ECOSYSTEM SERVICE PROVISION BY HERPETOFAUNA AS NATURAL PEST CONTROL AGENT: ASSESSMENT AND AWARENESS BUILDING

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CONTENTS

BACKGROUND OF THE WORK

Studies related to ecological service provisioning by herpetofauna are sparse. The work took place in Baruipur agricultural farm in the form of a controlled experiment to bridge the knowledge gap regarding herpetofauna playing a role a biological pest controller.

The work has seen good progress. The project aimed at evaluating the extent to which frogs and reptiles can control paddy pests depending on field realistic herpetofaunal density that we obtained from the first half of the project conducted in Odisha 2016-2017.

Pests of human and crops make up less than 1% of all the species in the natural system (David Pimental et al. 1992). With increasing human settlements there is an increase in agricultural intensification accelerating the usage of agrochemicals as a measure for controlling pest infestation. Though this creates homogenous landscape yet it harbors specific species of arthropods, birds, reptiles, amphibians and plants. Large amount of work exists regarding studies of biodiversity in such ecosystem but works concerning taxa like reptilia and amphibia are meagre. Diversity of these taxa in agricultural or agroforestry systems though has been worked upon but in comparison to this, works on the provisioning provided by these taxa especially as biological pest control warrants further studies. This unprecedented use of pesticides also has indirect effects on other organisms which inhabit these agricultural landscapes. Of these non-target organisms a bulk amount also constitute predators of these pests. These herpetofauna and specifically amphibians are also efficient biological pest controllers, an area of research that shows huge lack of scientific data (Hirai and Matsui, 1999).

The main aim of the project was to investigate the role of herpetofauna in controlling paddy pests.

SUMMARY

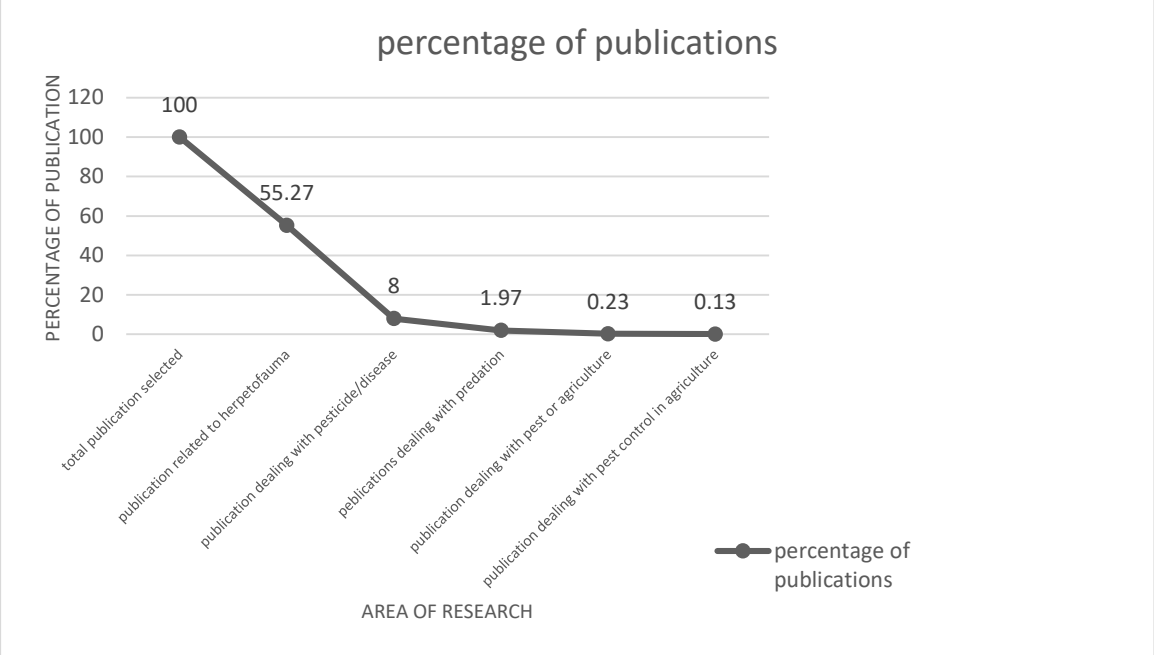
Conserving wildlife in forests or outside protected areas has been a much debated subject since long. Unprotected areas make up a bulk magnitude of earth's area which accounts to 95%. Sustaining biodiversity in such areas with progressing human encroachment is imperative and is of urgent need.

With increasing human settlements there is an increase in agricultural intensification accelerating the usage of agrochemicals as a measure for controlling pest infestation? This unprecedented use of pesticides also has indirect effects on other organisms which inhabit these agricultural landscapes. Of these non-target organisms a bulk amount also constitutes predators of these pests. These herpetofauna and specifically amphibians are also efficient biological pest controllers, an area of research that shows huge lack of scientific data (Hirai and Matsui, 1999). Realizing the need for conserving herpetofauna in such ecosystems warrants further studies.

No conservation strategy can be successful unless the local people's interest is piqued and they are made aware of the beneficial effects of conserving particular taxa. With this in mind, the project also was concerned about organizing a farmer's camp where the need for conserving herpetofauna was discussed in details. As a second major part of the work we have set a controlled experiment to evaluate the pest build up in presence of specific combination of herpetofauna depending on field realistic data from Odisha. The work is to be continued throughout the paddy season till December 2018.

LITERATURE REVIEW

Literature review shows a meager amount of work being attempted regarding pet control efficiency by herpetofauna.



Only 0.13 percent of articles have been published regarding pest control by herpetofauna in agriculture. This how a huge gap in ecological data related to this area of science.

STUDY AREA

Study area is in Institute of Agricultural Farm, Baruipur, South 24 Parganas. The project has been executed in an area of 7500 m^2.


EXPERIMENTAL FARM
Legend
Calcutta University Agricultural Farm
PLOT
1
2
3
Google earth
Image © 2018 DigitalGlobe
400 m
N


EXPERIMENTAL PLOTS
Legend
Calcutta University Agricultural Farm
PLOT
Calcutta University Agricultural Farm
PLOT 1
PLOT 2
PLOT 3
Google earth
Image © 2018 DigitalGlobe
100 m
N

Fig. 1 Study design 18 experimental units

TIME BUDGET:

TIME LINE AS PROPOSED			TIME LINE AS FOLLOWED	
1. collecting specimen for pesticide load assessment	**July-Sep'2017**		**COULDNOT BE ACHIEVED**	
2. Sampling herpetofauna	**Sep-Dec'2017**		**1. Awareness Camp**	**Jan-Feb'2018**
3. Experiment	**Sep-Dec'2017**		**3. Experimental setup construction**	**Mar-Jun'2018**
4. Data Analysis	**Mar-Aug'2018**		**2. herpetofauna sampling**	**May-Jul'2018**
5. Disseminating Result	**Jul-Sep'2018**		**4. Sowing**	**June 30.06.2018**
6. Campaign for raising awareness about herpetofauna	**Feb-Mar''2018**		**5. Transplantation**	**July 15.07.2018**
			6. Sampling	**August 20.08.2018-…Dec'2018(to be continued)**

The disparity in following the time- line is because of delay in the approval and the release of grants and field feasibilities which were unforeseen before. Though the project started off 3 months after schedule it has been able to meet the essential proposed activities.

ACTIVITIES

PHASE I

The first phase of our project aimed at raising awareness among the farming community. Not only was it important to pique the interest and concern of the farming community but it was outmost necessity to prepare the ground to work with reptiles and amphibians which were not only but relentlessly killed out of rage.

AWARENESS CAMP

The agenda of the awareness camp was-

1. **To bring to their notice the negative impacts of extending agricultural lands-**
    a. **Deforestation**
    b. **Increase in conflict**
    c. **Increase of Pesticide Input**

    Context- the rate at which forests are cleared for increase in agriculture which forces the animals to come to come close to human settlement and eventually increasing man-animal conflict resulting in relentless killing. We displayed a video to bring out the nature of conflict that the reptiles face in an agricultural landscape.

2. **The major negative effects of pesticide input-**
    a. **Soil health**
    b. **Crop nutrient loss**
    c. **Loss of biological diversity of which these bio controlling agents form a major part**
3. **Identifying some important and common reptiles and amphibian in an agricultural landscape**
4. **Types of pest- mammals and insects**
5. **When is an agent claimed to be a pest and when to control it and in this context how can we use the bio control agents**
6. **The ways pests could be controlled- a. by trapping**
    b. by pesticide
    c. by biological control – special reference to reptiles and amphibians

    Describing the positive and negative aspects of each
7. **How do pesticides effect these bio controlling agents of which reptiles and amphibians form a major part**
8. **How do amphibians and reptiles work as environmental indicators?**
9. **The camp ended with distributing pamphlets to the farmers with information regarding the topics we discussed and a farmers' interaction session.**

We tried to involve not only the farmers from the villages but also those who were workers in the Baruipur farm and some Master's degree students also some who are studying agro-ecology.


TROPICAL DEFORESTATION BY REGION, 1990-2000 & 2000-2005
In thousands of hectares per year. Data source: FAO/mongabay.com
1990-2000
2000-2005
4500
4000
3500
3000
2500
2000
1500
0
Central America
Oceania
South America
North America


চাষের জমি বৃদ্ধি পাওয়ার ফলে কী কী ক্ষতি হচ্ছে
জঙ্গল নষ্ট
জীবের সাথে মানুষের যগাযোগ বৃদ্ধি
কীট নাশকের প্রভাব বৃদ্ধি


EPSON


কখন তাদের পেস্ট বলব
above EIL, benefit > cost
EIL
below EIL, cost > benefit
সময়

PHASE II

The second part of the project dealt with control experiment. 3 plots each of 50X50 meter^2 area were selected in the agricultural farm. The experimental part had some major steps –
i) Preparing ground for seed bed preparing
ii) 6 experimental plots were set up in each of the 3 blocks. Each unit is 10X10 meter^2
iii) Soil preparation for sowing
iv) Procuring specimen from the Baruipur farm an area of 270 acre by night sampling
v) Transplantation
vi) Sampling
a) Day sampling for evaluating pest infestation
b) Night sampling for stomach flushing frog….This will be continued till the harvest time in December 2018.

I) FIELD PREPARATION FOR SEED BED

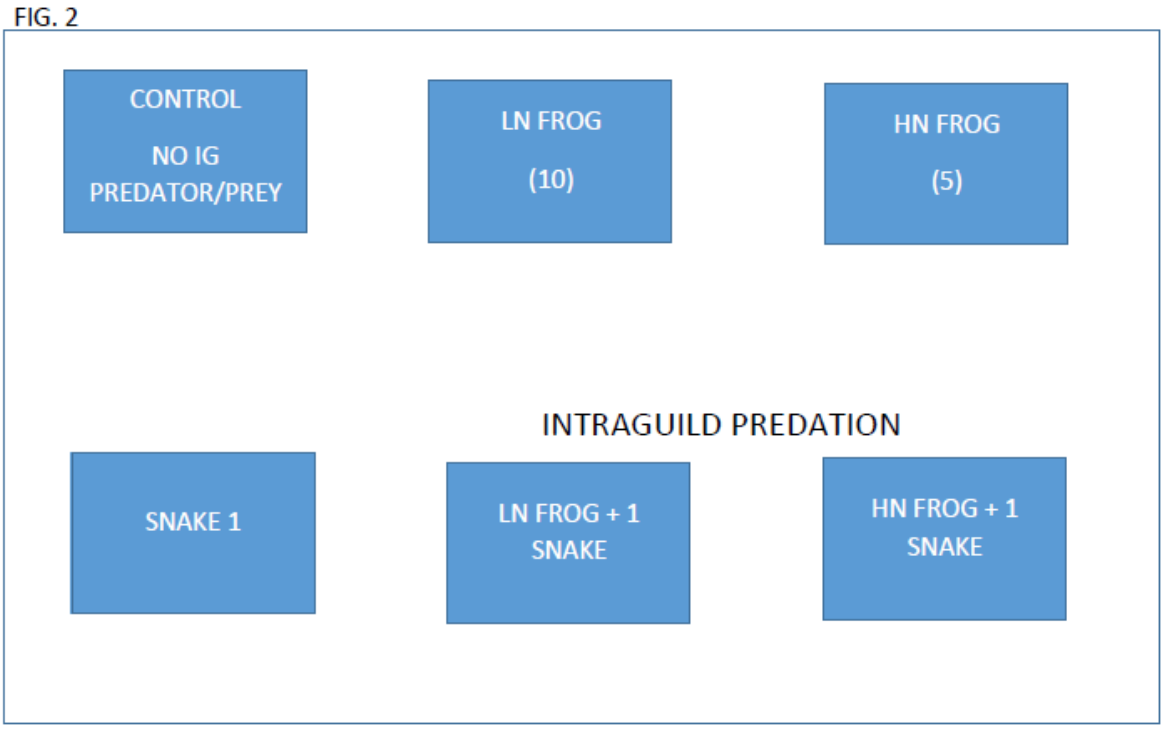
II) SEED BED PREPARATION

III) EXPERIMENTAL UNIT CONSTRUCTION

IV) SETTING UP OF EXPERIMENTAL UNITS

V) EXPERIMENTAL DESIGN

FIG. 2



Treatments in the control experiment are-

1. T_1- Control- no herpetofauna
2. T_2 –LN (With highest density of frogs as sampled in low intensification sites in Odisha)
3. T_3- HN (With lowest density frogs as obtained from high intensification sites in Odisha)
4. T_4-SNAKE
5. T_5- LN+SNAKE
6. T_6-HN+SNAKE

OBJECTIVE

The project aimed at studying the pest build up on paddy crops in presence of different combinations of predators i.e. frogs and reptiles.

EXPECTED OUTCOME

Pest buildup will vary among the different treatments as compared to the control plots where there was complete absence of any predators.

SEED BED PREPARATION

Seed bed was prepared on 30th of June 2018. We used a local variety Patnai. No fertilizer was applied in the field. Seeds were sown at 1916 seeds /meter^2 for a total area of 14X15 meter^2.

TRANSPLANTATION

Seedlings were transplanted on 27.7.2018, 28.7.2018, 29.7.2018 in plots 1, 2 and 3 respectively.

SPECIMEN PROCURING

Active searching was conducted from May 2018 till July 2018. We started night sampling from 6.30 pm till 9.00 pm. We maintained the animals in enclosures of 5X5 meters and fed them at regular interval. No animals were harmed during this entire process.

EXPERIMENTRAL SETUP

Each plot had 6 experimental setup of 10X10 meters. We covered each of the plots with 48 mm of mesh to avoid any predation risk and sealed the joints so that no reptile can escape.

It was made sure that each of the drift fences were dug deep into the soil so that no animals could escape and every gap was sealed.

We released the animals at specific numbers on 12.08.2018 and left the experimental setup undisturbed for a week.

On the day of release we temporarily kept the animals captive in drums for easy transportation.

We started releasing the animals at specific numbers from 5.30pm onwards.

VI) SAMPLING

Sampling required two phases of data collection.

a) Day time-

i) Day time data collection included pest infestation studies. We used a 1X1m quadrat which was randomly thrown within each plot.

The number of plants in each such quadrat, the total number of leaves, the total number of leaves infested with pest and the total number of dried leaves were calculated. We repeated this process 5 times in each experimental unit.

- 3 plants were randomly selected and each leaf was inspected for any pest infestation mar. All leaves with such marks were collected and preserved as herbarium sheets for later identification.


খেলা

ম্যান ইউ আটকে যাওয়ার দিনে পাঁচ গোল আগুয়েরোর ম্যান সিটির। ১৭

মরুশহরে ঘূর্ণিঝড়ে উড়বে আজ কারা?

ভারত

জাড্ডুর ফেরার লড়াইয়ে দিদির সমর্থন, চোখ এখন কাপ জয়ে

কৌশিক দাশ

কুলদীপ যাদব: এশিয়া কাপে তিন ম্যাচে তিন উইকেট। কিন্তু তাঁর প্রভাব উইকেট সংখ্যার চেয়ে অনেক বেশি। বাঁ হাতি লেগস্পিন-গুগলির কোন বলটা ভিতরে আসবে, কোনটা বাইরে যাবে, কেউ বুঝতে পারছেন না।

ii) We also collected pests or any insect that were available inside and outside our quadrat

iii) Insect sampling was done by using sweep net. One person walked in 4 paths along each 10X10 meter fence. A sweep with a single forward and backward movement is taken as one complete sweep. We used 10sets of such sweeps along each of the 4 paths within each experimental unit.

b) Night Sampling & Stomach Flushing

Night sampling was from 6.30pm till 9.30pm.

Each night we would search for frogs two person at a time moving at the same pace in the same direction searching either side of the line of walking. This continued for 30mins in each plot. The frogs we collected were taken away from the plot and were stomach flushed using. No frogs were harmed or sacrificed. We performed the technique with live specimen (Sole et

al., 2005). We used 60ml of injection syringe and attached an infusion tube. The other end of the infusion tube was inserted with the stomach of the specimen till it hit the pyloric end. Water was taken from a nearby pond for stomach flushing. We punched water till the animal regurgitated the stomach content. All the contents are collected and stored in 70% alcohol for later identification.

Active search for recapturing amphibians released in the experimental unit

Stomach flush of the amphibians recaptured from the experimental plot during night time sampling

Stomach flush content

Stomach flush: Grasshopper

Stomach Flush: paddy pest

We have collected 3 sets of data in the vegetative phase. The field is kept at halt till the panicle stage when we will be starting to sampling this pest build up and stomach flushing till fruiting season.

VII) DATA ANALYSIS AND IDENTIFICATION

Data analysis, identification of pest infestation marks and pests is yet to be done as we are still awaiting our last rounds of sampling.

EXPERIMENTAL PLOTS RANDOMLY ASSIGNED WITH TREATMENTS


B2 T5 LN+S-10+I
B2 T6 HN+S-5+I
B2 T1 CONTROL
B3 T6 HN+S-5+I
B3 T2 LN T0
B3 T1 CONTROL
B3 T3 HN 5
B3 T5 LN+S-10+I

Animals kept in container for transport before release

Checkered keel back to be released in the experimental plot

Reptiles temporarily maintained in a container for transportation and release in the plots

Frogs temporarily maintained in a container for transportation and release in experimental plots

Frogs release in specific experimental plots

Frogs after release in the experimental plot

FIG : 1

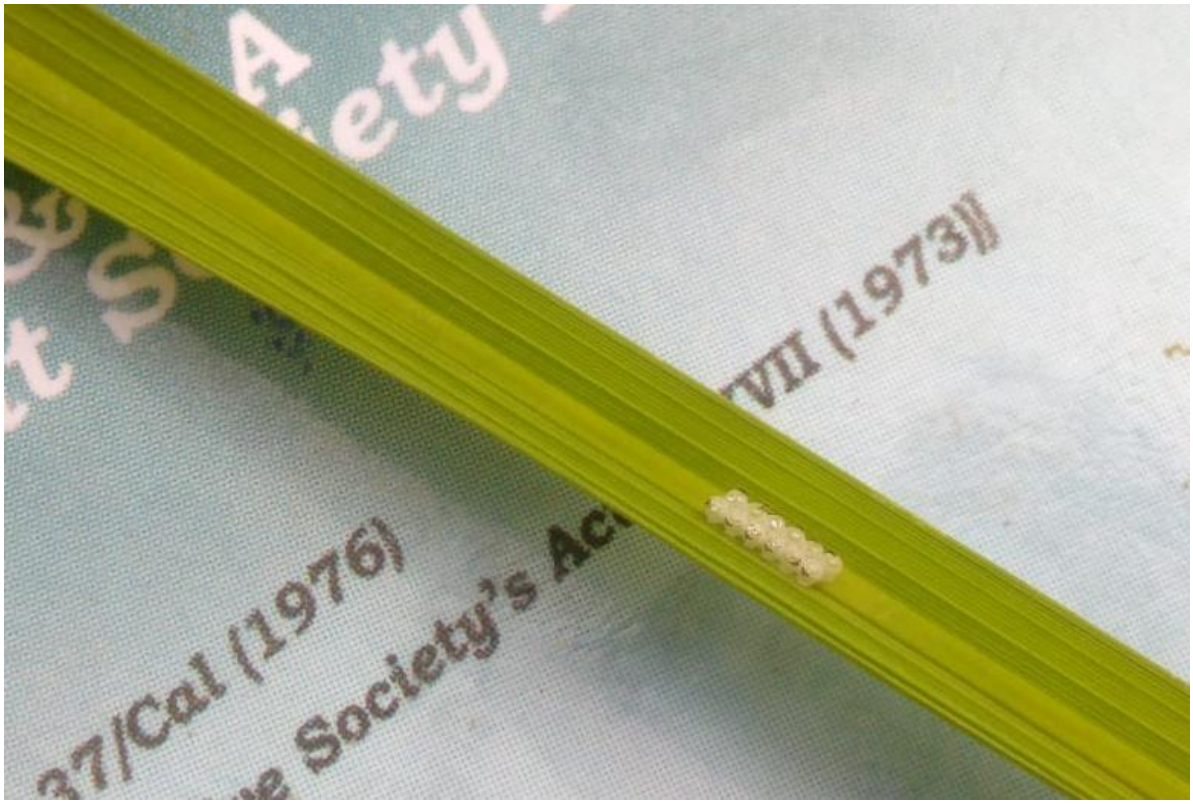


FIG : 2

FIG : 3

FIG : 4

FIG :5

FIG : 6

FIG : 7

FIG : 8

FIG : 9

FIG : 10

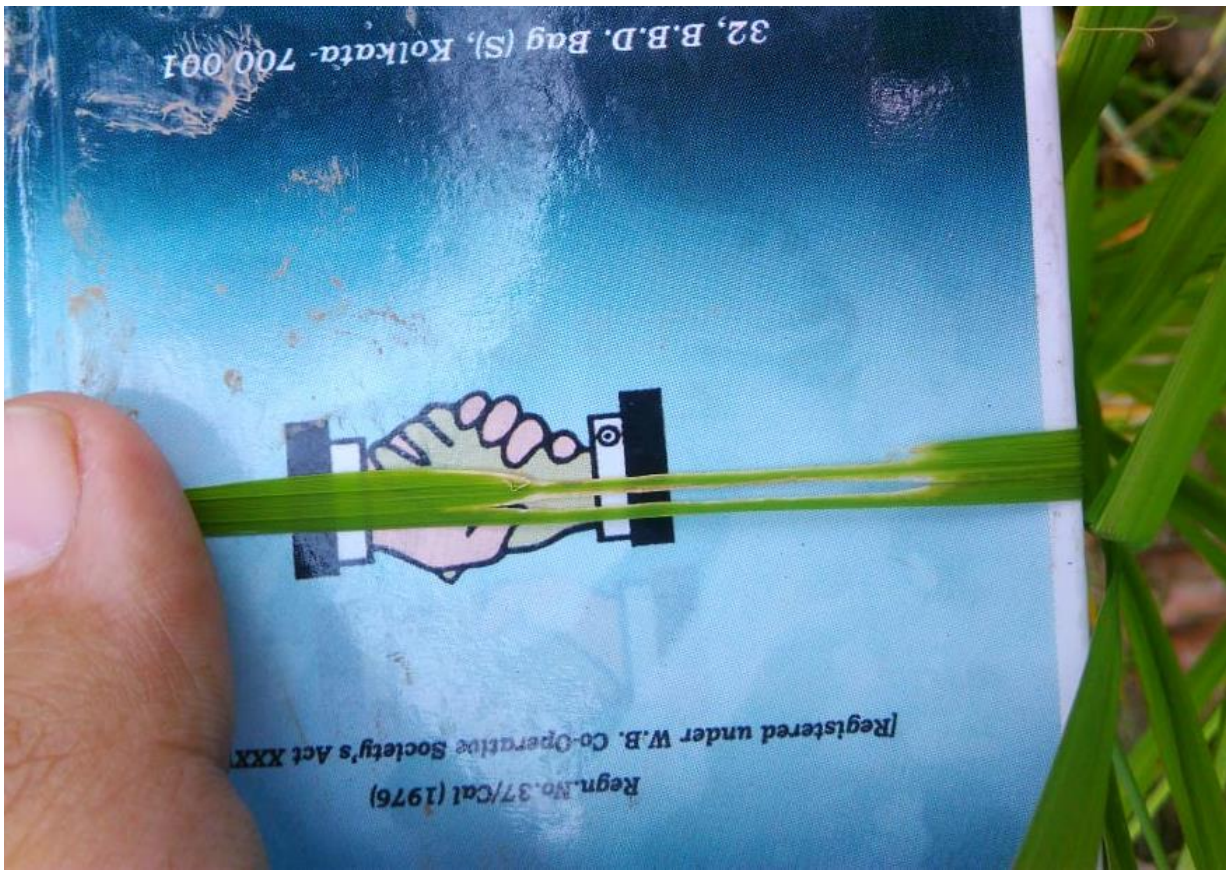

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FIG : 11

FIG : 12

FIG : 13

FIG : 14

CONCLUSION

Our work has seen a good progress in the tenure provided from September 2017 to September 2018.

The work needs more time till the harvest time. We are left with sampling in the flowering and fruiting season. We could not analyses the data yet and would be done only after we have the entire dataset. There has been some unforeseen situation in field that has delayed our work till the progress made is good enough. This work though is very essential in terms of filling the knowledge gap in ecological data regarding the efficiency of herpetofauna as a biological pest control yet the work needs to be further supported by some functional response study which will give us a more rigid conclusion regarding the study. Though we planned to do it but it doesn't seem to be feasible to pull it up this year because of the labor problem and the control experiment being done simultaneously.

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