Traditional & Indigenous Paddy Diversity at Sagar Island, in Sundarbans Delta, West Bengal: A Study on Biodiversity and Sustainability

An Initiative of the

Paribesh Unnayan Parisad (PUPA)

Project Conducted under the guidance of-

Krishna Suchitra Memorial Study Centre

(An Experimental Philanthropic School; a Unit of PUPA)

Vill & PO: Sagar Fulbari. Ps-Sagar, Dist -South 24Parganas, Pin-743373. West Bengal

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About Paribesh Unnayan Parishad (PUPA):

It is an *NGO established in 1991, with its registered office in Kolkata, operates mainly in Sagardwip, the biggest estuarian island in the* ***Sundarbans delta****. The island is located in the South 24 Parganas district of West Bengal and is about 100 kms. away from Kolkata. The frontline activity of PUPA is to disseminate awareness about* ***Environmental Education and Conservation of Nature,*** *supplemented by integrated farming, including promotion of traditional (wild/ desi) salt-resistant varieties of paddy and home-grown organic manure.*

*PUPA has launched an innovative project titled "****Smart Education and Project Shade & Seed"*** *to motivate the youth to take up agriculture and allied activities as a profession. This follows the spirit behind Indian Council of Agricultural Research (ICAR) project titled "Attracting and Retaining Youth in Agriculture (ARYA)" launched in 25 states (one district in each state through the concerned KVK) since 2015-16. For the purpose PUPA has organized the students into Community Bio Circle to act as one of the local institutional pillars, others being farmers' club and Women's group. The members of the bio-circles are engaged in collecting traditional paddy seeds and are associated with the farmer's clubs to get practical knowledge of farming. Further they have access to online training in scientific and sustainable agriculture organized by PUPA. The objective is to help them earn a dignified livelihood by using locally available bio-resources and build self- reliant smart villages as they grow up. PUPA also runs an informal school (pre-primary and primary) for less-privileged children of the island. The organisation follows the philosophy: "If a child cannot reach to the school, the school must reach the child". Thus, the mission is to empower children from marginalized cohort of society living in difficult circumstances by providing nature-based education and developing scientific awareness. CEE has been partnering with PUPA for implementing Wipro Earthian Programme in the schools of West Bengal since the year 2018.*

1. Introduction:

Biodiversity is the variability among living organisms (both animal and plants) from all habitats (terrestrial and aquatic ecosystems) where the organisms live; this includes diversity between species, within species, and of ecosystems (dynamic habitat).

Biodiversity is typically a measure of variation at the species, genetic and ecosystem level. The Biodiversity Study is basically a sustainability education programme designated as EARTHIAN project of Wipro, implemented by CEE, Luckhnow in various states of Indian including West Bengal. This will actually help and promote better understanding of our environment through meaningful sustainable education linking with syllabuses of different subjects & classes at school level; and will provide an exposure to various perspectives which develop an interconnected understanding of various disciplines in our school curriculum as well as us in life. Through this programme we the students along with our teachers as well as our school are benefitted to be informed of our choices about the life and the society as a whole.

2. Study Area:

Sagar Island[1] in Sundarbans, W.B., where we live, is vulnerable to different types of environmental hazards. *(Floods, water stagnancy, droughts, cyclone, tidal surge, river erosion, salinity, extreme temperature and low light intensity etc.)*. The vulnerabilities due to climate change are likely to aggravate more in the future in addition, the Island now faces the double crises of the Corona virus pandemic and Amphan Cyclone. All these catastrophic events, AILA (2009)[2], BULBUL (2019)[3], Amphan (2020)[4], to name a few, significantly hinder the agriculture production systems in the area. Intrusion of salt water makes the agricultural land unproductive, which is expected to be increased in the context of CLIMATE CHANGE.

Farmers have lost the resilient indigenous varieties to combat the effects of climate change as ***High Yielding Verities (HYVs) of Paddy with chemical inputs*** are the culture now. The traditional varieties of Paddy were also more resistant to pests, diseases, droughts and floods; with diversity in taste, nutrition in this time of climate change and natural disasters, adaptability to a range of conditions. Moreover, **the diversified resilient seed varieties (traditional/ indigenous) are known to allow our Nature to evolve the future seeds through the process of natural selection.** In addition, scientists need diversified genetic base for developing improved varieties of Paddy also. In this context, we decided to cultivate more than ***60 traditional and indigenous paddy varieties*** in a raised land (Betel vine yard), remain vacant after the cyclone (*Amphan*) for cultivation, and all the activities are performed as prescribed in the guidebook of "**Wipro Earthian Sustainability Education Programme, 2020".**

Observations made in and around the paddy fields, composting was done with the weeds of the field to provide manure for the paddy plants. Animal and plants associated with paddy are the main objects of observation, so as to establish relationships. The seeds of 60 indigenous varieties of Paddy are expected to be harvested after Amphan.

3. Aims and Objectives of the Study:

The Study Group have got the desired seeds and saplings from a local NGO in the month of July, 2020; which would be kept in the 'SEED BANK' of the school for future use.

3.1 Aims of the Study:

This study project aims-

[1] https://en.wikipedia.org/wiki/Sagar_Island
[2] https://www.indiawaterportal.org/articles/cyclone-aila-2009
[3] https://indiaclimatedialogue.net/2019/11/13/sundarbans-mangroves-save-bengal-from-cyclone-bulbul/
[4] https://www.downtoearth.org.in/news/natural-disasters/2-days-after-amphan-landfall-sagar-island-still-left-in-the-lurch-71290

i) To identify the traditional and Indigenous Paddy specious available in the local areas; i.e., in and around Sagar Island;
ii) To encourage cultivation of traditional indigenous paddy, as the climate registrant paddy;
iii) To find-out the effect of using organic manures in the cultivation of indigenous Paddy;
iv) To arouse awareness among the children and the youths of the locality through observations during the entire Life-cycle of paddy life.
v) To motivate and attract the children and youths towards agriculture from their early age, so that they could make it as a profession in their life;
vi) To create 'PADDY-SEED BANK of Indigenous Paddy' for conservation of wild variants of Paddy, which would help in further Scientific Study and Research.

3.2 Overall Objectives of the Study:

To understand the concept and importance of paddy Fields and its role in conserving diversified population of plants and animal for securing our food production system (inter-relationships and ecosystem services).

3.3 Specific Objectives:

- To get the basic knowledge of environment;
- To be familiarized with the flora and fauna in our surroundings;
- To realize the relationships and interactions between plants and animalslocally;
- To realize that the same environment can have different animals at differenttime; and
- To realize that the biodiversity (all together) in our surroundings is must forhealthy Living.

4. Rationale of the Study on 'Paddy -Biodiversity':

There are a good number of indigenous and traditional Paddy in Sagar Island, which are more climate resistant than the HYVs Paddy. But due to several reasons, these wield verities of Paddy are not familiar to the farmers of the locality; even they have no knowledge about these climate resistant Paddy seeds. Moreover, seeds of these indigenous Paddy are not easily available in the locality.

This study would help in identifying the 'Paddy-Biodiversity' in and around the Study area; i.e., Sagar Island, and this study may develop a "Paddy-Seed Bank", from where farmers can get the Paddy-seeds according to the need of their respective area; and would help in further Scientific Study. Furthermore, this study may have a great impact in conservation of the local environment. Moreover, it is also perceived as a strategy for understanding resilience against climatic hazards including cyclone and salination of soil, a phenomenon which is challenging coastal agriculture in the Sundarbans.

West Bengal is the rice bowl of our country. The wide range of weather condition of West Bengal induced a great diversity to meet diverse requirements. Due to high input type of agricultural practices, local varieties of agricultural diversity (mainly paddy) are now becoming locally unavailable in the market. The indigenous varieties of paddy crops have gradually lost, and High Yielding Varieties (HYVs) take its place. Due to presence of salt in soil, and uncertain water height in the agricultural fields, the production of HYVs is not satisfactory. Conservation of indigenous varieties of corps in a sustainable way; and it is the need of the day. Revival of traditional seed varieties, including those having salt-tolerant capacity, and the understanding all, is an important self-help strategy for maintaining genetic diversity (varieties of paddy) on farms along with productivity.

5. Methodology:

As there is lockdown situation, we visited our home and surrounding area for recording observation. We visited several times to observed local animals and plants in our surrounding area. Then we analyzed and discussed the data from the observation. Report was prepared after final discussion with guide teacher.

i) Individual observation was made to record the organisms at different locationwith a purpose;
ii) Observation in group to know more about the relationships;
iii) Recording of observation in the form of Sketches, Notes, Photographs, etc.
iv) Discussions and comparison of habitats.

5.1 Tools & Materials of the Study:

(i) Hand lens, (ii) forceps, (iii) camera (Mobile Phone). (iv) pen, pencils, (v) white sheet, etc.

5.2 Experimental Cultivation of Indigenous Paddy:

The Planning of the Experimental Cultivation of Indigenous Paddy has consisted of following Steps -

5.2.1 Identification and collection of Wild/ Indigenous Paddy Seeds;
5.2.2 Identification and Preparation/ Shaping of agricultural Lands for cultivation of Paddy;
5.2.3 Production of Natural Manure *(Sagar Sona)*;
5.2.4 Water Harvesting;
5.2.5 Preparation of Paddy-Seedlings and Transplantation of Seedlings;
5.2.6 Continuous Inspection and regular Monitoring of the Paddy-fields, Weeding and Maturing;
5.2.7 Paddy-Harvesting.

The above-mentioned Steps of the Experimental Cultivation of Indigenous Paddy have been made by the students and the youths judiciously under the leadership of Sakila Khatus, the Principal Student-Investigator, and under the guidance of the Teachers. Active participation of the students and their activities are shown through the photographs given below.

5.2.1 Identification and collection of Wild/ Indigenous Paddy Seeds:

The Study Group members have vividly surveyed door-to-door throughout the Sagar Island and have collected and identified 60 varieties of Indigenous Paddy Seeds. They have cultivated all these 60 variant Indigenous Paddy and observed throughout the Life-Process of the Paddy. The abstract of the observations is given in the Table-1 below.

5.2.2 Identification and Preparation/ Shaping of agricultural Lands for cultivation of Paddy:

5.2.3 Production of Natural Manure *(Sagar Sona)*:

5.2.4 Water Harvesting:

Small scale Rainwater harvesting for irrigation during long rain-less days

5.2.5 Preparation of Paddy-Seedlings and Transplantation of Seedlings:

5.2.6 Continuous Inspection and regular Monitoring of the Paddy-fields, Weeding and Maturing:

5.2.7: Paddy-Harvesting:

6. Observations:

Students were divided in different Groups and they have observed the local Paddy Fields and note-down habits and habitats of local organisms in the Observation Sheets. The Observation Sheets are given below.

6.1 Identification of Indigenous Paddy Varieties:

It has been revealed from this Study that there are more than 60 varieties of Paddy seeds from the intensive survey in Sagar Island. However, the Study Group have experimentally cultivated 60 varieties of Indigenous Paddy Seeds and observed throughout the Life-Process of these 60 variants of Indigenous Paddy. The abstract of the experimental cultivation and their observations is given in the Table-1 below.

Table- 1: Group Observations on the Life-Cycles *(i.e., from Germination of Seeds to Harvesting of Seeds)* of 60 Indigenous Paddy variants.

Sl. No.	Name of Paddy (Variety)	Date of preparation of seedbed	Date of Sowing /Plant	Application of Sagar-Sona (organic manure)			Counting of tillers				Flowering date	Harvestingdate
				date	date	date	04-08-20	03-09-20	29-09-20	18-10-20		
1	AJIT	26-06-20	04-08-20	24-08-20	22-09-20	08-10-20	2	5	22	35	13-09-20	04.11.20
2	PASA KHATI	17-06-20	07-08-20	-do-	-do-	-do-	2	8	18	38	19-09-20	-do-
3	TR-36	20-06-20	07-08-20	-do-	-do-	-do-	2	10	18	39	19-09-20	-do-
4	KUMRA GOUR	24-06-20	07-08-20	-do-	-do-	-do-	2	9	12	42	20-09-020	-do-
5	BINA-10	24-04-20	04-08-20	-do-	-do-	-do-	2	7	24	31	06-10-20	-do-
6	KAJAL GOURI	20-0620	07-08-20	-do-	-do-	-do-	2	7	8	39	18-10-20	-do-
7	JUGAL	20-06-20	04-08-20	-do-	-do-	-do-	2	7	18	26	15-10-20	16.11
8	KATA RANGI	24-06-20	04-08-20	-do-	-do-	-do-	2	5	25	37	18-10-20	-do-
9	BALA MUSUR	20-06-20	04-08-20	-do-	-do-	-do-	2	5	28	38	17-10-20	-do-
10	SWARNA PANJI	20-06-20	04-08-20	-do-	-do-	-do-	2	9	29	49	15-10-20	-do-
11	Pusha Sugandh	20-06-20	04-08-20	-do-	-do-	-do-	2	11	21	36	21-10-20	-do-
12	GOPAL BHOG	26-06-20	04-08-20	-do-	-do-	-do-	2	8	34	41	19-10-20	-do-
13	DERADUN GANDESHWARI	20-06-20	07-08-20	-do-	-do-	-do-	2	5	31	41	15-10-20	-do-
14	DOGRA PATNI	17-06-20	04-08-20	-do-	-do-	-do-	2	9	21	39	20-10-20	-do-

15	CR-2314	20-06-20	04-08-20	-do-	-do-	-do-	2	6	36	54	13-10-20	-do-
16	KANAK CHUR	20-06-20	04-08-20	-do-	-do-	-do-	2	5	31	42	18-10-20	-do-
17	TULAI PANJI	20-06-20	07-08-20	-do-	-do-	-do-	2	5	17	25	18-10-20	-do-
18	RADHUNIPAGAL	24-06-20	07-08-20	-do-	-do-	-do-	2	7	25	38	18-10-20	-do-
19	HARINA KHURI	24-06-20	07-08-20	-do-	-do-	-do-	2	6	25	33	18-10-20	-do-
20	PUSA SOUGHA	17-06-20	07-08-20	-do-	-do-	-do-	2	4	22	39	18-10-20	-do-
21	KALA VAT	24-06-20	07-08-20	-do-	-do-	-do-	2	6	25	47	18-10-20	-do-
22	KAPUR DHULI	26-06-20	07-08-20	-do-	-do-	-do-	2	9	31	42	18-10-20	-do-
23	RADHA TILAK	24-06-20	07-08-20	-do-	-do-	-do-	2	9	33	48	18-10-20	-do-
24	DERADUN GANDHESWARI	20-06-20	07-08-20	-do-	-do-	-do-	2	5	31	41	18-10-20	-do-
25	BHOG	24-06-20	07-08-20	-do-	-do-	-do-	2	8	9	32	18-10-20	-do-
26	BADSA BHOK	24-06-20	07-08-20	-do-	-do-	-do-	2	8	19	36	18-10-20	-do-
27	KAMAL BHOK	24-06-20	07-08-20	-do-	-do-	-do-	2	9	27	41	18-10-20	-do-
28	GOPAL BHOK	24-06-20	07-08-20	-do-	-do-	-do-	2	8	34	41	18-10-20	-do-
29	GOBINDA BHOK	24-06-20	07-08-20	-do-	-do-	-do-	2	8	24	37	18-10-20	23.11.20
30	MOHAN BHOK	26-06-20	07-08-20	-do-	-do-	-do-	2	7	23	31	18-10-20	-do-
31	RANI KAJAL	20-06-20	07-08-20	-do-	-do-	-do-	2	9	30	42	18-10-20	-do-
32	NILANJANA	20-06-20	04-08-20	-do-	-do-	-do-	2	11	34	55	18-10-20	-do-
33	SADA KAMINI	24-06-20	07-08-20	-do-	-do-	-do-	2	8	25	38	18-10-20	-do-
34	DAD SHAL	17-06-20	07-08-20	-do-	-do-	-do-	2	9	28	45	18-10-20	-do-
35	TANGRA SHAL	17-06-20	07-08-20	-do-	-do-	-do-	2	8	23	21	18-10-20	-do-
36	SITA SHAL	17-06-20	07-08-20	-do-	-do-	-do-	2	7	25	43	18-10-20	-do-
37	RABAN SHAL	17-06-20	07-08-20	-do-	-do-	-do-	2	8	29	49	18-10-20	-do-
38	JHINGA SHAL	17-06-20	07-08-20	-do-	-do-	-do-	2	8	27	44	18-10-20	-do-

39	RUP SHAL	17-06-20	07-08-20	-do-	-do-	-do-	2	7	23	43	18-10-20	-do-
40	ORA SHAL	17-06-20	04-08-20	-do-	-do-	-do-	2	7	15	33	18-10-20	-do-
41	MARIJ SHAL	17-06-20	04-08-20	-do-	-do-	-do-	2	6	13	28	18-10-20	-do-
42	MALLIK SHAL	17-06-20	04-08-20	-do-	-do-	-do-	2	7	16	31	18-10-20	-do-
43	NAGRA SHAL	17-06-20	04-08-20	-do-	-do-	-do-	2	6	17	32	18-10-20	20.11.20
44	DAROKA SHAL	17-06-20	04-08-20	-do-	-do-	-do-	2	8	17	36	18-10-20	-do-
45	RAJ SHAL	17-06-20	04-08-20	-do-	-do-	-do-	2	9	30	44	18-10-20	-do-
46	NARASINGHA SORU	20-06-20	07-08-20	-do-	-do-	-do-	2	5	18	38	18-10-20	-do-
47	MADAR DUDESHWAR	17-06-20	04-08-20	-do-	-do-	-do-	2	5	22	44	18-10-20	-do-
48	AMAN DUDESHWAR	17-06-20	04-08-20	-do-	-do-	-do-	2	9	25	47	18-10-20	-do-
49	HALKA LAL DUDESHWAR	17-06-20	04-08-20	-do-	-do-	-do-	2	7	24	46	18-10-20	-do-
50	N C KALMA	28-06-20	04-08-20	-do-	-do-	-do-	2	9	18	30	18-10-20	-do-
51	SADA MOTA	20-06-20	07-08-20	-do-	-do-	-do-	2	8	24	46	18-10-20	-do-
52	PATNI	17-06-20	04-08-20	-do-	-do-	-do-	2	9	22	35	18-10-20	-do-
53	NAGALAND	20-06-20	04-08-20	-do-	-do-	-do-	2	6	13	32	18-10-20	-do-
54	NIKO	20-06-20	07-08-20	-do-	-do-	-do-	2	8	12	31	18-10-20	-do-
55	SWARNA PANJI	20-06-20	07-08-20	-do-	-do-	-do-	2	9	29	49	18-10-20	-do-
56	BAL MUSUR	20-06-20	07-08-20	-do-	-do-	-do-	2	5	28		18-10-20	26.11.20
57	BAKHAR BAT	20-06-20	07-08-20	-do-	-do-	-do-	2	8	11	39	18-10-20	-do-
58	MOUL	17-06-20	07-08-20	-do-	-do-	-do-	2	7	10	46	18-10-20	-do-
59	KAJAL GOURI	20-06-20	07-08-20	-do-	-do-	-do-	2	7	28	39	18-10-20	-do-
60	BIRAHA	24-06-20	07-08-20	-do-	-do-	-do-	2	5	29	38	18-10-20	-do-

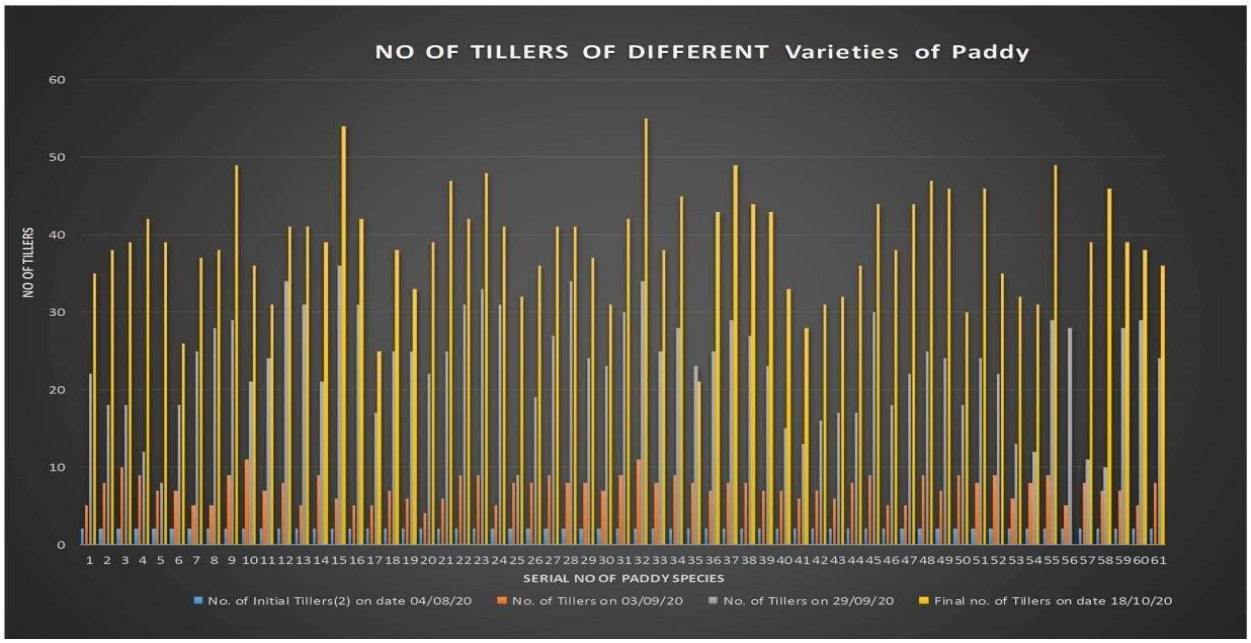

Figure-1: Bar-Diagramme showing the Number of Tillers of different variants of Indigenous Paddy

6.2 Observations about the Biodiversity in the Paddy Fields:

Table-2: Observations about Biodiversity in the Paddy-Fields on 15th September, 2020

Location: Surroundings our field Weather : Warm and Moist					Date : 15th September, 2020 Time :)7 am to 10 am	
Sl. no	Organism	Where	DoingWhat	How	Any other observation	Any Movement
1	Salikh (*Common Moyna)*	Betel Vine BORAJ	Sitting	—	—	Flying away
2	Kajal Pakhi *(tiger fly-catcher)*	On banana plant	Sitting	–	–	Still sitting
3	Small Frog *(crab eating)*	On bund of paddy field	Jumping	Searching food	Colleting small insects	Jumpingaway
4	Dragan-Fly. (red) (Very small insects)	On Paddyplant	Sitting	Doing not known	—	sitting and flaying
5	Spider	On leaf	Spinning	Small		Using
6	Small Grasshopper. *(nymph)*	On grass	Jumping On grass	—	Feeds by using mouthparts	Jumps occasionally
7	Medium Grasshopper*(nymph)*	On grass	Jumping	Grasses	Cutting	Jumping when disturbed
8	Dragon fly.	Above water	Flying	Using wings	Sometimes sitting on floating weeds	Sitting andflying
9	Snail	Under waterin the paddyfield	Attached to weeds	Feeding on (*Pata saola, Algae*)	Slow moving	Moving slowly underwater
10	Painted Grasshopper	On leaf	Sitting	leaf	Using mouth and front legs	Jump andfly

11	Green Grasshopper	On leaf	Sitting	Leaf	Sitting	
12	Ants	On the branches of a Arhar plant	Moving in groups	Branches	Small whitish insects arefound	Seems to get something from insects
13	Butterfly	On leaves of Akanda	Laying eggs (eggs are found)	For reproduction	Larva and Pupaseen	Moving
14	Insects	On leaves of grasses	Eating laves	Using mouth parts	Moving	Jumping

Table-3: Observations about Biodiversity in School Surroundings on 15th September, 2020

Location: School surroundings Weather : Warm and Moist					Date : 15th September, 2020 Time : 8 am to 11 am	
Sl. no	Organism	Where	DoingWhat	How	Any other observation	Any Movement
1	Garden lizard	*On the branches of a small mango tree*	*Sitting idlefor prey*	—	*Slowly moving towards ainsect*	*Caught the insect*
2	Tailor bird (Tuntuni)	*On a small flowering plant*	*Trying tobuild nest*	*Collecting small twigsof other dryplants*	*One bird is doing the joband the other observing it*	*Doing the job*
3	Phinge	*Sitting on abranch of atree near paddy field*	*Flying and catching insects from the field*	*Just colleting insects with itsbeak*	*After finishing trying for another insect*	—
4	Snake	*On the grassy field*	*Moving*	*Moving with a zig zac fashion*	*Moving away*	—
5	Frog	*Small size, onthe grasses near paddy pits*	*Sitting for collectingsmall insects*	*Peculiar way of throwing the tongue*	*Jumpingaway*	*Jumping Away*
6	Parrot	*Siting nearpaddy field on a tree*	*Makingsound*	*Voice Making cord*	*Colleting Fruits of the plants*	—
7	Inset Larva	*On leaves of Aswatha, Jamrul and other plants*	*Eating voraciously on leaves*	*Mouth parts*	*Continuously eating even If disturbed*	*Collected along with the leaves*
8	Machhranga(State bird)	*On a plants near a pond*	*Looking forfish in the pond*	*Fish collection not seen*	*Sitting*	*Sitting*

Table-4: Observations about Biodiversity in the Surroundings Gardens on different days during 2020

Sl. No.	Observed Organisms	Habitat	Remarks
1.	Small red ant (abundant)	On the apical part of Hibiscus (small whitish insects are there)	Moving in search of food`
2.	Spider	In the lower surface ofleaves of mango tree	Weaving web and wait for insects
3.	Yellow butterfly (life cycle studied)	On flower Rangan	Collect nectars from flower.
4.	Moth (along with Pupa)	On leaf of Rangan.	Flying
5.	Large black ant (abundant)	On the stem of Akanda	Moving towards tip from Ground
6.	Larvae eating leaves of Jamrul	On the ground.	Searching the food
7.	Butterfly	In the Peepal tree andin the field.	Flying and sitting on the branches of tree and ground.
8.	Grasshopper	On the leaf of smallgrass in the field.	Sitting on the leaf
9.	Garden snail (Achatina)	In the kitchen garden	Eating away leaves of plan In the garden
10	Birds (Crow, Sparrow, Salik)	In the ground in front ofhouse	Searching food, Crow cawing

7. Findings of the Study:

Following Findings have been revealed from this Study.

1) **60 varieties of indigenous Paddy:** It has been found that more than 60 varieties of indigenous Paddy have been cultivated in and around the Sagar Island for a long time back.

2) **Glossary of Indigenous Paddy:** It has been reaved from the experimental cultivation of 60 varieties of Indigenous Paddy Seeds (See Table-1) that these are ecofriendly with the local environment and climate resistant.

3) **Diversified habit and habitat, coexistence of Organisms in an Ecosystem:** Several types of organisms (plants and animal) are living in the same habitat, making an Ecosystem; but having different types of habits; e.g., some organisms found in the morning, but they are not found in the afternoon, other organisms are active in afternoon or in evening. Some organisms are living on the upper surface of the leaves, the others are seen on the lower surface of the leaves; some feeds on leaves, while others on flowers; some lives in soil, while others live in the water.

4) A single tree can be a habit for several types of organisms.

5) **Comparison of the Faunal Diversity and Richness in two different types of Areas:** A comparative Study between following two areas has been made-
   (a) **Study Area-1:** Residential areas of the village paras; which are full of trees and bushes, but very thin population, very cam-an-quiet area, silent, less disturbed environment;
   (b) **Study Area-2:** School surrounding area, where number of plants are less, but comparatively much populated, noises and disturbed with various activities.

   It has revealed from the Study that there are remarkable differences between the above-mentioned two types of areas within the Sagar Island.
   (i) Richness and presence of flora and fauna are high in Study Area-1, and it is due to changing of habit and habitats of organisms. Ants, Butterflies, Moths, Lies, Dragonflies and other insects are not only more in numbers but also more in varieties mainly owing to the high density and diversity of plants and habitat conditions.
   (ii) But it is found in the Study Area-2 that butterflies are damaging the plants, their larvae are eating the leaves and causing harm. It is assumed that change of habit and habitats, including feeding habits of Organisms are due to changes in Environmental demography of the area.

6) **Movement of Animals:** During Study it has been observed that mainly different types of movements-
   (i) **Crawling / Creeping:** some animals crawl or walk on the ground, tree trunk, leaves & flowers (e.g., centipedes, millipedes, ants caterpillars, birds, cats, dogs, cows, etc.);
   (ii) **Hop-n-Jump:** Some of the animals use in hop and jump (e.g., toads & frogs),
   (iii) **Walking/ Running:** Some animals are walking /running for their movement (e.g., cats, dogs, cows, etc.).
   (iv) Swimming: Fishes, prawns, and even some types of snakes are swimming in the ponds, rivers and water bodies;
   (v) Flying: Several types of Birds, and even Insects are flying on the sky.

7) **Completion of Life-cycle within Ecosystem:** From the observations of Life Cycle of Butterflies it is realized that butterflies prefer specific plants for their food, and also for laying their eggs. The caterpillars have eating preference and eat laves, which may seem to be causing harm, but on the other hand Butterflies helps in pollination, a great contribution in maintaining ecosystem.

8) **Preference of Habitats:** Different animals share different habitats depending on the micro- and macro-environments within the same ecological space; some organisms live on the upper-surface of the leaves, while others on the lower-surface of the leaves; some lives on the trunk (surface or within the barks); some on the ground (surface or under the surface). Such diversity is due to the sustainable adaptation to different microhabitats.

9) **Inter-relationship between Plant-Animal:** Some organism (animals) prefers particular type of plants for living and develop inter-relationship; perhaps, such interrelationship is based on their food, security, reproduction, resting, hiding, nesting, micro-climatic conditions of the organisms; e.g., a particular type of butterflies feed on nectars of a particular type of flowers, ants feed on juice of specific flower or plants or animals.

8. Conclusion:

It has been revealed from this Study that there are various types of plants and animals *(as recorded in the abovementioned Tables 1 to 4 and shown in photographs)* with different types of relationships. Both the Students and the Teachers, who have directly and indirectly associated with Project, have acquired vast experience and gained practical knowledge about the different types indigenous Paddy and relationships with the organisms (plants and animals); which makes the **Ecosystem** *(Paddy field Ecosystem)* of Sagar Island.

The Study helps in understanding the composition of Biodiversity (Species) of this Island, and the inter and intra relationships between the components (micro & macro-Flora & Fauna) of this ecosystem. The Study groups have witnessed the importance of different types or organisms for maintaining the food chain and food web of the Paddy-field.

It has evident from this study that-

"No Organism can live alone and stay isolated,rather, each and every Organism has to build and judiciously maintain its bonding and relationship with others of their surroundings for their own existence."

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