversity of Kanetthiri from June (2013) to May (2015) in the present study. There were eighteen species in this Station.

As can be seen from the table, in 2013, June and July had the highest diversity (2.30) during the studied period. The second largest number was found in October with 2.27. And followed by December (2.25), August (2.22) and September (2.13). The lowest diversity value was found in November (1.53) for the time being. For evenness (E'), the maximum value occurred in June and July (0.93) for each and the lowest value was found in November (0.62). In species richness (D'), the highest value was observed in August (3.67) and the lowest value occurred in November (2.86). In 2014, it is obvious that, August was the highest number with the diversity index 2.27 and October, April and June revealed with 2.25, 2.22 and 2.22 respectively. The lowest diversity value was found in March with 0.14 in the present study. For evenness (E'), the maximum value occurred in August and October with 0.91 and the lowest value was found in March (0.06). In species richness (D'), the highest value was observed in February (3.74) and the lowest value occurred in September (2.86).

In 2015, as can be seen from the table, March was the highest number with the diversity index 2.11. However, the second largest number was found in February with 2.05 and followed by May with 1.93 in number for the time being. For evenness (E'), the maximum value also occurred in February with 0.83 and the lowest value was found in January (0.06). In species richness (D'), the highest value was observed in March (3.51) and the lowest value occurred in May (2.98).

1.3. Monthly variations of three diversity index of intertidal polychaetes at Kyaukwutpyin

Table 3 gives the results of monthly variation of intertidal polychaetes diversity of Kyaukwutpyin from June (2013) to May (2015) in the present study. There were twenty species in this Station.

Table 1 Monthly variations of three diversity index of intertidal polychaetes at Kanetthiri

Months	No. of species	Abundance	Diversity (H')	Evenness(E')	Richness(D')
Jun (2013)	8	41	1.98	0.93	1.88
Jul (2013)	8	39	1.84	0.88	1.91
Aug (2013)	6	36	1.75	0.84	1.95
Sept (2013)	7	34	1.78	0.86	1.99
Oct (2013)	7	35	1.9	0.91	1.97
Nov (2013)	5	39	1.59	0.76	1.91
Dec (2013)	8	21	2	0.96	2.30
Jan (2014)	8	14	1.93	0.93	2.65
Feb (2014)	7	19	1.84	0.89	2.38

Mar (2014)	3	3	1.1	0.53	6.37
Apr (2014)	8	41	1.94	0.93	1.88
May (2014)	8	39	1.84	0.88	1.91
Jun (2014)	6	36	1.75	0.84	1.95
Jul (2014)	7	34	1.78	0.86	1.99
Aug (2014)	7	35	1.9	0.91	1.97
Sept (2014)	5	39	1.59	0.76	1.91
Oct (2014)	8	21	2	0.96	2.30
Nov (2014)	8	14	1.93	0.93	2.65
Dec (2014)	5	17	1.56	0.75	2.47
Jan (2015)	5	17	1.6	0.77	2.47
Feb (2015)	7	17	1.64	0.79	2.47
Mar (2015)	4	14	1.09	0.52	2.65
Apr (2015)	7	27	3.66	1.76	2.12
May (2015)	8	37	1.93	0.93	1.94
Total		669	43.92	21.08	56.01
Average		27.875	1.83	0.88	2.33

As a result, in 2013, December had the highest diversity (2.39) during the study period. The second largest number was found in June and August with the value of 2.18. Then come with July and November (1.98, and 1.97). The lowest diversity value was found in October (1.71). For evenness (E'), the maximum value occurred in December (0.88) and the lowest value was found in October (0.63). In species richness (D'), the highest value was observed in October (4.16) and the lowest value occurred in June (3.03).

In 2014, as can be seen from the table, June was the highest number with the diversity index 2.39. After that the number gradually decreased in the following months; February and April with (2.33) then came January (2.32). The lowest diversity value was found in December (1.76) in the present study. For evenness (E'), the maximum value occurred in June (0.88) and the lowest value was found in December (0.65). In species richness (D'), the highest value was also observed in December (3.88) and the lowest value occurred in July (3.03).

In 2015, as can be seen from the table, April was the highest number with the diversity index 2.24. After that the number gradually decreased in the following months; February and March (1.96 for the first one and 1.68 for the last one). For evenness (E'), the maximum value occurred in April with 0.83 and the lowest value was found in March (0.62). In species richness (D'), the highest value was observed in March (4.16) and the lowest value occurred in January (3.41).

Table 2 Monthly variations of three diversity index of intertidal polychaetes at Kyaukmatat

Months	No. of species	Abundance	Diversity (H')	Evenness(E')	Richness(D')
Jun (2013)	12	40	2.30	0.93	2.98
Jul (2013)	12	39	2.30	0.93	3.00
Aug (2013)	11	20	2.22	0.9	3.67
Sept (2013)	10	29	2.13	0.86	3.27
Oct (2013)	12	35	2.27	0.91	3.09
Nov (2013)	5	47	1.53	0.62	2.86
Dec (2013)	11	30	2.25	0.91	3.23
Jan (2014)	11	33	2.20	0.89	3.15
Feb (2014)	7	19	1.76	0.71	3.74
Mar (2014)	8	22	0.14	0.06	3.56
Apr (2014)	11	20	2.22	0.9	3.67
May (2014)	10	29	2.13	0.86	3.27
Jun (2014)	11	20	2.22	0.9	3.67
Jul (2014)	10	29	2.13	0.86	3.27
Aug (2014)	12	35	2.27	0.91	3.09
Sept (2014)	5	47	1.53	0.62	2.86
Oct (2014)	11	30	2.25	0.91	3.23
Nov (2014)	11	33	2.20	0.89	3.15
Dec (2014)	8	27	1.87	0.75	3.34
Jan (2015)	7	19	0.15	0.06	3.74
Feb (2015)	9	32	2.05	0.83	3.17
Mar (2015)	10	23	2.11	0.85	3.51
Apr (2015)	9	24	1.91	0.77	3.46
May (2015)	9	40	1.93	0.78	2.98
Total		722	46.07	18.61	78.96
Average		30.083	1.92	0.78	3.29

1.4. Monthly variations of three diversity index of intertidal polychaetes at Sinphyupyin

Table 4 gives the results of monthly variation of intertidal polychaetes diversity of Sinphyupyin from June (2013) to May (2015) in the present study. There were twenty one species in this Station.

By monthly observation for diversity, in 2013, December has the highest diversity (2.49) during the studied period. The second largest number was found in November (2.24). Then come June, July and September (2.13, 2.18 and 2.1 respectively). The lowest diversity value was found in August (0.43) for the time being. For evenness (E'), the maximum value occurred in December (0.85) and the lowest value was found in August (0.15). In species richness (D'), the highest value was observed in August (7.02) and the lowest value occurred in November (3.74).

In 2014, as a result, the highest diversity index was found in January, May and November with the value of 2.72 for each. And the number gradually decreased in the following months; February and March (2.33 for the first one and 2.32 for the last one); moreover, June and July also have the value with 2.33 for the first one and 2.32 for the last one. The lowest diversity value was found in August with the value of 2.13 in the present study. For evenness (E'), the maximum value occurred in January, May and November (0.93) and the lowest value was found in August (0.72). In species richness (D'), the highest value was observed in December (5.66) and the lowest value occurred in January, May and November (4.07).

In 2015, as can be seen from the table, May was the highest number with the diversity index 2.59. Whereas, the second largest number was observed in March (2.37) and then come with January (2.35). For evenness (E'), the maximum value occurred in May with 0.88 and the lowest value was found in April (0.65). In species richness (D'), the highest value was observed in April (6.23) and the lowest value occurred in May (4.47).

1.5. Monthly variations of three diversity index of intertidal polychaetes at Pangyishaung

Table 5 gives the results of monthly variation of intertidal polychaetes diversity of Pangyishaung from June (2013) to May (2015) in the present study. There were twenty three species in this Station.

It is obvious that, in 2013, December was the highest diversity (2.52) during the studied period. The second largest number was found in November (2.46), then came June, July and October (2.34, 2.3, and 2.34, respectively). The lowest diversity value was found in September with the value of 1.66 in the present study. For evenness (E'), the maximum value occurred in December (0.81) and the lowest value was found in September (0.54). In species richness (D'), the highest value was observed in August (7.57) and the lowest value occurred in November (3.93).

In 2014, as can be seen from the table, the highest diversity index was found in March and November (2.94 for each). And the number gradually decreased in the following months; January and September (2.86 for each); likewise, February and October (2.8 for each). In June, July and August, the diversity index reveal with the value of 2.34, 2.46 and 2.52, respectively. The lowest diversity value was found in May (1.66) in the present study. For evenness (E'), the maximum value occurred in March and November (0.95) and the lowest value was found in May (0.54). In species richness (D'), the highest value was observed in April (7.57) and the lowest value occurred in July (3.93).

In 2015, as can be seen from the table, March was the highest number with the diversity index 2.46. Nevertheless, April revealed the second highest value (2.41) and followed by January (2.39). For evenness (E'), the maximum value occurred in March with 0.79 and the lowest value was found in February (0.66). In species richness (D'), the highest value was observed in April (6.45) and the lowest value occurred in January (5.15).

Table 3 Monthly variations of three diversity index of intertidal polychaetes at Kyaukwutpyin

Months	No. of species	Abundance	Diversity (H')	Evenness(E')	Richness(D')
Jun (2013)	12	102	2.18	0.8	3.03
Jul (2013)	12	92	1.98	0.73	3.10
Aug (2013)	11	51	2.18	0.81	3.56
Sept (2013)	10	40	1.92	0.71	3.80
Oct (2013)	8	29	1.71	0.63	4.16
Nov (2013)	8	94	1.97	0.73	3.08
Dec (2013)	13	86	2.39	0.88	3.14
Jan (2014)	13	63	2.32	0.86	3.38
Feb (2014)	12	60	2.33	0.86	3.42
Mar (2014)	12	60	2.25	0.83	3.42
Apr (2014)	12	60	2.33	0.86	3.42
May (2014)	12	60	2.25	0.83	3.42
Jun (2014)	13	86	2.39	0.88	3.14
Jul (2014)	12	102	2.18	0.8	3.03
Aug (2014)	12	92	1.98	0.73	3.10
Sept (2014)	8	94	1.97	0.73	3.08
Oct (2014)	11	51	2.18	0.81	3.56
Nov (2014)	10	40	1.92	0.71	3.80
Dec (2014)	8	37	1.76	0.65	3.88
Jan (2015)	12	61	2.19	0.81	3.41
Feb (2015)	8	35	1.96	0.72	3.94
Mar (2015)	8	29	1.68	0.62	4.16
Apr (2015)	11	35	2.24	0.83	3.94
May (2015)	9	38	2.08	0.77	3.85
Total		1497	50.34	18.59	83.79
Average		62.375	2.09	0.77	3.49

1.6. Monthly variations of three diversity index of intertidal polychaetes at Kampani

Table 6 gives the results of monthly variation of intertidal polychaetes diversity of Kampani from June (2013) to May (2015). By monthly observation for diversity, in 2013, July was the highest diversity (2.81) during the study period. The second largest number was found in June with 2.7, then came with August, October, December and November (2.55, 2.57, 2.63, and 2.54 respectively). The lowest diversity value was found in September with

2.31 for the time being. The maximum value of evenness occurred in July with 0.87 and the lowest value was found in September (0.72). The highest value of species richness was observed in September (7.88) and the lowest value was in November (5.28). In 2014, February and October have the highest number with the diversity index 3.05. and gradually decreased in the following months; February with 3.03 and November with 2.98; and gradually decreased in other months; April, July and August with (2.54, 2.5 and 2.63 respectively).

Table 4 Monthly variations of three diversity index of intertidal polychaetes at Sinphyupyin

Months	No. of species	Abundance	Diversity (H')	Evenness(E')	Richness(D')
Jun (2013)	10	33	2.13	0.72	5.15
Jul (2013)	11	31	2.18	0.74	5.24
Aug (2013)	2	13	0.43	0.15	7.02
Sept (2013)	9	22	2.1	0.71	5.82
Oct (2013)	10	42	2.08	0.71	4.82
Nov (2013)	12	123	2.24	0.76	3.74
Dec (2013)	15	58	2.49	0.85	4.43
Jan (2014)	17	83	2.72	0.93	4.07
Feb (2014)	12	48	2.33	0.79	4.65
Mar (2014)	12	54	2.32	0.79	4.51
Apr (2014)	15	58	2.49	0.85	4.43
May (2014)	17	83	2.72	0.93	4.07
Jun (2014)	12	48	2.33	0.79	4.65
Jul (2014)	12	54	2.32	0.79	4.51
Aug (2014)	10	33	2.13	0.72	5.15
Sept (2014)	11	31	2.18	0.74	5.24
Oct (2014)	15	58	2.49	0.85	4.43
Nov (2014)	17	83	2.72	0.93	4.07
Dec (2014)	11	24	2.2	0.75	5.66
Jan (2015)	13	30	2.35	0.8	5.29
Feb (2015)	10	39	2.22	0.75	4.91
Mar (2015)	13	25	2.37	0.8	5.59
Apr (2015)	9	18	1.93	0.65	6.23
May (2015)	17	56	2.59	0.88	4.47
Total		1147	54.06	18.38	118.18
Average		47.791	2.25	0.76	4.92

The lowest diversity value was found in May with 2.31 for the time being. For evenness (E'), the maximum value occurred in October (0.95) and the lowest value was found in May (0.72). In species richness (D'), the highest value was observed in May (7.88) and the lowest value occurred in February (5.18).

In 2015, as can be seen from the table, January was the highest number with the diversity index 2.64. After that the number gradually decreased in the following months; February and March (2.5 for the first one and 2.4 for the last one). For evenness (E'), the maximum value also occurred in January with 0.82 and the lowest value was found in April (0.68). In species richness (D'), the highest value was observed in April (7.28) and the lowest value occurred in January and May (6.20 for each).

1.7. Variation of three diversity indices with Polychaetes abundance at six studied areas

Table 7 gives the information about the diversity indices of polychaetes and their abundance in this study among the different sic Station within the two years period from June (2013) to May (2015).

Table 5. Monthly variations of three diversity index of intertidal polychaetes at Pangyishaung

Months	No. of species	Abundance	Diversity (H')	Evenness(E')	Richness(D')
Jun (2013)	12	46	2.34	0.76	5.48
Jul (2013)	12	43	2.3	0.74	5.58
Aug (2013)	6	16	1.7	0.55	7.57
Sept (2013)	7	34	1.66	0.54	5.96
Oct (2013)	15	60	2.34	0.76	5.13
Nov (2013)	14	210	2.46	0.8	3.93
Dec (2013)	16	54	2.52	0.81	5.26
Jan (2014)	20	90	2.86	0.92	4.67
Feb (2014)	21	97	2.8	0.91	4.59
Mar (2014)	21	124	2.94	0.95	4.36
Apr (2014)	6	16	1.7	0.55	7.57
May (2014)	7	34	1.66	0.54	5.96
Jun (2014)	15	60	2.34	0.76	5.13
Jul (2014)	14	210	2.46	0.8	3.93
Aug (2014)	16	54	2.52	0.81	5.26
Sept (2014)	20	90	2.86	0.92	4.67
Oct (2014)	21	97	2.8	0.91	4.59
Nov (2014)	21	124	2.94	0.95	4.36
Dec (2014)	14	47	2.54	0.82	5.45
Jan (2015)	16	59	2.39	0.77	5.15
Feb (2015)	9	30	2.05	0.66	6.17
Mar (2015)	15	35	2.46	0.79	5.91

Apr (2015)	13	26	2.41	0.78	6.45
May (2015)	13	47	2.3	0.74	5.45
Total		1703	57.35	18.54	128.58
Average		70.958	2.38	0.77	5.36

Among six Stations, Kanetthiri revealed with the lowest number in different (8) species with a total of 669 individuals; in contrary, Kampani showed the highest number in different (25) species with 1402 individuals, though Pangyishaung was observed with total abundance of 1703 individuals in 22 different species, therefore, in total abundance, Pangyishaung was recorded the highest individual abundance than other five Station. In comparison with Kampani and Kyaukwutpyin, the first one was a total of 25 different species and the second was 15 in different species; however, the second revealed with 1497 in total abundance, so it was outnumber than the first one with 1402 individuals.

According to diversity index, the lowest index was found in kanetthire with 1.83 and the highest diversity index occurred at Kampani with 2.62 and closely followed by Pangyishaung and Sinphyupyin with 2.39 for first one and 2.25 for second and then come with Kyaukwutpyin and Kyaukmatat.

Besides, in richness index, in that order, the largest one was Kampani then Panpyishaung and come Sinphyupyin and Kyaukwutpyin followed by kyaukmatat and Kanetthiri. In evenness index, it was opposite and the highest value occurred at kanetthire and followed by Kampani and other Stations revealed the evenness index with 0.77 in this study.

To sum up, the highest species diversity was found in Kampani though Pangyishaung revealed with the highest total abundance in individual number. Likewise, diversity and richness indices showed the same order in different Stations; whereas, apart from Kanetthire and Kampani, all are the same in evenness with 0.77 in this study.

1.8. Similarity of intertidal polychaetes around the Dawei point

Similarity between Stations for polychaetes species were calculated using Chord distance (CRD) index formula and Jaccard similarity index.

Table 6. Monthly variations of three diversity index of intertidal polychaetes at Kampani

Months	No. of species	Abundance	Diversity (H')	Evenness(E')	Richness(D')
Jun (2013)	22	56	2.7	0.84	5.96
Jul (2013)	21	49	2.81	0.87	6.17
Aug (2013)	16	36	2.55	0.79	6.70
Sept (2013)	11	21	2.31	0.72	7.88
Oct (2013)	17	48	2.57	0.8	6.20
Nov (2013)	15	94	2.54	0.79	5.28
Dec (2013)	18	67	2.63	0.82	5.71
Jan (2014)	17	83	2.75	0.86	5.43
Feb (2014)	22	103	3.03	0.94	5.18
Mar (2014)	22	89	2.97	0.92	5.35
Apr (2014)	16	33	2.54	0.79	6.86

May (2014)	11	21	2.31	0.72	7.88
Jun (2014)	16	43	2.5	0.78	6.38
Jul (2014)	14	87	2.45	0.76	5.37
Aug (2014)	18	69	2.63	0.82	5.67
Sept (2014)	17	80	2.75	0.86	5.48
Oct (2014)	22	98	3.05	0.95	5.23
Nov (2014)	22	91	2.98	0.93	5.32
Dec (2014)	17	45	2.64	0.82	6.30
Jan (2015)	17	48	2.64	0.82	6.20
Feb (2015)	15	38	2.5	0.78	6.60
Mar (2015)	14	28	2.4	0.75	7.20
Apr (2015)	11	27	2.2	0.68	7.28
May (2015)	15	48	2.48	0.77	6.20
Total		1402	62.93	19.58	147.84
Average		58.416	2.62	0.81	6.16

1.9. Similarity index using Chord distance

Table 8 reveals the computations for the distance measures between the intertidal polychaetes for Dawei coastal areas; Kanetthiri, Kyaukmatat, Kyaukwutpyin, Sinphyupyin, Pangyishaung and Kampani in the present study. The chord distance (CRD) values between Stations were ranging from 0.86 (maximum similarity) to 0.11 (minimum similarity). Maximum similarity was noticed between paired Station Sinphyupyin and Pangyishaung (0.86) and minimum similarity was observed between Kyaukmatat and Sinphyupyin with 0.11 .

1.10. Jaccard similarity index

Jaccard similarity index was based on presence/positive reply (indicated with a 1) or absence/negative reply (indicated with a 0) data. This index is useful for calculating the similarity index of presence/absence or positive/negative reply data (qualitative). As a result, the highest value was (1.31) which occurred in between Kyaukmatat and kyaukwutpyin. The lowest value (0.49) was observed in between Sinphyupyin and Pangyishaung (Table. 9).

Table.7 Variation of three diversity indices with total abundance at six stations

Stations	Species no.	Total abundance	(Diversity) H'	(Evenness) E'	(Richness) D'
Kanetthiri	8	669	1.83	0.88	2.33
Kyaukmatat	12	722	1.92	0.77	3.29
Kyaukwutpyin	15	1497	2.1	0.77	3.49
Sinphyupyin	19	1147	2.25	0.77	4.92
Pangyishaung	22	1703	2.39	0.77	5.36
Kampani	25	1402	2.62	0.81	6.16

Table 8. Similarity of intertidal polychaetes at different Stations (Chord distance).

Stations	kanetthire	kyaukmatat	kyaukwutpyin	Sinphyupyin	Pangyishaung	Kampani
kanetthire		0.33	0.15	0.29	0.36	0.32
kyaukmatat			0.13	0.11	0.17	0.48
kyaukwutpyin				0.36	0.48	0.38
Sinphyupyin					0.86	0.52
Pangyishaung						0.57
Kampani						

Table 9. Jaccard index of intertidal polychaete at different Stations.

Stations	kanetthiri	kyaukmatat	kyaukwutpyin	Sinphyupyin	Pangyishaung	Kampani
kanetthiri		0.92	1.11	0.80	0.79	0.77
kyaukmatat			1.31	1.16	1.10	0.95
kyaukwutpyin				0.78	0.66	0.81
Sinphyupyin					0.49	0.65
Pangyishaung						0.60
Kampani						

Discussion

In analyzing and comparing the diversity of polychaetes in the study areas, different values were established and many species occurred at different Stations indicated their number varying from one Station to another. Based from formula of Shannon and Weaver (1963), Pielou (1966) and Margalef (1968) species diversity for all samples were conducted in the present study. A clear domination by any species would indicate non-stability in the benthic habitat (Yasin *et al.*, 1997). Similarity between Stations for polychaetes species were calculated using Chord distance (CRD) index formula and Jaccard similarity index.

The diversity of intertidal polychaete species were presented in the present study. In Kampani Station has diversity of > 3 and while in the remaining other Stations had diversity of > 2 . Dean (2008) and Sukumuran and Devi (2009) revealed that decrease in species diversity led to increase in species dominance, because of effect of pollutants on the benthic environment. Low diversity and higher population density of a few organisms denote some major stress condition, which eliminated many species but promoted survival of a few.

In the case of Kanetthiri, very low species diversity was found to be correlated with low species richness and suggesting poor environmental health due to anthropogenic activities. Highest species richness and diversity values were obtained from Kampani attributing to the more stable physical conditions. The high species richness and species diversity of polychaetes were observed at Kampani Station. The high species richness and high diversity attributed to the more stable physical condition (Joydas and Damodaran 2009). A similar observation in agreement with Joydas and Damodaran's comment was also obtained for polychaetes. The decrease in species richness and diversity of polychaetes probably could not be due to the lack of food, and the only factor that appears to be limiting was dissolved oxygen (Joydas and Damodaran 2009).

In the soft-bottom benthic community, polychaetes were considered good environmental perturbation indicator because they were the most abundance and species rich component of marine benthos (Dean, 2008). Lower H' value indicated poor environmental health. And Barrio Frojan *et al.* (2006) revealed that H' values greater than 4 was considered as good as clean environment. The quantitative abundance of bottom fauna generally decreases with depth and distance from the shore (Vinogradova, 1962). The enrichment of coastal waters due to riverine flow and land run off also seem to be factors contributing to richness of the fauna in the near shore regions (Parulekar 1973). A similar finding was made during the observation by Ansari *et al.* (1990).

Although most of the species had limited distribution, some species showed wide distribution. In terms of numbers of individuals, there were some species that were predominant; *Diopatra* sp, *Owenia* sp, *Glycera* sp., *Goniadella* sp, and *Neriesspp.* with the highest dominance index value than other species. *Trypanosyllis* sp. has the lowest dominance index value in kampani Station. The species similarity index values showed the similarities of polychaetes structure of study areas were poor, most of the similarities were more than 30% of similarity value. Datta *et al.*, (2010) stated the comparative study on intertidal faunal biodiversity of selected beaches of Mumbai coast. He pointed out the diversity indices in different level of ecological state of the shore. So, the study areas included not only high diversity but also low diversity.

Conclusions

In the study areas, the diversity of polychaetes presented slightly higher patterns in post-monsoon than monsoon and pre-monsoon. It can be stated that the total individuals of all stations were higher during July, September, November, December, January and February for the time being. Species diversity for all samples in the study areas were rather high, ranging from 2.68 to 3.37 while the Evenness index showed a range from 0.89 to 0.96. Species richness index value was observed ranging from 1.24 to 4.3. The species similarity index values showed the similarities of polychaetes structure of study areas were poor, most of the similarities were more than 30% of similarity value. The physical factors that control the community structure, such as slope and grain size were correlated with polychaetes density. Among the studied areas, the most diverse species was observed at Kampani. Polychaete species occurred more in soft substrate flat than on hard substrate. It is difficult to say that the present condition has been natural phenomenon and it has been changed due to human impact because there was no previous study describing the species-wise abundance, diversity indices and community structure. It is strongly believed that the present work will be valuable to be used as based line data to gauge any further change of polychaetes along the Dawei point in some year to come.

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