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Original Paper

Feasibility Study for Field Research: Ethnobotany and Ecology of Wild and Cultivated Aroids in Assam State, Northeast India

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Summary

Over a period of nine days (10 - 18 November, 2013), the authors conducted discussions, fieldwork and interviews with local researchers, forestry officials, village leaders, and farmers in Guwahati City and Karbi Anglong district, in Assam State, Northeast India. Our aims were to determine the potential, feasibility and practical requirements for ethnobotanical field research and plant collection in the region, with particular regard to cultivated aroids and their wild relatives (*Colocasia* spp., *Alocasia* spp., and others). The locations, habitats, abundance, vernacular names, and uses of wild and cultivated aroids were noted. We examined a range of environments in and around Guwahati City, Karbi Anglong (a low-mountain district where swidden farming is still practised), and the large island of Majuli (located in the Brahmaputra River).

1. Introduction

Taro, *Colocasia esculenta* (L.) Schott (*sato-imo* in Japanese), belongs to the large monocot family, Araceae, which includes many ornamental species, and a smaller number of domesticated food species (Matthews 1995, Bown 2000). In the last twenty years, numerous wild species of *Colocasia* have been discovered and described in the region from southern China to northern India and Borneo (Southeast Asia, broadly defined). As a natural species taro is believed to have originated somewhere in the region of Northeast India and Southeast Asia (Matthews 1991, 2014). Assam is therefore located within a key region (Northeast India) for understanding the evolutionary history and domestication of taro. In this region, three language families -- Indo-European, Austro-Asiatic, Tibeto-Burman -- are represented by numerous local languages, and the region lies within a larger area where High Linguistic Diversity (HLD) has been reported in the naming of taro (Blench 2012). This HLD zone for taro is likely to reflect an intersection of high biological diversity in taro and its wild relatives, and high cultural diversity among people in the region. In the present study area, the main local languages encountered were Assamese (Indo-European, approx. 12,800,000 speakers; India 2001 census, Lewis *et al*. 2014), and Karbi (Tibeto-Burman, approx. 420,000 speakers, India 2001 census, Lewis *et al*. 2014).

In our study area, wild taro (*C. esculenta*) was previously noted by the second author in

correspondence with the first author, and a small number of leaf samples were analysed in collaboration with Massey University of New Zealand (Ahmed 2013). This preliminary work confirmed the importance of Assam for research on taro. The present fieldwork was aimed at learning more about wild taro populations found by the second author, who organised the itinerary and made all necessary travel arrangements. In Guwahati City, the first author was also able to meet local botanists with wide field experience in the region. We also wished to learn more about the potential, feasibility, and practical requirements for ethnobotanical field research and plant collection in the region, with particular regard to cultivated aroids and their wild relatives (*Colocasia* spp., *Alocasia* spp., and others).

2. Methods and itinerary

Handwritten notes were made throughout the journey, in the form of a field diary, along with photographic records, Global Positioning Satellite (GPS) location records, and a video recording to record the pronunciation of plant vernacular names. The itinerary and outline of activities is shown in Table 1. Interviews were conducted after introducing our work aims, and required translation between local languages (Assamese and Karbi) and English. Our route (Fig. 1) included urban and rural lowlands along the southern side of the Brahmaputra River, the rural area of Karbi Anglong, and roads across the river island of Majuli. GPS location records are provided here for areas or locations of particular interest. All latitude, longitude and altitude data were recorded with a Garmin Model 60CSx device using the WGS84 mapping datum.

Locations, habitats, abundance, vernacular names, and uses of edible aroids and their wild relatives were recorded whenever possible. Special attention was given to *C. esculenta*, other *Colocasia* species, and *Alocasia* species. In the limited time available, we could not confirm all cultural data (plant names and uses) through interviews with many people. The present records should be treated as illustrative of the range of information that can be gathered regarding taro and its wild relatives in Assam.

Table 1. Itinerary and activities (the main locations mentioned are shown in Fig.1)

Date (Oct. 2013)	Area or location (Assam State)	Activities
Sun. 10	Guwahati City	Arrival. Travel in vicinity. Meeting with Mr. P. Kotoki, Officer in Charge, Office of the Range Forest Officer, Rani Range, Rani, Government of Assam. Visit to Rani Forest field station, near Guwahati.
Mon. 11	Guwahati City	Met Head of Department Mrs. Rekha Das, Dept. Anthropology, Gauhati University. First meeting with Mr. Jatindra Sarma (Divisional Forestry Officer, Upper Assam Division, Government of Assam)
Tues. 12	Guwahati City Guwahati City – Baithalangso Village - Hamren Town, W. Karbi Anglong	Met Prof. Gajen C. Sarma, Department of Botany, Gauhati University. Travel and survey of aroids along roadsides, with PhD student Mr. Robinson Senar. Meeting with Mr. D. Terang, Forest Range Officer, Karbi Anglong.
Weds. 13	vic. Hamren Town	Meetings with village leaders and local farmers, and road survey
Thurs. 14	vic. Hamren Town	Meetings with village leaders and local farmers, and road survey
Fri. 15	Karbi-Anglong – Majuli Island	Travel, road survey, and river crossing.
Sat. 16	Majuli Island	Meetings with local college staff, farmers, and temple residents.
Sun. 17	Majuli Island – Guwahati City	River crossing and return travel
Mon. 18	Guwahati City	Meeting with Mr. J. Sarma and Mr. Santanu Dey (student, Nagaland University). Departure.

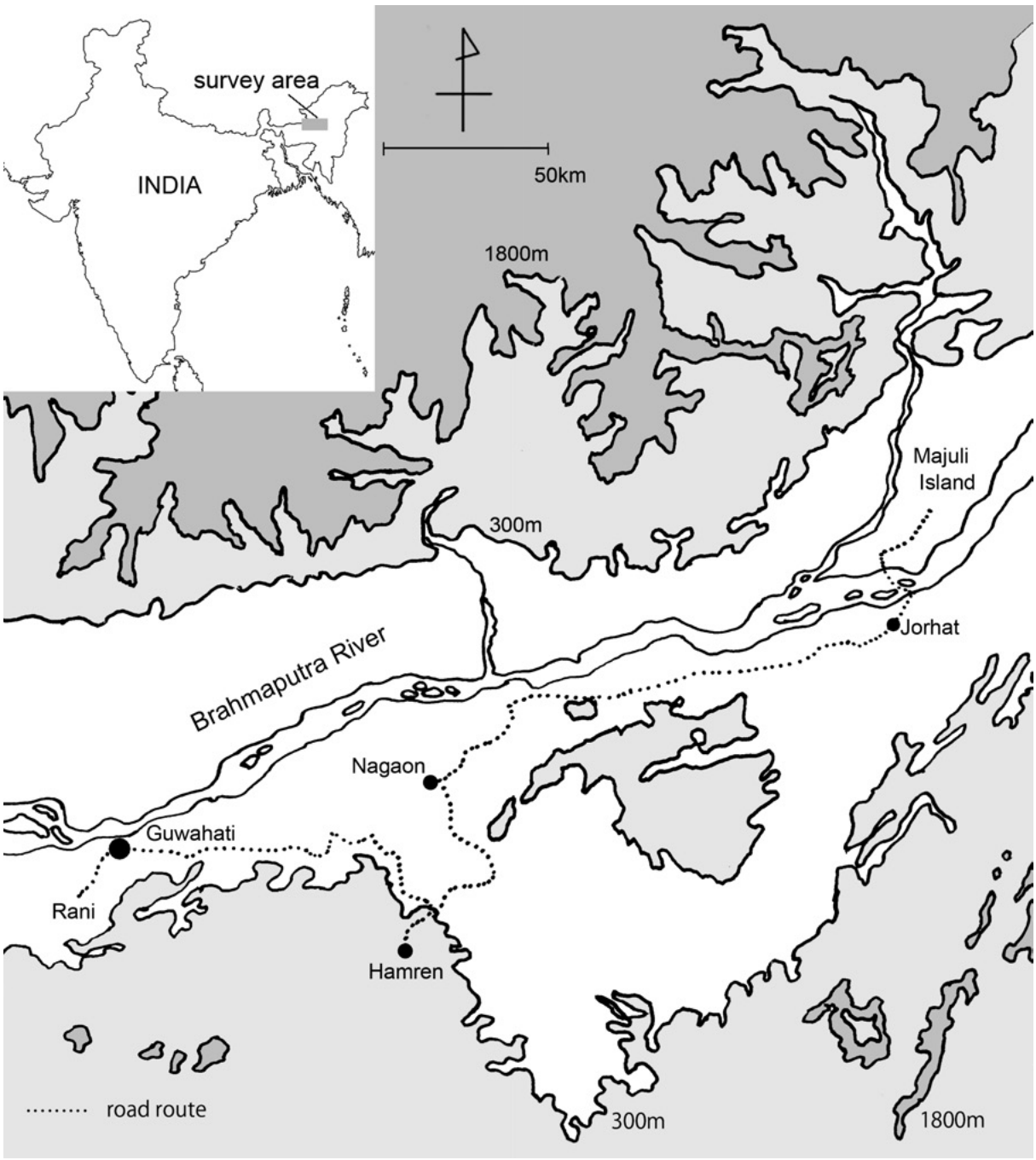

Fig. 1. Road route for the the Assam survey, 10 - 18, November, 2013 (map by E. Tabuchi). The district of Karbi Anglong consists of a western part in the hills around Hamren, and an eastern part in the isolated hill block lying to the east of Nagaon

3. Observations

The observations below are reported for each taxonomic group, in order of taxonomic interest for the present study, and certainty of identification. Table 2 provides an overview of taxa and habitats seen during our field survey.

Table 2. Overview of aroid taxa seen during the Assam survey. 'Commensal' wild habitats are modified or ruderal habitats located inside or close to human settlements. For the purposes of contrast, 'natural' wild habitats are those that appear largely natural in their origin, even if substantial disturbance is evident (e.g. in regenerating secondary forest). Paragraph references in the left column refer to observations presented in the text.

para.	Tribe	Genus	Species	Habitats
Taro				
3.1	Colocasieae	*Colocasia*	*esculenta*	cultivated, wild (commensal/natural)
Other *Colocasia* species				
3.2a	Colocasieae	*Colocasia*	*lihengieae*	wild (natural)
3.2b			*affinis*	wild (natural)
3.2b			?*fallax*	wild (natural)
3.2c			*gigantea*	cultivated
Other Colocasieae				
3.3a	Colocasieae	*Alocasia*	*macrorrhizos*	cultivated
3.3b			*odora*	wild (commensal/natural)
3.3c			*fornicata*	wild (natural)
3.3d			sp. 1	ornamental (potted)
3.3e			sp. 2	wild (commensal)
3.3f		?*Steudnera*	sp.	ornamental (potted)
Other aroids				
3.4a	Caladieae	*Xanthosoma*	*sagittifolium*	cultivated, wild (commensal)
3.4b	Homalomeneae	*Homalomena*	sp. 1	wild (natural)
3.4c			sp. 2	wild (natural)

3.1 *Colocasia esculenta* (L.) Schott (taro)

During this trip, no attempt was made to examine cultivated taro in home gardens or agricultural fields. November is a relatively cool and dry time of year, and the weather was clear on most days during our survey. Road conditions were good, and all roads encountered in the rural areas were passable with an ordinary vehicle. The dry winter season is not the best time of year to observe flowering and fruiting by wild taro, though a late fruit fruiting head was found on one plant in Rani Forest (Photos 1 and 2). Seeds from this fruit germinated after separation and transfer to pots in Guwahati City, confirming the potential

for breeding by wild taro populations in this area. The months of July and August may be the best time to see flowering and fruiting of taro in Assam (R. Senar pers. comm. and G. C. Sarma, pers comm., 2013).

Wild taro is abundant in and around Guwahati City (c. N26° 9' E91° 40', 57 m a.s.l.) and in many settlements and towns in the region generally. Those that are located in urban areas appear to be naturalised wild populations, commensal with people, and may have spread through deliberate dispersal as a vegetable food or fodder, as well as through discard or escape of cultivars from gardens. Most wild taro patches are cut for food or fodder purposes, and as in other parts of Southeast Asia, wild *C. esculenta* is regarded as a very useful plant. In Guwahati City itself, taro is super-abundant as a naturalised plant in wet ditches and open low ground, and includes a mix of purple and green-stemmed forms. In some urban locations, in Guwahati and elsewhere, plants displayed purple patches (Photos 3 and 4) similar to those seen in *Colocasia affinis* (Photo 9) suggesting that there may have been interspecies hybridisation somewhere else in the past (*C. affinis* was not seen in the urban areas). In Guwahati city, the English/Assamese name "black spotted *baga kochu*" was previously noted by DM (second auther) for plants with similar appearance. In rural settings where natural streams or seepage provide water, it is not clear whether or not taro populations (*C. esculenta*) are naturally occurring or the result of naturalisation (i.e. from plants introduced to the area by people). Generally speaking, the urban wild taros have very angular leaves, with the rear lobes well defined by a deep sinus. A wild taro found in the *jhum* (swidden farming) area of Karbi-Anglong had more rounded leaves with a less deeply-incised sinus (Photos 5 and 6).

Vernacular names and local uses of wild and cultivated taro (a-c)

(a) Wild taro. In Karbi-Anglong (vic. Hamren town, Fig. 1, N25° 51' , E92° 35', c. 400 m a.s.l.), two Karbi names were found: *henru-naini*, 'taro that wilts' (i.e. easily stressed by loss of water/hot sun), and *lank-a-henru*, 'water taro'. These may be alternative names for the same wild form. The young leaves of wild taro can be eaten, and the whole plant can be prepared as a fodder for pigs. The 'flower' (i.e. upper spathe) can be boiled for use as an ingredient in *keseng* style chutney, in which garlic, ginger, chili, sesame seeds, salt, turmeric, and dried tea leaf.

(b) Cultivated taro. In Assamese, *kochu*, *kachu* or *kasu* can mean taro (*C. esculenta*), or can be a generic term for aroid. In Karbi language, the usual or general name for cultivated taro is *hen-ru*. This name has both narrow and wide uses, depending on speaker and context: (i) taro plant or corm, or literally 'taro stem'); (ii) all taro-like plants in the forest; (iii) loosely applied as name for an ornamental relative of taro, *Alocasia* sp. cv "Green Shield" cf. *A. clypeolata* (see below). Cultivars recorded in Karbi language, in Karbi-Anglong (vic. Hamren town, Fig. 1) were: (i) *hen tong* - multi-headed corms, side-corms, and petioles all sold and eaten; morphology similar to cv *yatsugashira* in Japan; (ii) *lank-a-hen* - elongate corms; (iii) *hen pongsi* - 'flute taro', elongate corms; morphology similar to cv *takenoko-imo* in Japan; (iv) *hen-longdar*, (*or* - *langdar*) - part used is a thickened stolon, longer and thinner than side-corms of *hen pongsi*, but similar in having terminal stolon growth (in contrast to wild taros with stolons that appear non-terminal, and unlike any cultivars reported in Japan); (v) *hen ke-me* - 'true taro', with large oval corms; name suggests that it may be an older local variety; (vi) *hen sek* - corm with pink apical bud; a white form of this also exists (a related name, *hen sek voso* was also recorded in a previous visit by DM, together with a Nepali name, *chaore kochu*, given by descendants of Nepalese immigrants); (vii) *hen tebok* - 'pot taro',

with dark purple apical bud and pale skin; said to be a kind of *hen sek*. The latter two types (vi-vii) display common morphologies found in many cultivars in Japan and elsewhere.

(c) Parts of the plant. The following terminology was recorded in Karbi-Anglong, but does not represent all parts of the plant, and needs further clarification: (i) *hen* = taro [i.e. the plant] or corm. (ii) *hen-ru* = taro stem (ru = stem, i.e. petiole). (iii) *hen-arvo* = taro leaf (i.e. blade). (iv) *hen-adar* = taro stolon. (v) *eng-dung* [?*hen-dung*] = taro flower.

Food uses

Taro (*C. esculenta*) is used as both a starchy root crop and leafy vegetable in Assam. Taro corms appear to be commonly peeled and cooked in soups of various kinds. Using the leaves, stolons, and spathes as vegetables, from wild or cultivated plants, is highly seasonal, as taro plants grow most actively during the wet season. Frequent cutting of the wild taro was said to have a beneficial effect, because it helps reduce the acridity (itchiness) of leaves (the cutting may encourage young growth). Young stolons are preferred, and can be eaten as a delicacy in a sour sauce made using tamarind and tomato. Stolons can also be fried and eaten. A sour pickle made with bamboo shoots is a good accompaniment for taro leaf or spathe. The yellow upper spathe is eaten. *Kachu-pitika* (Assamese name) is a chutney-like dish made by mixing starchy taro paste with potato, rice, dal and fish, black sesame, raw onion, and salt. Taro leaves can also be cooked for cows, to increase milk production. According to observation by DM, the arrival of refugees from Bangladesh in Assam, over a period of many years, has led to a decline in the abundance of wild taro in ditches as the plant is a favored food among the immigrants.

3.2 Other *Colocasia* species

(a) *C. lihengieae* Long & Liu (Photos 7-8)

In the low mountain area of Hamren in Karbi Anglong (Fig. 1) we found a sparsely scattered population of what appears to be *C. lihengiae*. So far, there is no evidence that this plant is cultivated, though it was considered by some informants to be a better food than wild *C. esculenta*. In the Karbi language, it is called *arlok-a-henru*. The plants are scattered in their distribution, never forming large colonies. The main use is as a vegetable for people (leaves and stolons), while the corms can be fed to pigs, cooked or uncooked.

(b) *C. affinis* Schott and *C. fallax* Schott (Photos 9-10)

In Karbi Anglong, we also found *C. affinis* (Photo 9) and what appears to be *C. fallax* (Photo 10) growing alongside the same boulder stream (Photo 11), at around 400 m asl. Apart from the lack of purple colour patches, the putative *C. fallax* was very similar to *C. affinis*, and might be a colour variant of the latter, or vice versa. Both forms or species were located in a high-energy streambed, firmly attached to the banks and rock crevices with wire-like roots, and spreading with stolons that were covered by a fibrous brown integument. This integument may provide tensile strength and reduce dehydration. The stolons of *C. lihengiae* or *C. esculenta* are thicker and softer, with thin fibrous coverings, and are easily broken (qualities that may promote the dispersal in water of these two species). For both *C. affinis* and *C. fallax*, one local name was recorded: *kawang sangkhi* (Karbi language). No translation could be given for this name, and

there may be other names for these plants.

(c) *C. gigantea* (Blume) J. D. Hooker (Photo 12)

In Guwahati City and in Karbi Anglong, we found single plants of *Colocasia gigantea* planted as a vegetable in gardens. The common or usual name may be *dudh kachu* ('milk taro', Assamese). The reference to milk may reflect the milky sap colour (opaque, white), or pale hue of the leaves. The corm is not eaten, usually only the petiole, but sometimes also the young leaf (Senar pers. comm. 2013). In Karbi Anglong, one informant who did not know the proper name identified *C. gigantea* as 'a kind of *bor kasu*', the name usually used for *Alocasia macrorrhizos* (see next).

3.3. Other Colocasieae (*Alocasia* species and ?*Steudnera*)

Of special interest was the finding of *Alocasia macrorrhizos* as a food plant in Assam. From its distribution, *A. macrorrhizos* seems to be mainly a lowland plant. Other *Alocasia* species that we found are also noted here briefly. There is clearly much more to learn about the diversity and uses of this genus in the region.

(a) *Alocasia macrorrhizos* (L.) G. Don (Photo 13)

Vern. *man kasu or bor kachu* (Assamese). Plants were seen occasionally in house-garden front yards, visible from the road, and were widespread in lower elevation villages from Guwahati to the border of Karbi Anglong, and from Karbi Anglong to Majuli Island, across the floodplain of the Brahmaputra River. In one village near Karbi Anglong, the owner of a house-garden with *A. macrorrhizos* (Photo 13) explained that the plants are never eaten in the rainy season, only in the dry, and that they are located in front of the house because their leaves are big and require a lot of space. By two years after planting, the stem is ready to eat. The large leaves of *A. macrorrhizos* and/or *A. odora* (see next) are used for wrapping, processing, or displaying food and other materials (Photos 14 and 15).

(b) *A. odora* (Roxb.) K. Koch (Photos 16-18)

Vern. *barai nakhua kachu* (Assamese; meaning literally, "aroid that pig does not eat"). This has more-rounded blades than *A. macrorrhizos*, and grows more abundantly along roadsides, in urban vacant land, and other open spaces in the lowlands and low hills. The mature upper spathe is typically greenish white in colour, and the upper flowering stalk (peduncle) and lower spathe are typically waxy (glaucous) (Li and Boyce 2010; Boyce pers. comm. 2014). Pollinating insects (apparently *Colocasiomyia* sp.) were seen on the inflorescence of *A. odora* growing spontaneously in Guwahati city (Photo 16). The apparently stunted form shown in Photo 17 was seen only once.

(c) *Alocasia fornicata* (Roxb.) Schott (Photo 19)

No vernacular name recorded; wild in damp gully near foot of Karbi Anglong hills, above the plain, at edge of road, and together with *Homalomena* sp. (N25° 58' , E92° 37', 165 m a.s.l.).

(d) *Alocasia* sp. 1 (cv "Green Shield" or "Green Cuprea") (Photo 20)

Vern. *henru* (Karbi, see above); seen as an ornamental, potted plant in two house gardens at Baithalangso, Karbi Anglong, and was said to be 'found in the forest' or 'purchased at a shop in Guwahati

city'. Hay (1999) tentatively identified this cultivar as a form of the Philippine endemic species, *Alocasia clypeolata* A. Hay.

(e) *Alocasia* sp. 2 (no photo)

Vern. *thampanai-a-so* (Karbi); a very itchy wild species, never eaten (*cf. Xanthosoma sagittifolium*), on open slope next to Ronghang Rongbong village (N25° 47' , E92° 31' , 672 m a.s.l) in Karbi Anglong. The small plants seen were possibly young growth of *A. odora*, or adult growth of a different species.

(f) ?*Steudnera* sp. (Photo 21)

This ornamental aroid, with convex blades was seen in Guwahati city, and may be either *Steudnera colocasiifolia* C. Koch (Engler and Krause, 1920), which is sometimes depicted with convex blades, or *S. assamica* Hook. fils (Engler and Krause, 1920), which appears, in the 1920 line drawings, to have a similar leaf shape and plant habit.

3.4 Other aroids

(a) *Xanthosoma sagittifolium* (Photos 12 and 22)

This South American domesticated aroid and root crop was seen occasionally in ditches and gardens. Two local names were recorded: *nal kachu* or *neel kochu* (Assamese), and *thampanai* or *thampanai kelok* (Karbi). In Karbi Anglong, the corms and leaves are eaten, and mature leaves are used as a fodder for pigs.

(b) *Homalomena* sp. 1 (Photo 23)

Vern. *gonsana* (Assamese); seen at Rani Forest (Fig. 1; N25 ° 59', E91 ° 33', 97 m a.s.l.)., on the Assam-Meghalaya border. The blades are more angular than those of sp. 2 (see next).

(c) *Homalomena* sp. 2 (Photo 24)

Vern. *okhi atehang* (Karbi, meaning 'deer's forehead'); seen at Karbi-Anglong (location N25 ° 49' E92 ° 33', 433 m a.s.l.). A possible explanation for this name is that the plant leaf shines in manner that loosely resembles the pale-coloured ridges 'shining' on the forehead of an endangered North Indian deer species, *Cervus duvauceli* (swamp deer). This plant was seen on a shaded bank under trees, next to a flood-channel and terrace that may have been a favoured grazing area for deer in the past. The tender (i.e. young) leaves can be steamed in a bamboo tube to make a curry with other ingredients (spices, dried fish) (J. Timung pers. comm.).

3.5 *Majuli Island*

On Majuli Island (Fig. 1, vic. N26°57', E94°10', 88 m a.s.l.), floating rice cultivation in the summer (wet season) alternates with paddy rice and dryland vegetable crops in the winter (dry season). Around each village, many artificial ponds have been created; these have multiple functions, and on the banks of some ponds, clumps of taro were seen (apparently planted). No wild taro or wild *Colocasia* species were seen on the island. Many ponds in Majuli Island have water lilies growing in them, as the flowers are popular for ornamental and religious purposes (water lilies were also seen in ponds in Karbi Anglong and

near Guwahati City). The pink-flowered *Nelumbo nucifera* (lotus, with flowers raised above the water), is called *phetphul* (Assamese), and produces edible rhizomes. The white-flowered water lily, *Nymphaea lotus*, is called *podum* (Assamese), and has floating flowers.

4. Discussion

4.1 *Colocasia* species

Excepting the easily recognised crop species (*C. esculenta*, *C. gigantea*), the present identification of *Colocasia* species in Karbi Anglong is tentative, since we could not observe flowering. To confirm our identifications, photography and collecting for herbarium reference collections should be carried out during the wet season, which is when flowering is most likely to occur. Cleghorn (1913), while describing the insect pollination of taro, stated that taro in tropical India grows all year round, but flowers 'only in the rainy season, from July to September'.

Colocasia lihengiae was first described as a wild species in Yunnan, China (Long and Liu 2001), and has not been the subject of detailed ethnobotanical research anywhere in its range in Southeast Asia. Before the present survey, reports of *C. lihengiae* came from Arunchal Pradesh (Gogoi and Borah 2013), upper Assam (J. Sarma pers. comm. 2012), Nagaland (S. Dey pers. comm. 2012), and in nearby Bangladesh (Ara and Hassan 2005), as well as in northern Vietnam and southern China (Long and Liu 2001, Matthews 2014, Matthews and Nguyen 2014). Frequent harvesting of this species may be of concern from a conservation standpoint, as it may limit the breeding and resilience of wild populations. The local preference for *C. lihengiae* as a wild vegetable suggests that it may be a low-acridity wild relative that is geographically sympatric with wild taro (*C. esculenta*) while occupying a slightly different edaphic niche (see Photo 8). All of these suggestions are tentative, and require further investigation.

In Guwahati city, the Beltola Market is open on two days each week, and is known as a hill people's market where various edible aroids are sold. Winter is the main season for harvesting corms, including those of *Amorphophallus* (J. Sarma pers. comm. 2013), and an abundance of taro corms of different kinds were found for sale in the winter markets in Hamren Town, Karbi Anglong, during our winter visit. The cooler dry season (autumn to winter) will be the best period to learn about the uses of taro as a starchy root crop, and the warmer wet season (summer) will be the best period to learn about the uses of taro as a green vegetable, and to look for gathered aroid leaves and inflorescences in local markets. In Guwahati City, taro is abundant in ruderal habitats (ditches and open fields) and this wild population may be very old if derived from pre-existing populations in settlements that were absorbed by the growing city. Breeding and continuous harvesting in urban and peri-urban locations may have lead to a form of mass-selection that has resulted in positive selection for resistance to stress and disease, in a continuing process of domestication. Urban and peri-urban populations of wild taro may be of special interest for plant breeding, not just in Assam, but throughout Southeast Asia.

An important destination for further botanical work in Northeast India will be the Kanjilal Herbarium (ASSAM) at Shillong (see Barbhuiya and Gogoi, 2010). The recent report of two new *Colocasia* species in Arunachal Pradesh (Gogoi and Borah 2013), and the past lack of field research on *Colocasia* in Northeast India generally, suggest that further *Colocasia* species will be found in the region. Further botanical exploration is needed alongside studies of the management, naming, and uses of the known *Colocasia* species and their plant parts. Particular attention is needed to distinguish the starch and green-

vegetable uses of *Colocasia* species, as these vary according to season, and have different implications for plant selection and domestication. Herbarium specimens are needed for reference in local herbaria in Assam (Gauhati University, Kanjilal Herbarium, and elsewhere) and for national or international collections.

4.2 *Alocasia* species

The use of *Alocasia macrorrhizos* as a starchy stem crop appears to be widely known in the region, but the plant is not abundant in gardens, and appears to be of very minor importance at present. Among the Khasis of neighbouring Meghalaya State, the stems are also cooked and eaten (Ahmed and Borthakur 2005). Historically the plant is of great interest because of its wide distribution and use in the Philippines and Pacific Islands (Thompson 1982, Matthews 1995, Hay 1999). Taxonomically, *A. indica* (Lour.) Spach has been treated as synonymous with *A. macrorrhizos* (L.) G. Don (Hay and Wise 1991, Hay 1998, 1999). If *A. macrorrhizos* originated as a natural species with limited natural range in island Southeast Asia, then wild plants reported as *A. indica* in Assam might represent a naturalised form of *A. macrorrhizos* following introduction of the latter as a cultigen. In the Darlong community, in the neighbouring Tripura State of India, *Alocasia indica* Roxb. (Schott) has been reported as both wild and cultivated, with medicinal uses, and is named *kumthumbal* in the *Darlong tawng* language (a Tibeto-Burman language) (Dipankar *et al*. 2012).

With further study, the past spread of *A. macrorrhizos* as a cultigen might become more obvious if names for the plant in gardens are shared over a wide region, and show uniformity in contrast to names for wild relatives (*Alocasia* spp.) or wild forms of *A. macrorrhizos*. In Bangladesh, for example, the Bengali (Indo-European) name *man kachu* has also been reported for *Alocasia* sp. (Chowdhury and Hussain 1979), but no details of habitat or usage were noted. This may refer to *A. macrorrhizos*, just as it does in Assam (see the cognate form, *man kasu*, above).

As far as we know, *A. odora* has not been reported as a food plant anywhere within its known range, in mainland Southeast Asia to Taiwan and southern Japan. The most western occurrence may be in Bhutan (range reported by Li and Boyce 2010). Names indicating that *A. odora* is not edible for humans (e.g. 'aroid that pig does not eat', recorded above) might have arisen independently in different areas across the natural range of the species. Vernacular distinctions between edible and inedible may be most important in areas where both *A. odora* and *A. macorrhizos* are present, and where the latter is known as an edible plant, because of their similar appearance. In the past, introduction of *A. macorrhizos* as a food crop might have led to changes in the naming of *A. odora*, for safety reasons.

4.3 Vernacular names

Most aroids in Assam appear to be distinguished through the use of descriptive binomials in which one term is a general name for aroids, while the other identifies a particular species or cultivar. This contrasts with the lists of single-term names used by linguists to analyse the naming history of taro over wide geographical regions (see Blench 2012, for example). To better understand the naming history of taro, detailed studies of aroid folk taxonomy are needed in many different geographical and linguistic regions. During our survey, a greater diversity of wild relatives of taro was found in the relatively wet and humid

foothills and hills above the Brahmaputra river-plain. Similar areas in Assam and beyond are likely to support a great diversity of wild aroids, and a corresponding diversity in aroid folk taxonomy.

In a recent ethnobotanical survey in Arunachal Pradesh (Srivastava and Community, 2010), names for *Colocasia affinis* and other aroids were recorded, including a name shared by *Tacca*, a useful plant in a different plant family:

Araceae
Alocasia fornicata Schott - *kanjok*.
*Colocasia affini*s Schott - *maksar, jangli kachu*
Pothos cathcartii Schott - *anoti*
Pothos scandens L. - *ridik*
Raphidophora glauca Schott - *chulu*.

Taccaceae
Tacca integrifolia Ker. Gawl. - *kanjok*

The leaves of *Tacca integrifolia* are similar in shape to the leaves of some aroids (including *Amorphophallus konjac*), so *Tacca* may have acquired its name from an aroid, or vice versa. This example points to the need to consider non-aroid plants that are similar to aroids (in any aspect) when investigating aroid folk taxonomy.

In recent years, a large number of ethnobotanical studies have been published in Northeast India (Raja Chakraborty *et al*. 2012). It is beyond the scope of the present report to review these publications comprehensively, but initial exploration of the literature indicates that aroids are commonly under-represented. This may reflect a dry-season bias for conducting fieldwork (when the plants are smaller, or less likely to be flowering), and/or a general lack of taxonomic study of Araceae in the region. Any gap in previous taxonomic studies makes identification especially difficult for ethnobotanists and linguists who are not aroid specialists. This in turn makes it difficult to assess the botanical significance of vernacular names recorded in ethnobotanical and linguistic reports.

5. Conclusions

For the study of taro, Assam is of great interest because near wild relatives (other *Colocasia* species) and apparently wild-type populations (*C. esculenta*) are present in the same region as morphologically diverse cultivars. The urban or commensal populations of wild taro are also of interest. In the future, it may be possible to elucidate a domestication sequence among the wild and cultivated forms of taro present in this region.

We hope to continue our study of relationships between people and edible aroids in Karbi Anglong and Assam more generally, in collaboration with local communities and other researchers. From the joint survey reported here, we now have a much better grasp of what kind of work can be undertaken in Assam, with regard to edible aroids and the communities using them.

Ideally, this work will continue as: (i) a longitudinal study of the use of wild and cultivated aroids by Karbi communities, in different seasons, and (ii) a wider survey of the uses and management of edible aroids, in different cultural and ecological regions of Assam.

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Photo 1. Fruiting head of wild taro (*C. esculenta*), Rani Forest (see also Photo 2). The seeds later germinated in Guwahati city, after transplantation to a pot

Photo 2. Wild taro (*C. esculenta*) on stream bank, Rani Forest (a possibly natural wild habitat) (see also Photo 1)

Photo 3. Wild taro (*C. esculenta*, or possibly a hybrid) in Guwahati City, showing purple colour patches similar to those seen in *C. affinis* (Photo 9). This trait might reflect hybridisation or introgression between *C. esculenta* and *C. affinis*

Photo 4. Wild taro (*C. esculenta* and a possible hybrid) in vacant land, Guwahati City: a typical urban, commensal habitat with low-lying, wet, open ground (see also Photo 3)

Photo 5. Wild taro (*C. esculenta*) found in Karbi-Anglong (see habitat in Photo 6). This plant was called henru-naini-the taro that wilts. It has more-oval leaves with lesspointed lobes than those of wild taro seen growing in urban areas in Assam (see Photo 3, for example)

Photo 6. Habitat of wild taro (*C. esculenta*) in Karbi-Anglong (see plant, Photo 5). Wild taro was found growing at the foot of hill at left, in a natural flood channel at the back of the terrace visible in this photo

Photo 7. Purple form of *Colocasia lihengiae*, a close wild relative of *C. esculenta* (vic. Hamren, Karbi Anglong). Petiole colour is variable in this species (tentative identification; inflorescences not seen)

Photo 8. *Colocasia lihengiae* (lower left) in open, damp gully, without running water (vic. Hamren, Karbi Anglong). This species may have greater drought tolerance than wild *C. esculenta*

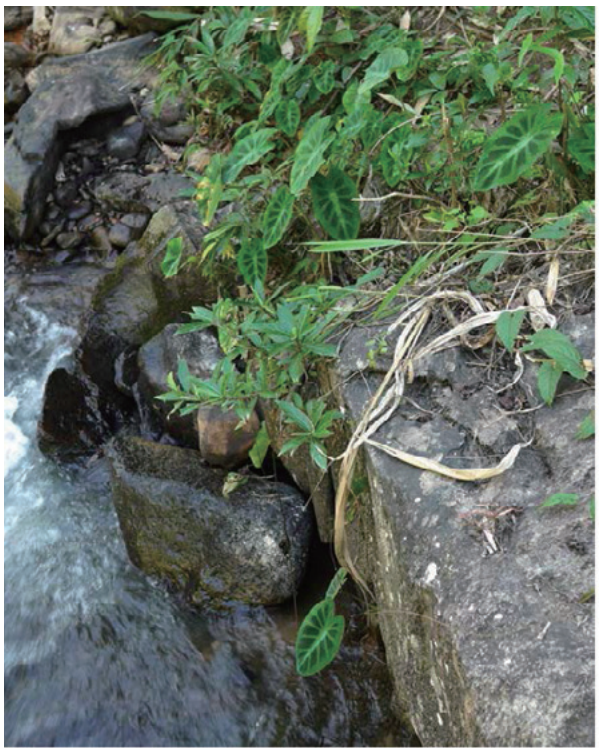

Photo 9. *Colocasia affinis*, abundant and wild alongside boulder stream (vic. Hamren, Karbi Anglong) (see Photo 11). The leaf blades (10-15 cm length) are smaller, and purple patches more distinct, than those of the possible hybrid (*C. esculenta* x *C. affinis*?) shown in Photo 4

Photo 10. *Colocasia* ?*fallax* (blades 10-15 cm, with central pale blush), abundant and wild alongside boulder stream, vic. Hamren, Karbi Anglong (see Photo 11). This identification requires confirmation by the collection of inflorescences

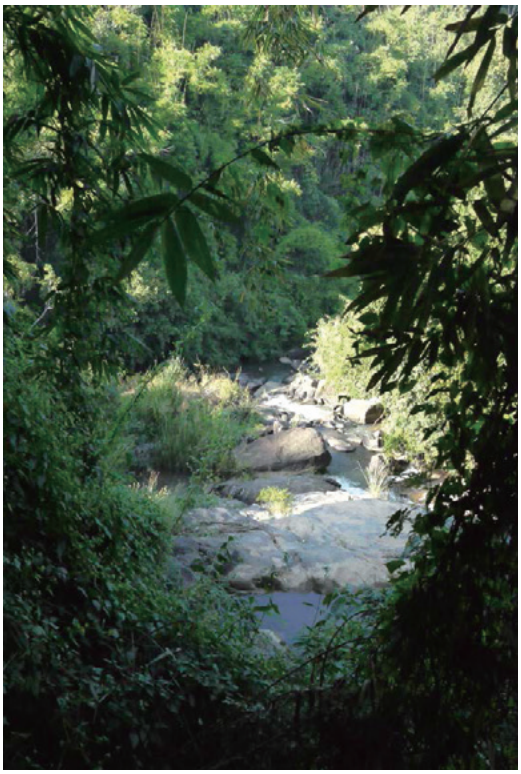

Photo 11. Natural habitat of wild *Colocasia* species. On the banks of this boulder stream in secondary regrowth forest, *C. affinis* (Photo 9) and *C.* ?*fallax* (Photo 10) grew together, while *C. lihengiae* grew in a damp gully approx. 100 m distant, above the stream; vic. Hamren, Karbi Anglong

Photo 12. House garden with aroids at 'Pinpo village, Ronghang Rongbong, Karbi Anglong. From left to right (front to rear): *Colocasia gigantea* (pale plant with white waxy petiole, oval peltate blade, and shallow sinus), *Xanthosoma sagittifolium* (bluegreen sagittate blade with pale veins, angular shape, and deep sinus), and *C. esculenta* (dark-green peltate blade with oval shape, and sinus of intermediate depth)

Photo 13. *Alocasia macrorrhizos* (L.) G. Don (bor kachu) in lowland house garden, near Karbi Anglong. Note the erect blades (sagittate , i.e.'spear-like') with strongly undulating margins

Photo 14. Unidentified flowers spread on leaf of *Alocasia* sp. (*A. macrorrhizos* or *A. odora*) for drying, in house garden (lowland, near Karbi Anglong)

Photo 15. Keeping vegetables fresh with a leaf of *A.odora*, Hamren market, Karbi Anglong. Note the presence of leaf blade tissue around the sinus between the rear lobes (arrow); in *A. macrorrhizos*, the blade is 'naked' around the sinus in mature plants (Li and Heng 2010)

Photo 16. Wild *A.odora* near Hamren, Karbi-Anglong. Compared with *A. macrorrhizos* (Photo 13) these plants have less pronounced undulation of the leaf margin, and a shorter, more rounded blade that narrows in the lower part (around the sinus)

Photo 17. *A. odora* growing spontaneously in house garden, Guwahati city. Inset images from same plant show the inflorescence with green upper spathe (left) and pollinating flies clustered inside the spathe (right; here tentatively identified as *Colocasiomyia* sppp.)

Photo 18. *A. odora* This plant has a stature and habit similar to *A. odora*, but the rounded blades appear stunted. This could be due to disease, mutation, or hybridisation between *A. odora* and another species (*A. macrorrhizos*, *A. culcullata*?)

Photo 19. *Alocasia fornicata* at edge of forest and next to road, Karbi Anglong. The blade is peltate and the tip apiculate (a tapering point)

Photo 20. *Alocasia* sp. 1 (cv "Green Shield"), which Hay (1999) tentatively identifies as the Philippine endemic species, *Alocasia clypeolata*, growing as an ornamental plant in Karbi Anglong

Photo 21. ?*Steudnera* sp., growing as ornamental indoor plant, Guwahati city

Photo 22. *Xanthosoma sagittifolium*, large, mature leaves transported for use as fodder, vic. Hamren, Karbi Anglong.

Photo 23. *Homalomena* sp. 1, at Rani Forest, near Guwahati city. The rear lobes are wide apart (cf. Photo 24)

Photo 24. *Homalomena* sp. 2, at Karbi-Anglong, on shaded bank at foot of hill next to the stream and terrace shown in Photo 6. Similar to sp. 1 (Photo 23) but the rear lobes are rounded and close together.