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RESEARCH ARTICLE

Multi-crop Exploration in Unexplored Areas of Garo Hills, Meghalaya

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Abstract

A multi-crop exploration trip in difficult and unexplored areas falling under South Garo Hills, West Garo Hills and South West Garo Hills districts of Meghalaya was conducted to collect the diversity in different agri-horticultural crops, their wild relatives and other economically important plants. During exploration, 170 diverse germplasm belonging to cereals, millets and pseudo-cereals, pulses, oilseeds, vegetables, tuber crops, citrus etc., were collected from 10 development blocks from 21st to 30th November 2018. Rice is the main staple crop of the area. Interestingly, the germplasm collected included aromatic, sticky, and medicinal rice landraces with tremendous variability. Of the landraces collected in different crops, 29 landraces of paddy and 14 of maize are the new addition to the National Gene bank from the area. In addition, some less known ethnically important plants being cultivated in kitchen gardens/homesteads collected with traditional knowledge were *Corchorus capsularis* (as vegetable), *Clerodendrum colebrookianum* (a source of treating high blood pressure), *Aegle marmelos* (source of local tea), *Citrus indica* locally known as *Memang Narang* (cure for jaundice and stomach ailments) and also information on preparation of local liquor from sticky rice and Job's tears. Due to the spread of new technology, the use of high-yielding varieties, and the introduction of new crops, many traditional varieties are eroding. Hence, conserving the available diversity from such unexplored and difficult areas is of tremendous importance and value.

Keywords: Garo hills, Germplasm, Multi-crop, Unexplored areas, Wild relatives.

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Introduction

Meghalaya, one of the states of North-eastern hill (NEH) Region, is considered a hot spot of India's biodiversity (Mittermeier *et al.,* 2011). The inhabitants of the state have different cultural backgrounds, various food habits, and inhabit in adverse climatic situations resulted in the cultivation of diverse crops. The agricultural production system, characterized by large variation in cropping intensity, mono-cropping and subsistence farming, is complex, diverse and risk-prone. Shifting cultivation, locally known as *jhum*, is the mainstay of the economy in most of the parts of NEH states, including Meghalaya. Keeping in view the richness of genetic diversity and gap analysis of conserved germplasm, multi-crop germplasm collection trips were conducted mainly in unexplored localities of South Garo Hills, West Garo Hills and South West Garo Hills districts of Meghalaya, located between 25°.10′ & 25°. 35′ N latitude and 90°.15′ & 91°. 0′ E longitude. The average altitude of the explored area ranged between 300 to 1000 above msl. Over 1800 accessions of various agri-horticultural crops, wild relatives and other economic species were collected from Garo Hills, while only over 800 accessions could be collected and conserved from explored districts.

Garo tribe (*Sangma, Marak, Momin*) is the inhabitant of surveyed area. The tribe has two divisions, one inhabits the hilly mountains,

and the other lives in the plain areas and valleys. Besides this tribe, *Koches, Rabhas, Hajongs*, and Banars also reside in these districts. Plants and plant products play an important role in folk life of inhabitants and thus are an integral part of their culture (Jaiswal, 2010). Agriculture (*Jhum* or slash & burn and settled agriculture) is the main occupation of local tribes. Generally, mixed cropping is done in hilly areas, which the inhabitants opt to produce their household food and to fulfill nutrition needs from their own farm. Rice is the main crop grown both in *jhum* land and plain areas. They brew local beverages (beer) known as *Mi-Bitchi* or *Chubitchi* or *Minil Bichi* or *Chubok*, using local sticky/glutinous rice for consumption and also to offer their deity '*Saljong*' (Sun) during '*Wangla*' (festival of harvest). It is also served during *Dosi Dodoka* (wedding festivities) and religious rituals and as a refreshment drink for weary field laborers and guests. The local beverage has a great significance in the social and cultural life of the *Garos* (Marak *et al.,* 2021). Besides rice, the other major crops grown in the areas are maize, ginger, turmeric, vegetables, foxtail millet, *Coix*, rice bean, cowpea, pigeon pea, areca nut, taro, yam, Indian bay leaf, and some fruit crops such as banana, citrus, pineapple, coconut and cashew nut.

The forests of Meghalaya provide a large number of plants, the economic parts of which make an important contribution to the diet of local tribes, particularly those living near forests. About 70% of the state's total area is covered by forest, and the tribal communities own 90% of this (Kayang, 2007). The study of such useful plant wealth could be helpful in the identification of alternative sources of food and future crops for domestication. The explored area belongs to the outer territory of "Nokrek Biosphere Reserve", which is located on the Tura range. Evergreen and semi-evergreen deciduous forests dominate the landscape, while some patches of bamboo forest can also be found in the lower altitudes. The reserve is also known for the occurrence of rich diversity of *Citrus* spp. including *C. indica* (Indian wild orange), endemic to this region, hence has been designated as 'Citrus Gene Sanctuary', covering an area of 47 sq. km, provides a gene-pool for the improvement of citrus. Collecting and conserving the available genetic diversity from such important and under-explored difficult areas are, thus of tremendous importance and value.

Materials and Methods

As per National Exploration Plan 2018-19, two explorations were planned and inputs about areas and crops were obtained during a workshop organized on the conservation of plant genetic resources of Meghalaya, involving Krishi Vigyan Kendras (KVK's), officials from state agriculture and horticulture departments, local research organizations and progressive farmers of Meghalaya. During the survey, ten development blocks (Zikzak, Dalu, Dagenggiri, Rongram, Selsella, Gasuapara, Baghmara, Rongra, and Chokpot) belonging to South Garo Hill, West Garo Hill and South West Garo Hill districts were extensively explored during 21st to 30th November 2018. The route followed and areas covered in the exploration and germplasm collection trip have been depicted in Figure 1. Standard germplasm exploration and collection procedures developed by ICAR-NBPGR, New Delhi (Tyagi *et al*., 2016) were followed. Whereas, individual and selective sampling methods were adopted for horticultural crops, and a random sampling method was adopted for agricultural crops with an aim to capture all the alleles from the represented population. In the majority of cases, the germplasm was sampled from the farmer's field; however, the germplasm was also collected from threshing yards/farmer stores as and when required.

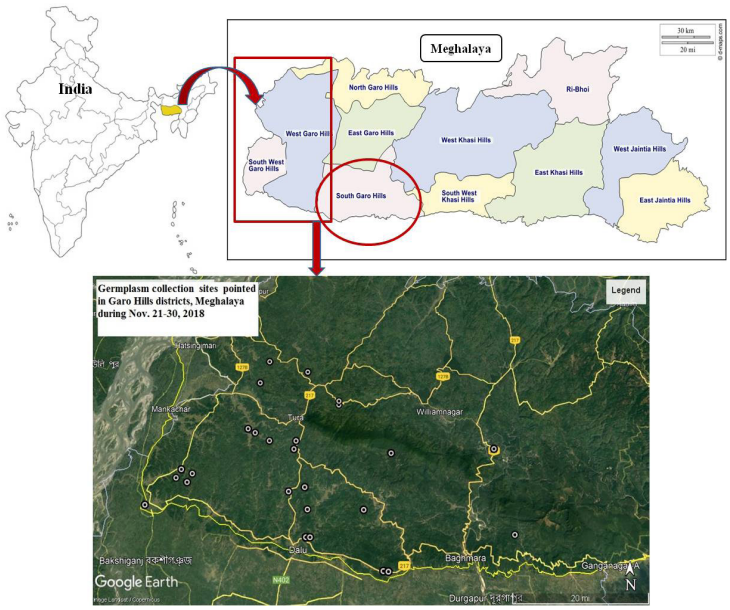

Figure 1: Area covered and route followed during exploration and germplasm collection programme undertaken in parts of Garo hills

Natural and partly-disturbed habitats were sampled for collections of wild useful plants and crop wild relatives. The samples were collected in the form of seeds, fruits, bulbs, corms, rhizomes, tubers, etc., based on their mode of propagation. Tribal markets or weekly *haats* were also visited to record the plants and plant products sold there. For recording ethnobotanical information, discussions were held with the headman (Nokma's) and head of the families of villages surveyed. The passport data were recorded as per standard passport datasheet, and the collector number was allotted to each collected sample. One set of the collected germplasm samples along with passport data were deposited in the National Genebank, ICAR-NBPGR, New Delhi for assigning IC numbers and conservation, while another set was retained for characterization and multiplication at a suitable site.

Results and Discussion

As per available records, over 5000 accessions of different agri-horticultural crops, wild relatives and other economic species have been collected from Meghalaya, of these over 1900 accessions are from Garo Hills. Among the three districts of Garo Hills, South Garo Hills is the least explored district, with only 110 accessions collected and conserved, while West Garo Hills also shows same trend. During the present exploration trips, a total of 170 diverse crop germplasm comprising rice (85), maize (17), millets (17), *Coix lacryma-jobi* (2), amaranth (3), pulses (4), oilseeds (7), vegetables (19) and others (16) have been collected as presented in Table 1. As far as the availability of rice landraces in NEH region, including Meghalaya, is concerned, thousands of rice landraces are being cultivated under lowland, upland and deep-water conditions (Hore, 2005). The farming communities of NEH region are still growing local landraces despite the impact of changes in climate, food habits and various demographic changes. A total of 85 accessions of rice with significant variability for grain & kernel size, shape and husk color, aroma, and early and late types were collected from surveyed areas (Figure 2A). Details of variability observed in 85 landraces comprising of scented or aromatic, sticky type, upland rice, and early types are given in Table 2. Of these, 29 landraces, namely *Babu jaha, Chaging minil, Chaging, Jaha gapok, Jarong, Kotchu ghisim, Kutchia ghisim, Lakhipur, Minil aringa, Minil gachcha, Minil gambal, Minil kakua, Minil michmopok, Minil mikongsi, Minil midambak, Minil nasket, Minil pappu, Mima buring, Mi kotchu, Mi kudep, Mima mianjke, Mi phisa, Mi wasit, Nal bini, Raha bini, Rong chram, Tairol, Thepra, Tulsimala* are new addition to the National Gene bank. The inhabitants of the study area consume rice as daily meal; however, sticky rice is eaten only in breakfast. Some of the local recipes prepared from rice are *Mimagorum, Jahagipok* (consumed both as regular meal and as special recipes during festivals); *Jahagitchak* rice landrace is mainly cooked during festivals or on special occasions; '*Pura*'- a traditional recipes prepared from a scented/ aromatic rice landrace *Jahagisim* is also supposed to be medicinal to cure *mibangnapa* (weakness); while cooked rice is wrapped with a banana leaf known as 'Rongjanggi' and is given to the patient the sticky rice landraces are used to make local recipes called **'***Pitha'* (steamed rice cake), '*Jakep'* (a mixture of rice flour and sesame seeds), and '*Sakin'* (rice is soaked in water for overnight the roasted sesame seeds are mixed in it while sugar is added for taste, which is wrapped by banana leaves and placed in a pot for cooking); a local liquor '*Mibitchi'* is also prepared by fermented sticky rice landraces. But at present, the above-mentioned recipes are hardly prepared by the inhabitants as most of the landraces have been eroded, except in a few pockets in and around the *jhum* lands of the Garo Hills.

Maize is the second most important food grain crop of entire NEH region. The availability of rich maize diversity in the region supports the consideration of the secondary centre of maize diversity (Singh, 1977). Being a part of the eastern Himalayas, Meghalaya also has remarkable diversity in maize. Diverse germplasm accessions with variability in grain color (yellow, cream, white and reddish black), grain shape (flint, dent, flat, beaked, pop) and grain size (small, medium, bold) were collected (Table 3). As per the existing genebank data, out of 17 collected maize landraces, 14 are new addition to the National genebank. Maize is consumed in different preparations like steamed and roasted grains cooked with rice and is also considered a good feed for animals and poultry.

In foxtail-millet, variability was collected (Table 4; Figure 2B) in panicle for grain color (black, yellowish and greyish) and size (10–20 cm). The tribals consume its grains as rice or make it into porridge, which is considered light and nutritive food. *Coix* is also very nutritive food of the area and generally cooked with rice and pulses; its grains are also used to brew local liquor and its roots are used as medicine. A specific plant type of *Coix* landrace having red grain has been collected from *Jhum* field in the Rondong area of Baghmara, South Garo Hills (Figure 2C). In the entire surveyed region the area of cultivation under *Coix* and little millet (*Panicum sumatrense*) is gradually declining due to change in food habits and adoption of remunerative cash crops by the farming community. In pulses, a rare type of soybean was collected with unique morphological characteristics like bushy plant habit, height up to 75 cm, profusely branched, 2.5 cm long, hairy pods with 2 to 3 seeds, grain small, flat, dull-white, greenish. Perennial pigeon pea is generally found to grow mainly in homesteads and *jhum* fields with rice, and it has been collected with variability in grain color, shape and size. In turmeric and ginger, the tribal people are cultivating local landraces on a large scale as commercial crops.

Table 1: Crop group wise collected accessions during exploration and collection from Garo Hills of Meghalaya

Crop group	*Botanical name*	*Crop name*	*Vernacular name*	*No. of accs.*
Cereals (102)	*Oryza sativa*	Rice	Mi, Mi ma	85
	Zea mays	Maize	Maraku, Meraku	17
Millets & pseudo-cereals (22)	*Coix lacryma-jobi*	Job's tear	Mairukku, Megaru	2
	Setaria italica	Finger millet	Misi	14
	Amaranthus spp.	Amaranth	Dangasak	3
	Panicum sumatrense	Little millet	Suji	1
	Sorghum bicolor	Jowar	Gonggit	2
Pulse crops (3)	*Cajanus cajan*	Pigeonpea	Mendu	1
	Vigna umbellata	Ricebean	Bil'lik	1
	V. mungo	Black gram	Maskalai	1
Oilseed crops (6)	*Brassica juncea*	Mustard	Me'jak	1
	Sesamum indicum	Sesame	Spin	4
	Glycine max	Soybean	Do'dim	1
Vegetable crops (16)	*Abelmoschus esculentus*	Okra	Dorai	1
	Benincasa hispida	Ash gourd	Akarukobok	1
	Solanum melongena	Brinjal	Mantau/Baring a'rongga	5
	Capsicum annuum	Chilli	Jal'lik/Murich	5
	Cucumis melo var. *conomon*	Oriental pickling melon	Bangi	1
	Luffa acutangula	Ridge gourd	Zinkha Daring	1
	L. hermaphrodita	Satputia	Satpuli-jinga	1
	L. cylindrica	Sponge gourd	Sawil	1
Tuber/bulbs, rhizomatous (6)	*Allium tuberosum*	Garlic chives	*RasinChisik*	1
	Alocasia indica	Giant taro	Kimachu/Kachchu	1
	Colocasia esculenta	Arvi	Ta'a	1
	Curcuma longa	Turmeric	Holdi	1
	Zingiber officinale	Ginger	E'ching	2
Fiber crops (2)	*Corchorus capsularis*	Jute	Nalia Pat	1
	Gossypium arboreum	Cotton	Kil	1
Fruit crops (11)	*Citrus medica; C. indica; C. xlatifolia; C. x limon; C. latipes; C. aurantium; C. hystrix; Citrus* hybrid	Citrus	Gancheng	11
Other crops (2)	*Clerodendrum colebrookianum*	East Indian Glory/Bhrangi	Dongum	1
	Trichosanthes wallichiana	Wild snake gourd	Trichosanthes	1

North eastern region holds over 23 species, 01 sub-species and 68 varieties of citrus, including wild and natural hybrids (Malik *et al*., 2012; Sharma *et al*., 2004).From Nokrek Biosphere Reserve, a total of 11 accessions of citrus species (*Citrus medica*, *C.indica*, *C. xlatifolia*, *C. latipes*, *C. aurantium*, *C. hystrix* and *Citrus* hybrid) were collected. The details of the characteristics recorded in different species are given in Table 5. *Citrus indica* (Figure 2D), locally known as *Memang Narang* is supposed to be the most primitive species and perhaps the progenitor of cultivated *citrus* occurring here (Tanaka, 1937). It is an endangered endemic species of this region; hence, is considered an important and unique germplasm. Garo tribe also used this species as medicine to cure jaundice and stomach ailments (Malik *et al*., 2006). Good variability in collected germplasm of citrus (Figure 2E) was observed for fruit shape (oval, oblong, pyriform, spherical), fruit weight (50–1300 g) and fruit color (yellow, orange, pale yellow) with smooth shining and rough peel as also reported by Singh and Singh (2006) from Garo hills.

Use of both wild and cultivated vegetables is an integral part of the food habit of local tribal communities (Samati, 2004; Kayang, 2007, Singh *et al.,* 2012). They consume different vegetables either raw or cooked and with non-vegetarian food preparations. As the tribals in the study area are largely dependent on wild plants and plant products for their existence, while their local markets can be seen with full

Table 2: Characters recorded at collection site in rice (*Oryza sativa*) landraces

Landrace name	*IC/Collector No.*	*Remarks (Trait-specific characters)*
Babujaha	IC-0635671	Small and bold grain, scented, kernel white, non-sticky
Chaging/ Chagingminil	IC-0629109	Grain bold, leaves broad, tall 3.5- 4ft., tillers 8-12, plant strong, upland rice, normal type
Champali	IC-0637008	Grain yellowish & medium, kernel white, plant thin & weak tall up to 3.5ft., tillers 6-12, normal, low land rice landrace with good taste
Ganji	KC/SK/AS-59	Sticky, grown in rainy season (saalidhan)
Goriya	IC-0631761	Blackish husk, kernel reddish (pre-kharif season crop locally called Ashudhan), early in maturity, require fertilizer for good yield
Halai	IC-0635676	Bold grains, good in taste
Jahaghisim	IC-0635673	Scented, aromatic, black husk, kernel white, elongated grain, small sized, easy in threshing
Jahagapok	IC-0635672	Plant height is medium, maturity 4 months, whitish or yellowish grain color, rice grain is smaller and finer, slightly sticky, two types of *Jahagapok, because of having* , smaller and bigger sized grains. The aroma of smaller grain *Jahagopok* is stronger than the bigger sized grain, yield upto 3.0-3.5 qtl./bigha.
Jarong	IC-0629108	Grain light brown & bold, tall up to 4.5ft., plant strong, upland rice, medium maturity
Kalajira	IC-0637005, IC-0635677	Highly scented, black husk, kernel white, small and elongated, low yielder tall up to 4.5 ft., scented
Kala bini	IC-0631763	Good in taste
Kishor mi	IC-0631760, KC/ SK/AS-47	Non-sticky, awned, kernel reddish white, good yielder, grain small, golden
Kotchughisim	KC/SK/AS-24, KC/SK/AS-46	Less sticky, scented, with strong aroma, blackish husk, kernel white grows well on medium lowland, plant ht. 140-150 cm, lodging prone, low yielder, medium, yield 3.0-3.5 qtl./ bigha
Kuchia	RSR/SH-18-20	Lowland, late type, grain bold, leaves broad, tall 4 – 5ft., tillers 10-15, strong plant.
Lakhipur	RSR/SH-18-10	Lowland, late type, grain bold, light brown, plant ht. 3ft.
Malbhog	IC-0637002, IC-0635674	Creamy husk, kernel white non-sticky, scented, soft and tasty, plant ht. 4 ft., scented, lowland type
Malschira	IC-0637003	Grain husk brown, sticky, plant week, leaf narrow, plant ht. 3 ft., tillers 8-10
Mekudep	IC-0631765	Early in maturity (six months), golden yellow husk, kernel white
Mikudep	IC-0631742	Non-sticky and scented
Memietimgitchak	IC-0631766	Husk light golden, kernel reddish. Considered good for rice beer
Mikatchu	IC-0629116, IC-0631747	Golden husk, oval, kernel white, used for preparation of rice beer' Chubak', tall up to 4ft, best for *jhum* cultivation, early type, maturity in August
Miron	IC-0629111	Husk colour pale yellow/ straw color, grain bold, plant tall up to 3.5ft., awned, irrigated, lowland rice
M chandak	IC-0635682	Light golden husk, grain flat, kernel white, good in taste
Mi bissa	IC-0631757	Grains small, oval, husk blackish, kernel white
Mi kotchu	IC-0631752	-
Mi kudep	IC-0631751	Less sticky, flat, light yellow/reddish grain husk
Mi ma	IC-0631754	Flat, golden yellow husk, kernel white
Mi miraka	IC-0631767	Husk light reddish, kernel white
Mi phisa	IC-0629117	Grain husk brown, kernel white, tall up to 4ft, best for *jhum* cultivation, early type, maturity in August
Mi wasit	IC-0635668	Sticky, scented, grains reddish, elongated, kernel white
Mi maboldok	IC-0629120, IC-0631748, IC-0635667	Whitish yellow husk, grain bold, pale yellow/straw color, kernel white, sticky, plant tall up to 4ft., best for *jhum* cultivation, early type, maturity in August
Mi maburing	IC-0635670	Golden yellow grains, scented, non-sticky
Mi machureng	IC-0629113	Old rice landrace, grain light brown normal, kernel white, tall up to 4ft. good yielder, upland rice, early, maturity in August
Mi maghisim	IC-0635666	Husk black, kernel white, scented
Mi maghisim	IC-0631749	Husk black, grain oval, sticky, tasty

Cont....

Mi maghisim	IC-0635669	Blackish husk, flat, small, reddish kernel
Mi magitchak	IC-0631744, IC-0631746, IC-0631755	Flat, blackish husk, kernel white, also used for medicinal purpose
Mi magorum	IC-0631768	Grain with golden husk, flat, kernel white, scented, also used as medicine. Rare in dry areas but grown in moist localities in Jhum.
Mima mi	KC/SK/As-14	Grain oval, bold, taste is good, kernel white
Mi mamianjke	IC-0629121	Grain light brown in color, medium bold, white kernel, plant tall up to 3.5–4ft., best for *jhum* cultivation, late type, maturity in Nov.
Mima misokmal	IC-0629118	Kernel white, plant tall up to 4 ft, best for *jhum* cultivation, early type, maturity in August
Minil agunia	IC-0637011	Grain husk brownish red, plant tall up to 3.5–4 ft., strong, sticky, low land rice, early type
Minil aringa	KC/SK/AS-28	Reddish husk, grain elongated, sticky
Minil danggap	IC-0629110	Grain bold, plant tall up to 5.5 ft, strong, tillers 8–12, low land rice
Minil dokdang	IC-0631769	Golden yellow husk, sticky, kernel white. Used in preparation of rice beer "Chhu"
Minil gachcha	IC-0629114	Grain husk pale yellow/ straw color, kernel red and long, plant tall up to 4ft, early, maturity in Sept., best for jhum cultivation, sticky rice, considered best for break fast meal
Minil gambal	IC-0629115	Grain husk yellow, bold, kernel white, plant tall up to 4 ft, best for jhum cultivation, early type, maturity in August, aromatic rice, good in taste
Minil gapok	IC-0629119	Kernel white, plant tall up to 4 ft, best for jhum cultivation, early type, maturity in August, sticky rice, best for break fast meal
Minil ghipok	KC/SK/AS-10	Fine, elongated grains, sticky, golden husk
Minil gisam	IC-0637006	Grain husk dark brown, plant tall up to 5 ft., strong, sticky, late type rice landrace
Minil gitchak	IC-0637010, IC-0631743, IC-0631753	Grain husk brown, kernel red rice, sticky, scented, grain slim, plant tall up to 4 ft., tillers 5–8, low land yield 2.0–2.5 qtl./bigha
Minil guhati	IC-0631759	Sticky, brought from Guwahati, used only for breakfast. Good for rice beer, easy in threshing
Minil kakua	IC-0637009	Kernel light black & medium fine grain, plant thin & week, tall up to 4 ft., tillers 5–10, normal sticky, low land rice
Minil mikongsi	IC-0631756	Reddish husk, elongated. It is considered best for rice beer and prepared during festival *Wangla,* also fetch good price
Minil michmopok	IC-0631745	Highly sticky, reddish husk, scented
Minil midambak	KC/SK/AS-49	Reddish, kernel white, elongated, sticky
Minil mikohgken	IC-0631764	Husk light golden, kernel white, sticky, tasty, used for making cake by mixing seeds of sesame
Minil nasket	KC/SK/AS-50	Reddish husk, grooves prominent, oval, bold, sticky, kernel white.
Minil pappu	IC-0631741	Sticky rice, scented, very much preferred by local people
Nalbini	IC-0635675, IC-0635680	Sticky, kernel long, reddish
Purabini	IC-0637001	Grain black, plant ht. 4 ft., tillers 8–15, sticky, lowland rice
Purabini	IC-0635681	Husk maroon, kernel white. It is considered as oldest paddy, grown in small scale. Used for making kheel/moodi
Rahabini	IC-0631762	Husk black, kernel reddish, sticky. Offered to guest, also cooked with milk
Rangabhog	IC-0635679	Fine grained, scented, kernel reddish, good yielder
Rongchram	IC-0635665	Easy in threshing, awned, scented
Sarang	RSR/SH-18-21	Grain medium brown, tall 4–5 ft., tillers 10, low land rice, late type
Sillgutti	IC-0637004	Grain husk pale yello/straw color, plant tall up to 5ft, late type
Tairol	IC-0631758	Light yellow, kernel white, elongated
Thepra	IC-0631750, KC/SK/ AS-15	Fine grains, husk reddish, kernel white, elongated
Tulsimala	IC-0637007	Grain black & small, plant thin & week tall up to 3.5 ft., tillers 6–12, aromatic
	IC-0635678	Golden husk, oval in shape, kernel creamy white, good yielder, grown in large scale, less sticky, good in taste

Table 3: Characters recorded at collection site in maize (*Zea mays*) landraces.

Landrace name	*IC/Collector No.*	*Remarks (Trait-specific characters)*
Minilgitchak	KC/SK/AS-1	Reddish brown grains, sticky, cobs small
Mirakuwabok	KC/SK/AS-2	Creamy white grains, medium sized cobs
Gippok	KC/SK/AS-8	Small, 8–10 cm long cob, grain creamy white, sticky
Binimaku	KC/SK/AS-73	Sticky, medium sized cobs, grains maroon
Mirakujagiting	KC/SK/AS-82	Plant dwarf in height (up to knee height), cobs small (2 per plant), light yellow grains, early in maturity (Sown in March- April and harvested in May last)
Mirakuagatchi	KC/SK/AS-83	Medium sized plant, cobs 2–3 per plant with yellow grains, reddish grains at bottom of cobs, when boiled in water it turns red, sticky grains
Mirakuashok	KC/SK/AS-88	Medium sized cobs, 3–4 cobs/ plant, grains sticky
Meraku	RSR/SH-18-16	Grain orange in color & bold, plant ht. 6–7 ft., cob length 12–15 cm, March-April sowing & August harvesting months
Meraku	RSR/ SH-18-17	Grain yellow & medium in size, sticky & aromatic, plant ht. 5-6 ft., cob length 12-15cm, April –May sowing & September maturity months
Merakusobok	RSR/SH-18-18	Sowing March & October (twice in a year), harvesting in Jan-Feb & May-June, Sobok means banana, spade in shape
Merakminil	RSR/SH-18-19	Sowing March & October (twice in a year), harvesting in Jan-Feb & June, aromatic maize
Mikop	RSR/SH-18-48	Kernel white, medium, pl. ht. 5–6 ft., roasted cobs eaten, sowing in March-April & harvesting in July, sticky, very sweet in taste, oldest landrace
Meraku Burma	RSR/SH-18-65	Kernel yellow & medium, sowing in March-April & harvesting in July-August, sticky
Meraku Agra	RSR/SH-18-66	Kernel mottled, white, sticky, sweet, strong/hard and boiled cobs/grains eaten
Merakubadur	RSR/SH-18-67	Kernel creamy, medium sized, sticky, sweet in taste, cob length up to 15 cm, boiled & eaten
Merakuminil	RSR/SH-18-68	Kernel reddish black, medium, sticky sweet in taste, cob length 6–8 cm, boiled & eaten, farmer cultivating it more than 100 years

Table 4: Characters recorded at collection site in foxtail millet (*Setariaitalica*) landraces

Landrace name	*IC/Collector No.*	*Remarks*
Missi	IC-0631458, IC-0631460	Small brown grain, rice are eaten after mixing with rice or also made into porridge
Missidongji	IC-0631464	Grains brown, panicles without bristles
Missighisim	IC-0631462, IC-0631465	Grain & panicle black, panicle 15–20 cm long, bristles less
Missijongsi	IC-0631467	Panicles small, 12–16 cm long, elongated, bristles present, grains brown
Misijongsu	IC-0631456,	Small seeded, Black seeded panicle with bristles like caterpillar, cooked as rice
Missijongsu	IC-0631463, IC-0631466, IC-0631468,	Panicle 20–25 cm long with bristles, grains brown, good in taste, cooked with rice
Missisarang	IC-0631461	Brown seeded, long panicle
Samcheng/Missi	IC-0631517	Panicles small, 12–16 cm long, elongated, suitable for *jhum* cultivation, rice cooked and eaten
Missiwangal	IC-0631519, IC-0631459	Panicles black 20 cm long, grain husk black, kernel white, good yielder under *jhum* cultivation, rice cooked and eaten, rice very tasty

of wild edibles for sale. Some of the important wild species consumed and sold in local market by the inhabitants are *Bauhinia purpurea, Begonia palmata, B. roxburghii, Centella asiatica*, *Corchorus olitorius*, *Diplazium esculentum*, *Eryngium foetidum*, *Flemingia procumbens, Homalomena aromatica, Phlogacanthus thyrsiformis, Solanum violaceum, S. nigrum, Spilanthes acmella, Clerodendrum colebrookianum, Zanthoxylum khasianum, Baccaurea sapida*, *Castanopsis indica*, *Docynia indica*, *Elaeagnus latifolia, Garcinia paniculata*, *Myrica esculenta, Rhus javanica* etc. indicating their popularity and future potential. During the present exploration, an interesting/new information from the farmers of Sadolpara village of West Garo Hill district was recorded on the use of fruit rind of *Aegle marmelos* (Bael). Its dried rind is used as a substitute for tea leaves, producing the same color as tea leaves (Figure 2), which is Tea from bael rind is considered as medicine medicinal and useful for stomach disorders.

Table 5: Characters recorded at collection site in *Citrus* species

IC/Collector No's.	*Botanical Name*	*Vernacular name*	*Trait-specific characters*
IC0628827	*Citrus x limon*	Komla/Khasi mandarin	Fruit medium in size, the fruit turns pale-yellow when ripe, peel/rind is very soft and shinning
IC0629323	*Citrus aurantium*	*Bomsim*	Ripe fruit yellow in color, fruit appearance same as orange but ridges on fruit
IC0629326	*Citrus hystrix*	*Matchadu*	Medium size pyriform fruit (300 g), yellow ripe, rind thick & rough, tree tall 4-5 m
IC0629327	*Citrus hybrid*	*Memang*	Fragrant fruit oblong, aromatic, tree tall up to 5 m
IC0628824	*Citrus indica*	*Memangnarang*	Wild citrus species, fruit spherical & orange in color, peel/rind is very soft and shinning
IC0628825	*Citrus x latifolia*	*Sohkymphor (Khasi)*	Tree looks like Khasi mandarin
RSR/ SH-18-40	*Citruslatipes*	*Surengki*	30-year-old tree, tree ht. 10–12 m. fruit appearance same as orange, fruit sour, used as flavouring agent in non-veg preparations, semi wild
RSR/ SH-18-22	*Citrus medica*	*Slongga*	Fruit big (1300 g), sour in taste, used to eaten, Pl. Ht. 5–7 m, 5–6-year-old tree
IC0629324 RSR/ SH-18-73	*Citrus medica*	*Gancheng*	Large fragrant citrus fruit with a thick rind, resemble like rough lemon, tree tall up to 5 m,ripe fruit yellow in color & oblong, fruit weight 300–400 g
IC0629325	*Citrus medica*	*Thematchu*	Large fragrant citrus fruit oblong pyriform, resemble like rough lemon, tree tall 5–6 m

(A)

(B)

(C)

(D)

(E)

(F)

Figure 2: Diversity in grains of rice landraces (A), panicles of foxtail millet(B), specific grain and plant type in coix landrace, collected from *Jhum* field in Rondong area of Baghmara, South Garo Hills (C), big size fruits of *Citrus indica* (D), *Citrus* species collected in nearby areas of Nokrek Citrus Gene Sanctuary(E) and dried rind of*Aeglemarmelos* (Bael) used as a substitute of tea leaves (F)

Conclusion

The widespread loss of global biodiversity is one of today's most serious crises. Population explosion, climate change, deforestation, urban development, various developmental activities, and the introduction of improved varieties are some of the major causes of biodiversity loss. As hotspots of biodiversity, the North-eastern hill region is also facing genetic erosion in the diversity of crops, economically useful species and associated indigenous knowledge mainly due to shifting cultivation. Now, the inhabitants have started cultivation of cash crops like strawberry, ginger, pineapple, large cardamom and other commercial crops like areca nut, rubber, cashew nut, black pepper, tea, and coffee, which are responsible for replacing the traditional varieties, crops and associated agricultural practices. Efforts have been made to collect and conserve the available diversity of crop landraces, wild relatives and wild economic species from the surveyed areas for use in breeding new varieties. Some significant collections made from the area were 29 named rice landraces unrepresented to the National gene bank; bushy type soybean landrace; perennial pigeon pea with variation in grain color, shape & size; and a specific plant type having red grain in *Coix lacryma-jobi*.

The collected germplasm should be characterized to Identify promising germplasm as well as to plan an extensive survey for the further collection of trait-specific germplasm. The wild species being domesticated in homesteads need to be popularized through the development of suitable agro-techniques, which can boost the economic condition of local tribal communities. Efforts should also be initiated for *in-situ* on-farm conservation of landraces facing erosion and for establishing community seed banks to safeguard and promote the utilization of local landraces.

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