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*Research Article*

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# Bioresource Utilization in the Management of Insect and Pest in Rice Cultivation by Garo Tribe of West Garo Hill District, Meghalaya

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## ABSTRACT

*Bioresource utilization forms an inseparable part in the life among the tribal communities in the management of insect and pest in rice cultivation. As they reside close to hill ranges and forest with vast bioresource, their main and only option is the uses different plant parts as food, fooder, medicine as well as botanical pesticides for pest management of insect and pest in crop field. In the present scenario of rice cultivation as more emphasis is being given on save or eco-friendly agriculture, it has become very much necessary to know about the role of existing botanicals as well as different new plants or trees which can serve the purpose of botanical pesticides in rice or other crops. The present paper is an effort made to explore and document some vital aspects of plant based traditional skills and knowledge related to rice pest management by Garo tribe in west Garo Hill District, Meghalaya. The study was conducted through extensive personal interview through a questionnaire and depth discussion with the farmers of West Garo Hill District, Meghalaya. About 24 biopesticide plant species distributed across 20 families have been documented in the present study. This study may provide ample scope for further pest management studies as well as in the development of eco-friendly technologies for biopesticide production.*

***Keywords***: *Bioresource, Biopesticide, Rice pest management, Garo Tribe.*

## INTRODUCTION

Tribal people are the ecosystem people who live in harmony with the nature and maintain a close link between man and environment[11]. They depend to a great extent on the plant diversity as the main source of raw material being used traditionally as biopesticide, food, fodder, fuel, ethno-medicine, agricultural and, handicrafts etc. Due to their constant interaction with nature; they have also developed culturally important technologies of utilizing the vast available plant resources in the management of insect and pest in crop field.

NE India represents an important part of the Indo-Myanmar biodiversity hotspot, one of the 25 global biodiversity hotspots recognized currently[8]. Besides its rich floristic diversity NE India is also a *living anthropological museum* as large number of tribes with varied social-cultural traditions and they lead an intricate life totally dependent on the surrounding plant resources. Although numbers of studies have been carried out on ethno medicine among different tribes in NE India the extensive research and scientific documentation of utilization of bioresource in the management of insect and pest in crop field by tribal communities is very less[1,2,4,7,9,12–14]. The Garo people live in and around the hill tract and actively involved in rice farming as rice is their main food from morning breakfast to dinner, they possess enormous ethno botanical knowledge in the management of insect and pest in rice field.

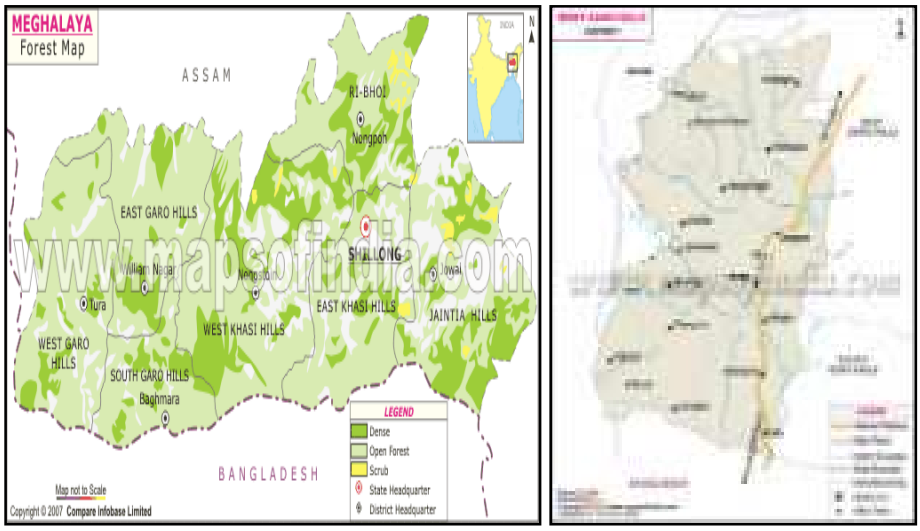
To enhance eco-friendly agriculture, the role of existing botanicals as well as different new plants or trees is very much necessary to know which may serve purpose of botanical pesticides in rice cultivation[6].

Hence, an attempt has been made in the present paper to document of some plant resource uses by Garo people in the management of insect and pest aspects in rice field.

## STUDY AREA

West Garo Hills is one of the largest district of Meghalaya located in the western part of the State. The population is pre-dominantly inhabited by the Garos, a tribe with a matrilineal society belonging to the Bodo family of the Tibeto-Burman race tribes. The whole of Garo Hills region forms a sort of undulating plateau with plenty of flat lands and valleys with altitudes varying from 100-1400 m above sea level. The climate of the district is largely controlled by South-West monsoon and seasonal winds. The average rainfall is 330 cms.

**Fig: Map of study area (Source- www.mapsoindia.com)**




## LOCATIO AND GEOGRAPHICAL AREA

The district occupies an area of 367700 Hectare. West Garo Hills district is located at the westernmost part of Meghalaya. The district is bounded by East Garo Hills on the east, by South Garo Hills on the south- east, Goalpara district of Assam state on the north and north-west and Bangladesh on the south.

## TOPOGRAPHY

The West Garo Hills district is mostly hilly with plains fringing the northern, western and the south-western borders. Tura Range , Arbella Range and Ranggira Range are the three important mountain ranges in the district of Garo Hill. The district falls between 90°30' and 89°40' East longitudes North latitudes and 26° and 25°20' North latitudes. The forests of West Garo Hill district spread over an area of 165508 Hectare.

## The GARO TRIBAL

The early history of Garo is shrouded in mystery. The different epic lores of the Garo portray the glorious aspects of this history of the Garo nine hundred years back when they were independent and powerfull with their capital at Gaur, now in ruins in modern west Bengal[10]. The Garo have also tradition that in dim and distant part their fore father i.e nine headmen, the offspring of a Hindu fakir and a Tibetan woman came down from the northern mountains and after a halt at Koch Behar, made their way to Jogighopa and thence cross the Brahamaputra to Dalgoma and finally into Garo Hills[3]. According to Sangman Garo moves from Koch Behar to Rangamati in Goalpara District of lower Assam[17]. They wandered eastward up the Brahamaputra velly and move on to the bank of Manas River, Jogighopa, Garomari( Goalpara), Kamakha, Baghmela pahar, Tukreswari ( Goalpara) and finally settled in the Garo Hills that now forms the home of the tribes. Although the route of their migration is not clear the river Brahamaputra definitely played its major part in the process of their migration and finally settlement in the region of Garo Hill.

Ethnically the Garo belongs to the Mongoloid race like most of the tribe of the NE India. Garo like other tribes of Assam belong to Tibets-Burman families of Boro linguistic group. The Garo call themselves Achik-Mande which literally means –Hill man, ‘Achik’ means hills and ‘Mande’ means man.

## MATERIALS AND METHODS

The study was conducted with a sample of 75 farmers of West Garo Hill District, Meghalaya and southern part of Goalpara District, Assam. Standard methods such as extensive personal interview, in-depth discussion and participant observation were used in the field to generate the required mass of data. Information about uses of different plant species against target pest, mode of application against specific pest in rice field, vernacular names of these plant species and their different part/parts used for the same etc. were recorded. All the enumerated plant species were identified with the help of relevant and standard literatures in Botanical survey of India (BSI), Shilong.. For each plant species their scientific name, family and local names (in Assamese) are enlisted. The data on scientific orientation were collected by using the scale developed by Supe and Singh[16]. Frequency and percentage of respondents using bioresource as biopesticide against insect and pest in rice field were calculated from these collected data.

## RESULTS AND DISCUSSION

After going extensive personal interview and in depth discussion with farmers it was revealed that majority of farmers were aware about plant bioresource utilization in crop protection and these are known to them from senior farmers. Among them marginal farmers depend on more plant resource than medium and large farm holding farmers for insect pest management in rice field. This may be due to the high cost of chemical insecticide and pesticide against low cost of utilization of surrounding plant resource for crop protection.

The collected informations on plant bioresource utilized against insect pest and mode of applications are compiled into an orderly fashion by placing common and scientific names of plants their family.

- Name of plant: **Neem** (*Azadirachta indica* A. Juss) , Meliaceae

***Target against pest***: Stem borer ( *Scirpophega incertulus*) Rice weevil (*Sitophillus oryza*) and rice moth (*Sitotroga cerealella*) and Gandhi bug(*Leptocorsia oratoris*)

***Mode of application***:

1. Neem seeds and leaves are collected and are dried in the month of July. It is dehusked and the seed kernel is pounded to make powder. The powder is steamed and extract is sprinkled in the rice crop. The extract is prepared by mixing 1 to 3 grams of neem powder in 11 liter of water for 12 hours.
2. During milky stage of paddy crops small bundles of neem plants are placed here and there. Bug are repelled by using this practice.
3. Twigs of neem plants are kept over the stored rice to control rice weevil.

- Name of plant : **Koras**( *Pongamia pinnata)* , Fabaceae

***Target against pest***: Yellow stem borer ( *Scirpophaga incertulus*)

***Mode of application****:*

Koras seeds are collected and properly dried during April May. The seed covering are separated and seed carnels are pounded to powder. The powder is steamed and extracted by applying pressure. The seed powder is mixed with other seed powders for preparation of seed mixture.

- Name of plant: **water piper or bihlongi** (*Polygonum hydropiper* L.), Polygonaceae

***Target against pest***: WBPH ( *Sogatella furcifera*) and BPH ( *Nilaparvata lugens* )

***Mode of application***:

Leaves and Seed are collected during April-May. The dehusked seeds and leaves are subjected to extraction. The extract is applied as soil incorporation at the time of final field preparation or as broadcast during initial tillering stage of the crop (July –Aug). It is used by the farmers for both insecticidal as well as fertilizer purposes.

- Name of plant: **Sal** ( *Shorea robusta),* Dipterocarpaceae

***Target against pest***: Rice hispa (*Dicladispa armigera*)

***Mode of application***:

Sal trees flowers during May-June. The flowers are collected by the farmers and applied to the standing water of rice field against insect pest.

- Name of plant: **Tobacco or Dhopat** ( *Nicotiana tabaccum)* , Solanaceae

***Target against pest****:* Stem borer (*Scirpophega incertulus*) and leaf folder (*Cnaphalocrocis medinalis guenee*)

***Mode of application****:*

Tobacco plant powder at 7-10 days after transplanting of rice in kharif effectively controls the stem borer and leaf folder as it contain nicotine sulphate, which act as repellent.

- Name of the plant: **Garlic/ Naharu** ( *Allium sativum)*: Liliaceae

***Target against pest***: Repellent against all rice pest.

***Mode of application*:**

Garlic and tobacco leaves are boiled in water for about half an hour. The decoction is taken out and is diluted to desired concentration. The solution made of extracts of 1 kg of garlic, 200 grams of tobacco leaves and 200 grams of washing powder is dissolved in 200 liters of water and sprayed on the affected crop of paddy. This solution is applied as foliar spray to rice plants for protection against insect pest.

- Name of plant: **Colocasia/ Kola kasu** ( *Colocasia esculenta,)*Araceae

***Target against pest***: Case worm (*Nymphalla depunctalis*)

***Mode of application*:**

Wild colocasia plants are chopped and applied to the field on standing water and raw cow dung is applied to the standing water in the rice field. The purpose of this practice is to kill the larvae of the case worm which float in the standing water in the rice field and feed on the leaf epidermis of rice plants during morning and afternoon. The case worm larva respires with the help of rectal gills and oxygen is taken from the water like fish. Therefore, if water is drained out of rice fields, they cannot thrive. On the other hand, if the raw cow dung is applied to standing water, it becomes turbid and respiratory function is disturbed. Application *of* colocasia *plants* makes the water toxic to Protection of Crop field larvae. Draining out water from rice fields has excellent effect, killing about 100% caseworm larvae, whereas, application of chopped colocasia plant and raw cow dung to standing water in the field controls 75-80 % of case worm larvae.

- Name of plant: **pulp of pumelo/ Robabtenga** ( *Citrus grandis )*,Rutaceae

***Target against pest***: YSB(*Sciropophega incertulus)*

***Mode of application:***

Slices of fruits are placed in the paddy field @ 1 trap/6 m2. These pieces are fixed on bamboo sticks which are inserted in the paddy field.

The essential oils of pumelo respells stem borer.

- Name of plant : **Drumstick/ Sajina** (*Moringa oleifera* Lam),Moringaceae

***Target against pest***: YSB (*Sciropophege incertulus)*

***Mode of application*:**

Placing grounded bark of drumstick in the rice field. Bark may contain insecticidal principles. It has also some medicinal properties.

- Name of plant: **Costus/ Jamlakhuti**( *Costus speciosus), c*ostaceae

***Target against pest***: Rice hispa (*Dicladispa armigera*)

***Mode of application****:*

Rhizome of Jamlakhuti is crushed to make a pest and the juice extract is diluted and sprayed in paddy field to control rice hispa.

- Name of plant: **Wild sugarcane**(*Saccharum spontanum),* Poaceae

***Target against pest***: Leaf folder (*Cnaphalocrocis medinalis guenee)* and caseworm (*Nymphalla depunctalis*)

***Mode of application****:*

Wild sugarcane twigs of height 4 to 5 ft and 4 to 5 cm diameter are planted after 15 days of transplanting in rice field for control of leaf folder. These erect branches harbour the predators of leaf folder at the time of occurrence, thereby suppressing the incidence of the pest.

- Name of plant: **Vitex/ Posotia** ( *Vitex negundo),*verbenaceae

***Target against pest****:* All major type of insect and pest.

***Mode of application:***

The mixture of vitex and hing is considered effective bio-pesticide for rice pest. It contains certain ingredients having insecticidal as well as insect repellent property which makes it useful for control of insect pests of paddy crop. About 30-40 leaves of vitex are boiled in 10 liter water till it condensed to one liter. About 10 gram of hing is then mixed in it. These gradients are mixed in about of 5 liter of cow urine. The mixture is then filtered and sprayed as biopesticide over affected crops

Dried leaves of Vitex and neem are also kept in container containing storage of rice. The container gives protection against insects and free from insect infestation.

- Name of plant : **Croton/ Konibih**( *Croton tigelium),*Euphorbiaceae

***Target against pest***: rice moth and other pest in stored grain

***Mode of application***: branches of Croton and neem are mixed and spread in between and at the upper surface in the stored paddy grains. This practice has been found to control rice moth.

- Name of plant: **Murraya/ Narasingha** ( *Murraya koenigii),Rutaceae*

***Target against pest****:* Pest of stored grain

***Mode of application***:

Leaves of Narasingha are placed on the heaps of rice grains in the storage. It prevents storage insects pest from causing damage because curry leaves have high pesticidal properties.

Besides these several other plants have been recorded which are used in pest management in rice field by tribal community. Some of these are nux vomica *( Strychnos nux vomica)* Bihdhekia' (*Sphaerostiphnos unitus*; wild fern), 'Bogori' (*Ziziphus* spp.), citrus (*Citrus* spp.) or lemon (*Citrus lemon*), sida hemp (*Sida rhombifolia*), '*Keturi Haldhi'* or wild turmeric (*Curcum* spp.), Bhung*'* (*Cannabis sativa),* Ghoraneem (*Melia azadirachta), etc.*

From this observation it is noticed that a total of 24 plant species have been identified having the insecticidal properties. Although all the plants had not been used equally for all purpose, it is observed (Table I) that most of the respondent used *Pongamia pinnata*(94.66%), *Vitex negundo*( 94.66%*)*, *Azadirachta indica* A. Juss (93.33%), *Saccharum spontanum* (85.33%*),Croton tigelium (*85.66%*)* as biopesticide in rice cultivation. In addition to this (Except *Saccharum spontanum)* these plants are used in both pre and post harvest time. Other remaining plants are used for specific purpose against specific pest.

As the Garo people use plants in their day to day life they have very rich knowledge about botanical resource. Their knowledge has become very much necessary to know about the role of existing botanicals as well as different new plants or trees which can serve the purpose of botanical pesticides in rice. But there are many of the botanical based traditional knowledge still exist and have not found a proper place in record with their geographic position of existence. Till now they use available botanicals in their rice field for pest management which provided a scope for implementing botanical based IPM in their area.

**TableI: Frequency and percentage of respondents using bioresource against insect and pest in rice cultivation**

| Name of plants | Purpose of use | Category of respondents | | | Total no of respondents used the specific plant | Percentage of respondents |
|---|---|---|---|---|---|---|
| | | use Regular | use Some time | Not used | | |
| *Azadirachta indica* A. Juss | Protection of Crop field, storage grain | 49 ( 5.33) | 21 (28.00) | 05 (06.66) | 70 | 93.33 |
| *Pongamia pinnata* | Protection of crop field, stored grain | 55 (73.33) | 16 (21.33) | 04 (05.33) | 71 | 94.66 |
| *Polygonum hydropiper* L | During field preparation , as fertilizer | 40 (53.33) | 22 (29,33) | 13 (17.33) | 62 | 82.66 |
| *Shorea robusta* | Protection of Crop field | 27 (36.00) | 35 (46.66) | 13 (17.33) | 62 | 82.66 |
| *Nicotiana tabaccum* | Protection of Crop field | 26 (34.66) | 22 (29.33) | 27 (36.00) | 48 | 64.00 |
| *Allium sativum* | Protection of Crop field | 34 (45.33) | 29 (38.66) | 12 (16.00) | 63 | 84.00 |
| *Colocasia esculenta* | Protection of Crop field from case worm, seed germination | 24 (32.00) | 32 (42.66) | 19 (25.33) | 56 | 74.66 |
| *Citrus grandis* | Used during flowering | 21 (28.00) | 32 (42.66) | 22 (29.33) | 53 | 70.66 |
| *Moringa oleifera* Lam | Protection of Crop field | 19 (25.33) | 43 (57.33) | 13 (17.33) | 62 | 82.66 |
| *Costus speciosus* | Protection of Crop field | 22 (29.33) | 29 (38.66) | 24 (32.00) | 51 | 68.00 |
| *Saccharum spontanum* | Protection of Crop field | 45 (60.00) | 19 (25.33) | 11 (14.66) | 64 | 85.33 |
| *Vitex negundo* | Protection of Crop field, stored grain | 39 (52.00) | 32 (42.66) | 4 (05.33) | 71 | 94.66 |
| *Murraya koenigii* | Protection of Crop field, stored grain | 51 (68.00) | 11 (14.66) | 13 (17.33) | 62 | 82.66 |
| *Croton tigelium* | Protection of Crop field, stored grain | 44 (58.66) | 21 (28.00) | 10 (13.33) | 65 | 85.66 |

Total number of respondents: 75( N=75) Figures in the parentheses indicate percentages

## CONCLUSION

In the present scenario of increasing population and health hazards created by chemical pesticides, the existing botanical based knowledge can form a powerful tool to combat the complex insect pest situation of rice without damaging the environment and human health. The past experiences with present efforts combined with suitable modification will certainly enable the researcher as well as the farmers to revive the valuable technologies existing in our country so that selective, diverse, economic and environmentally acceptable plant products can be used for successful management of insect pests in rice.

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