

Utilization of wild *Citrus* by *Khasi* and *Garo* tribes of Meghalaya

Anamika Upadhaya, S S Chaturvedi & B K Tiwari*

Department of Environmental Studies, North-Eastern Hill University, Shillong 793022, Meghalaya
E-mails: anamika ya@gmail.com; sschaturvedinehu@gmail.com; bktiwarinehu@gmail.com

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Uses of wild and semi-wild *Citrus* are inculcated in the culture of tribal people of Meghalaya owing to its ubiquitous distribution and availability. In this paper, the traditional uses of *Citrus hystrix* DC syn. *Citrus macroptera* Montrouz., *Citrus latipes* (Swingle) Yu.Tanaka and *Citrus indica* Yu.Tanaka by the *Khasi* and *Garo* tribes of Meghalaya are documented. The study was conducted in 16 villages of the state having significant area under forest with *Citrus* species as natural component of forest vegetation using standard socio economic research methods. Distribution of these species are mostly confined to sacred groves, community conserved forests, core zone of protected areas and home gardens. Fruits and its parts are used for various medicinal and culinary purposes by these tribes. Owing to its distribution, *Citrus latipes* (Swingle) Yu.Tanaka is more commonly used by the *Khasi* people; *Citrus indica* Yu.Tanaka is more used by the *Garo* people while *Citrus macroptera* Montrouz. is equally popular among people of both the tribes. Wild *Citrus* spp and traditional knowledge associated with it are faced with a great threat of loss and call for protection and conservation. Documentation of traditional knowledge associated with *Citrus* spp could be a treasure for the future generation.

Keywords: Wild, Utilization, *Khasi* tribe, *Garo* tribe, *Citrus macroptera* Montrouz., *Citrus latipes* (Swingle) Yu.Tanaka, *Citrus indica* Yu.Tanaka, Meghalaya

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Wild edibles have been an important source of food for mankind; in fact, earlier to the advent of agriculture humans were exclusively nurtured by food from the wild. All over the world, there has been an increasing interest in the scientific study of man-plant interaction in the natural environment. Indigenous peoples, commonly designated as aboriginals, natives, autochthonous, fourth world, first nations, first people, *adivasi* (original settlers), *vanyajati* (forest-castemen), *adimjati* (primitive castes), *janjati* (folk communities) and tribals are the people holding ancient knowledge relating to such interactions. Food is integrated into a culture as a reflection of their history, their belief system and the ecological and social context of the community. Since ancient times, wild plants have remained a sustainable source for subsistence for most indigenous communities¹. Patterns of wild plant use depend on the socio-cultural milieu of the population being studied². A World Health Organization (WHO) estimate suggests that up to 80% of the world's population, mostly in developing countries, relies on traditional medicine practices for their health care needs. This is particularly true of the poorer sections of the

population because natural remedies are not only cheaper than modern medicines, but are often the only medicines available in remote rural regions³.

Citrus fruit belong to three closely genera, viz. *Citrus*, *Fortunella* and *Poncirus* of subfamily Aurantioideae, family Rutaceae. In India, 27 species of *Citrus* have been reported to occur and of these 23 species are found in northeastern India⁴. *Citrus indica* Yu.Tanaka falls under subgenus *Citrus* and *Citrus macroptera* Montrouz. and *Citrus latipes* (Swingle) Yu.Tanaka under subgenus *Papeda*. *Citrus* thrives well in the tropical and sub-tropical climates and are therefore grown throughout the world in areas lying between approximately 40°N and 40°S latitude which is also known as "Citrus Belt". *Citrus* has its center of origin in the Indian Center and therefore, indigenous species of *Citrus* are found in almost all parts of India⁵. *C. latipes* (Swingle) Yu.Tanaka and *C. indica* Yu.Tanaka are found in North east India, *C. megaloxycarpa* and *Citrus aurantiifolia* (Christm.) Swingle syn. *Citrus* × *pseudolimonum* Wester are found in foothills of the Himalayas and *C. pennivesiculata* and *C. maderaspatana* are found in the south India. *Citrus latipes* (Swingle) Yu.Tanaka is native and endemic to Khasi hills of Northeastern India.

*Corresponding author

C. macroptera Montrouz. is distributed in Thailand, Indochina, Phillipines, New Guinea, New Caledonia and Polynesia and is considered to be native to these regions of South east Asia. *C. indica* Yu.Tanaka is endemic to North eastern Himalayas and reported to be occurring wild in Naga Hills of Nagaland, Kaziranga Reserve forest in Assam and Garo hills of Meghalaya.

Meghalaya, one of the hilly states of North eastern India, is exceptionally rich in biodiversity. The Khasi and Jaintia Hills of the state are described as some of the richest botanical habitats of Asia. The state falls in the region considered to be the centre of origin of *Citrus* species and is very rich in *Citrus* germplasm⁶. Fruits of *Citrus* are known to have long history of use and appear in old documents of Chinese and Sanskrit literatures of as early as 800 BC. They are valued throughout their distribution for their fruits, essential oils and medicinal properties⁷. *Citrus* species have been traditionally used by indigenous tribal communities for medicine world-wide^{5,7,8}. Yet, very few detailed accounts on the uses of *Citrus* species exist⁹. In India, a vast reservoir of *Citrus* diversity exists both in wild and cultivated forms, and northeastern region, is considered as paradise of genetic diversity and natural home of many *Citrus* species. Several, past explorers have described the region as hot spot of *Citrus* biodiversity and have underlined that the erosion of its genetic resources is a cause of concern^{6,10}. It is well recognized that traditional communities have knowledge on utilization and conservation of *Citrus* in forests and homesteads, however the same have not been documented and researched. The present study has been carried out to document and analyze traditional knowledge associated with utilization of *Citrus macroptera* Montrouz., *Citrus latipes* (Swingle) Yu.Tanaka and *Citrus indica* Yu.Tanaka by *Khasi* and *Garo* tribes of Meghalaya.

Study area

Meghalaya lies between 25°4'N to 26°10'N and 89°48'E to 92°50'E longitudes with a total geographical area of 22,429 sq km. For the collection of data on the local and traditional knowledge associated with utilization of selected *Citrus* species, the state was divided into four broad agro-ecological regions¹¹ viz., Western Region, comprising of Garo Hills and some adjoining areas of the West Khasi Hills, Central and Upland Region, covering the East Khasi Hills, parts of West Khasi Hills, Ri-Bhoi and Jaintia Hills districts, Northern Undulating Hill Region, including most parts of the Ri-Bhoi district

and some part of West Khasi Hills and Southern Precipitous Region, popularly known as the War Area which includes most of the southern part of the West and East Khasi Hills, parts of Jaintia Hills and a small area of South Garo Hills district.

Sixteen villages/towns; 2 from western region, 7 from central upland region, 3 from North undulating region and 4 from South precipitous region, having significant area under forest with *Citrus* species as natural component of forest vegetation were selected for detailed survey on traditional knowledge associated with utilization of *Citrus* species.

Methodology

The household survey for the collection of data on traditional knowledge associated with the *Citrus* species was conducted during April 2008 to March 2009. The data was collected using Focus Group Discussion, Key Informant Interview, Participatory Rural Appraisal (PRA) and Household Survey¹². Stratified random sampling on 15% of the total households in each village was carried out for Household Survey. People were interviewed using a semi-structured questionnaire. Questions were focussed on the uses of the different plant parts of the *Citrus* species including culture and tradition associated with *Citrus*.

The key informants included the village head-men and village elders and other knowledgeable persons of the village. Focus Group Discussion in each village were held where groups were divided into the citrus cultivators and users, the non-cultivators but users, the young generation and the elders of the society. Forests and the homesteads of the selected villages were surveyed for the presence of *C. Latipes* (Swingle) Yu.Tanaka, *C. macroptera* Montrouz. and *C. Indica* Yu.Tanaka. The specimens of three *Citrus* species were collected and identified from Botanical Survey of India, Eastern Regional Centre, Shillong.

Results

The survey on distribution and traditional knowledge relating to the three wild endemic and rare *Citrus* spp found in Meghalaya revealed that *C. latipes* (Swingle) Yu.Tanaka and *C. indica* Yu.Tanaka were mostly found in the natural forests. *C. latipes* (Swingle) Yu.Tanaka was found growing in primary forest namely Sacred Groves of Mawphlang, Ialong, Raliang and in the community forests of Mairang and Upper Shillong while, wild population of *C. indica* Yu.Tanaka was found in the core region of Nokrek Biosphere Reserve, foot hills of Nokrek and in

community forests of South Garo Hills. Villages surrounding these forests were also seen to harbour erstwhile naturally growing populations of the species which were selectively retained by the villagers in their homesteads while clearing forests for settlements. *C. Macroptera* Montrouz., on the other hand, was found in the semi-wild state cultivated and protected in the forest-gardens of South precipitous region.

Citrus latipes (Swingle) Yu.Tanaka

C. latipes (Swingle) Yu.Tanaka is locally known as *Soh Kymphor Shrieh* in *Khasi* language and *Sa Bah* in *Jaintia* language. The medicinal uses of *C. latipes* (Swingle) Yu.Tanaka by the *Khasi* tribe of Meghalaya are given in Table 1. Different parts of the plant are used for treating different ailments. Leaves are used for treating cold, headache and bodyache. Leaves are

Table 1 — Traditional uses of *C. Latipes* (Swingle) Yu.Tanaka, *C. macroptera* Montrouz. and *C. indica* Yu.Tanaka by *Khasi* and *Garo* tribes of Meghalaya

Fruits	Tribes	Parts used	Uses	Method of uses
<i>Citrus latipes</i> (Swingle) Yu.Tanaka	<i>Khasi</i>	Leaves	Common cold	Leaves of the plant are boiled in water until water turns green in color and this water is used for bathing when suffering from cold.
			Headache and body ache	Leaves of the plant are boiled in water until water turns green in color and this water is used for bathing to get relief from headache and bodyache.
			Stomach disorder	Fruit is peeled and boiled in small amount of water. It is then cooled and strained through the muslin cloth and stored. This concoction is diluted in water and given for stomach ailments like gas in the stomach, constipation, etc.
		Fruit juice	Skin diseases	Fruit is peeled and boiled in small amount of water. It is then cooled and strained through the muslin cloth and stored. The concoction is applied over chapped skin to get relieve from dry skin. It is also used in frost bite and also as a stain removal for the skin.
			Fever	Juice mixed with mustard oil is embalmed on forehead and nose to get relieve from cold and fever.
			Cuts and wounds	Juice is applied on cuts and wounds as antiseptic.
	<i>Khasi and Garo</i>	Juice	Stomach disorder	A small amount of fresh or stored juice is taken in a cup of water with a pinch of salt to cure ailments.
			Fever	Juice is applied on forehead or on pate (top of the head) in case of children during fever to bring down the temperature.
			Headache and Body-ache	<i>Garo</i> people apply the juice on forehead and also all over the body to get relief from pain.
		Antidote	Cuts and wounds	<i>Garo</i> people take it orally as an antidote during food poisoning.
			Skin diseases	Juice applied on cuts and wounds act as antiseptic
				<i>Khasi</i> people rub the juice on cracked and chapped skin to heal.
<i>Citrus macroptera</i> Montrouz.	<i>Khasi</i>	Peel	Culinary	Fresh peel is used during the season or it is also preserved for later use. Peel is used in various traditional cooking of non-vegetarian dishes to add flavor. It is used with pork, beef, fishes and also chicken.
		Pulp	Pickle	Pulp is sun dried and pickled with different spices and oil.
		Juice	Culinary	Juice is used to flavor the fried pork. It is said to neutralize the fat.
	<i>Garo</i>	Peel	Culinary	Fresh peel is used during the season or it is also preserved for later use. Peel is used in various traditional way of cooking non-vegetarian dishes to add flavor. It is used with pork, beef, fishes and also chicken. One delicacy of <i>garo</i> with this fruit is called as “ <i>Wak Chambal Phura</i> ”
		Whole Fruit	Pickle	Peel is scraped, fruit cut into pieces, sundried a little and preserved in glass bottle with warm mustard oil and other local spices. This preparation is sundried for a few days before it is ready to use.
			Wangala dance	The fruit is tied with strings on the hips and swung which depicts the protection of crop field from the pests.
<i>Citrus indica</i> Yu.Tanaka	<i>Garo</i>	Juice/fruit	Food poisoning	Whole fruit or Juice is taken orally as an anti-dote for food poisoning.
			Stomach disorder	A small amount of fresh or stored juice is taken in a cup of water with a pinch of salt to cure the ailments.

boiled in water until the water turns green and this water is used for bathing to get relief from common cold, fever, bodyache and headache. Fruit is peeled and boiled in small amount of water, it is then cooled and strained through muslin cloth and stored. This decoction is used for treating stomach disorders and also skin problems. The decoction is diluted in water and is orally taken to get relief from ailments like gas in stomach, constipation, etc. The same decoction is also applied over chapped skin to get relief from dry skin problem and for removal of stain from the skin. Fruit juice is mixed with mustard oil and embalmed on forehead and nose during cold and fever to lower the body temperature. It also acts as antiseptic when applied on cuts and wounds. *C. latipes* (Swingle) Yu. Tanaka fruit is bitter sour in taste and is not commonly consumed raw, but in Khasi villages of Laitjem and Sadew, fruits are eaten between meals as snacks, usually blended with finely cut tender leaves of mustard or radish, with excess of chillies and sugar and salt for taste (Fig. 1).

Citrus macroptera Montrouz.

C. macroptera Montrouz., locally known as *Soh Kwit* in Khasi language and *Chambal* in Garo language mostly grows on the southern slopes of Meghalaya. The villages where this species was recorded are: Mawlong, Wahlong, and Tyrna. Sohra is the local market for surrounding areas, where the growers from interior villages sell the fruits on the weekly market day. In Garo hills it is widely distributed and mostly grows on hill slopes as a component of natural vegetation.

The medicinal uses of *C. macroptera* Montrouz. by the Khasi and Garo tribes of Meghalaya are given in Table 1. The fresh or stored juice of this fruit is used

to get immediate relief from various common ailments, viz., stomach disorder and fever. Juice diluted in water, mixed with salt and sugar is orally taken for stomach ailment like flatulence, constipation, etc. It is also used to get relief from high fever. Topical application of juice all over the body or just on forehead during high fever brings down the temperature. Some families mix juice with mustard oil and lime and apply on forehead or on pate (top of the head) in case of children during fever to bring down the body temperature. It also acts as an antiseptic when applied on cuts and wounds. People of *Garo* tribe use juice as an antidote for any type of food poisoning in human and also cattle and pets. The fruit is boiled with the food and given to the pets.

C. macroptera Montrouz. is cherished for its culinary properties by the people of Meghalaya (Table 1). Peel is used in the preparation of non-vegetarian dishes and some pulses. It is used for tangy flavour and aroma in the dishes and also believed to neutralize the fats. Fresh peel is used during the season and for later use peel is dried and kept. *C. macroptera* Montrouz. is intricately woven in the lives of *Garo* people of Meghalaya. Other than its medicinal properties it is highly valued for its culinary value (Table 1). Both juice and peel is used in the traditional cooking of the non-vegetarian dishes. Commonly used with pork, it is also used with beef, fish and chicken. Juice is added in the fried meat for the flavour and is said to neutralize the fat. Fresh peel is used during the season and for the off season it is dried in the sun and preserved. One delicacy of *Garo* tribe with this fruit is “*Wak Chambal Phura*”, where pork is prepared with rice flour and peel of the fruit. Fruit is also relished in the form of pickle. For pickle preparation, peel of the fruit is scraped; fruit is then cut into pieces and bottled with lots of salt. The other way of making pickle is by cutting the fruit into pieces and drying it in the sun and pickled with species and mustard oil (Fig. 2).

C. macroptera Montrouz. also has an important role in the most famous “*Wangala* dance”, which is a folk dance performed by *Garo* people during harvest festival. This festival is observed by *Ambeng*, the traditional *Garo* tribe, living in Meghalaya and Assam in India and Greater Mymensingh in Bangladesh. The festival is celebrated for the thanks giving to the Sun-God (*Misi Saljong*) for good harvest. A part of the dance called “*Chambal moa*” depicts the protection of crop field from birds and other



Fig. 1- *Citrus latipes* (Swingle) Yu. Tanaka plant with fruits



Fig. 2- *Citrus macroptera* Montrouz plant with fruits

predators. In this section the dancers tie *C. macroptera* Montrouz. fruit behind their back with string and swing in a very rhythmic way chasing away the birds and the other animals from the crop field.

Khasi people preserve the juice of *C. macroptera* Montrouz. by simply storing it, whereas *Garo* people boil the juice for a long time and cool it to room temperature before storing it in glass bottles. The stored juice can be used for at least one year or more if it is kept in air tight containers.

Citrus indica Yu.Tanaka

C. indica Yu.Tanaka is commonly known as *Memang Narang* in *Garo* language. In *Khasi* and *Jaintia* language it is called as *Soh Kumphlair* and *Sa Kymphrai*, respectively. The fruit grows mostly in *Garo Hills* below 1000 msl. Natural or wild population of *C. indica* was not recorded during the study from *Khasi* and *Jaintia Hills*. Medicinal uses of *C. indica* Yu.Tanaka by *Garo* tribe of Meghalaya are given in Table 1. *C. indica* Yu.Tanaka has uses similar to *C. macroptera* Montrouz. and according to users, the former is more potent but rare, as a result *C. macroptera* Montrouz. is used more frequently. *C. indica* Yu.Tanaka is used as an antidote for any type of food poisoning. Either fresh fruit or juice is administered to the patient and in case of dried fruit being used the dose is increased. This fruit is also reported to cure hypertension, snake bite, jaundice and small pox. Juice is also used as energy drink for persons suffering from fatigue and dehydration. In villages of lower elevation of *Khasi* and *Jaintia Hills*, *C. indica* Yu.Tanaka is grown in the homestead for its aesthetic and ornamental value. This plant was



Fig. 3- *Citrus indica* Yu. Tanaka twigs with fruits

preferred in the home gardens as the flowers had pleasant fragrance and fruits remained in the tree for longer time from October to February. Fruits are small and beautiful with orange to scarlet red colour. The fruit is highly valued for its medicinal and culinary properties by the people of Meghalaya. Since, these fruits are available only during certain season of the year, various traditional techniques are used to preserve fruit as a whole or in parts that are used. Both *Khasi* and *Garo* tribes have their indigenous ways of preserving it. *Garo* people dry the whole fruit and store it for later use. The fruit is dried in the sun either by tying in the string or by placing it outside. The other way of drying the fruits is by traditional smoking method. In this method fruits are placed on the bamboo rack called “*gamchang*” made over the traditional fire place (Fig. 3).

Discussion

Citrus is one of the most consumed fruit and is well known for its food value and nutritional and medicinal properties¹³. The acid lime has antiseptic, astringent, restorative properties. It is a digestive stimulant and encourages the appetite when eaten with meals. Citrus antioxidants are also anti-carcinogenic, anti-inflammatory and anti-allergens¹⁴. Carbohydrate, protein, dietary fibres, minerals, vitamins, and antioxidants content in *C. Latipes* (Swingle) Yu.Tanaka, *C. macroptera* Montrouz. and *C. indica* Yu.Tanaka have been reported to be higher than the commercial *Citrus* species¹⁵. Being rich in nutritional content and part of regular diet of the rural tribal people, these species significantly contribute to the health care system of the region.

Identification of a particular plant by the indigenous people for their potential use is based on their techno-ecological knowledge¹⁶. The study on traditional knowledge revealed that these species are extensively used in food and traditional healthcare system prevalent among the tribal people of Meghalaya. Malik *et al.*⁸ while studying the germplasm of *C. indica* Yu.Tanaka and *C. macroptera* Montrouz. of North eastern India have briefly outlined the uses of these species. The survey further revealed rapid decline in the natural populations of wild *Citrus*. This can be attributed for various reasons like unsustainable use of these plants, destruction of their natural habitats and also due to promotion and cultivation of commercially important *Citrus* species. The old practices have diminished considerably in the last century, producing an impoverishment of plant diversity in people's diets²¹. Many studies on indigenous communities have shown that wild plant knowledge decreases through generations^{18,2} which is also happening in the present case. The present study corroborated that the decrease in the tradition of gathering wild edibles like *Citrus* by the folk communities studied is attributed to diverse social, economic and ecological factors. In places where environmental transformation has led to changes in food practices, many indigenous communities have abandoned or changed their traditional customs and thereby lost their plant knowledge over time^{2,18,20}. Threat of the loss of traditional knowledge associated with the plant and also erosion of their genetic pool calls for the need for collection and conservation of the *Citrus* species mostly found in the wild. Research on propagation, cultivation and conservation and further inventorying the traditional knowledge available is urgently needed. For conservation of rare plant species, cultivation is often considered an alternative to wild collection²¹. Though *C. indica* Yu.Tanaka is being domesticated in a small scale other species still remain confined to natural forests. Loss of natural forest is causing a threat to the *Citrus* germplasm in the state and reduced availability of the resource is emerging as a threat to the knowledge associated with this plant.

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