

Survey Report

TEA IN MYANMAR, WITH SPECIAL REFERENCE TO PICKLED TEA

Hla Hla Htay*, Kawai M*, MacNaughton L.E*, Katsuda M* and Juneja L.R*

ABSTRACT

*Eating habit of fermented wet green tea leaves (Pickled tea) in Myanmar and its culture, history, production, processing and health benefits are reported in this paper, together with drinking green tea and black tea. Types of tea plants found in Myanmar, include the indigenous species *Camellia irrawadiensis*. The antioxidant effects of Myanmar tea were determined for 3-minutes and 30- minutes infusion. The latter infusion is Myanmar's way of drinking tea and has 3 times higher antioxidant activity than 3-minute infusion. Antioxidant activity of green tea is higher than black tea and pickled tea in both 3 min and 30 min infusions. This is the first report on the antioxidant properties of Myanmar tea, which needs to be studied further.*

*Key words; Myanmar tea, antioxidant, pickled tea, *Camellia irrawadiensis* , Caffeine-free tea, theobromine, theophylline degradation.*

HISTORY

Tea is indigenous to Myanmar (formerly Burma), which is one of the countries of its origin (Noorma Wati Haron, 1998, Robert L. *et al.*, 1996). That it was NOT introduced from another country is indicated by its Burmese name that bears no resemblance with common names of tea (Cha or Tay or Tea.), which are used in almost all those tea growing countries of the world where the crop has been growing long before recorded history *viz.* China, India, Indonesia, Japan, Russia. Kenya and Sri Lanka are late entrants in tea growing. A legend by famous Burmese poet U Ponnya (AD 1812-1867) bears testimony to its indigenous nature in Myanmar. It says that tea seeds were given to Pyu King Duttabaung (BC 443-372) by an

one hand from the king without paying respect as per the norm of receiving gifts with both hands from the king. For this reason, tea in Myanmar was named "Let ta phet", meaning "one-hand" in Myanmar language. (Thaw Kaung 2001). Perhaps, another possible origin of the name was derived from the way tea leaves were plucked from tea trees. Tea in nature is a big tree (five to fifteen meters high) and was known to be useful for its leaves. Tea pluckers used to climb the tree and pluck the leaves by right hand while the left hand held the branches to avoid falling down. Therefore, it was named one-hand pluck leaves "Let ta phet". The accent has been changed gradually from "Let ta phet" to Letphet or Laphet, which is call-name for tea leaves in Myanmar at present. When tea was processed for pickeling, it was called Laphet So (Pickled tea) while dry processed tea was called Laphet Chouck (green tea for drink). This tea nomenclature proves once again that tea was grown and used in Myanmar for a long time, may be, as long as Myanmar's history.

*Central Research Laboratories, Taiyo Kagaku Co., Ltd.

1-3 Takaramachi, Yokkaichi-shi 510-0844, Japan.

Department of Microbiology and Immunology, Aichi Medical University, Nagakute cho, Aichiken, 480-1195, Japan

Corresponding author: Dr. Hla Hla Htay

E Mail<hhlahla@taiyokagaku.co.jp>

AREA & PRODUCTION

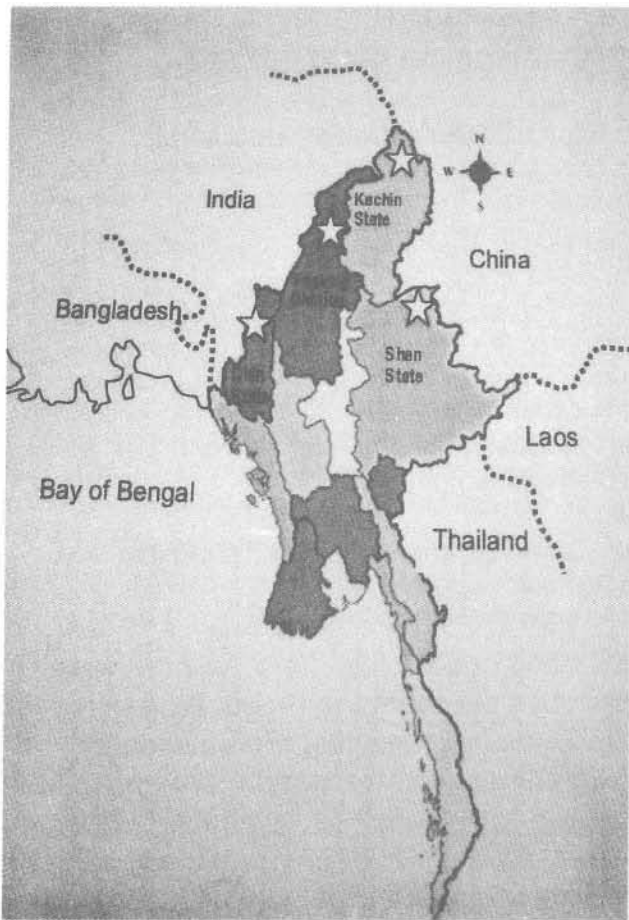


Fig.1 - Tea plantation area in The Union of Myanmar (Stars show tea plantation area of State and Division in The Union of Myanmar)

Myanmar has a tropical climate. Tea plantations are found in the fertile Eastern hilly region of Myanmar named Shan State, in the Northern region of Kachin State, Saging division and Chin State (Fig.1).

According to the Food and Agriculture Organization (FAO) report, Myanmar tea production increased from 1992 to 2002, at an annual growth rate of 3.4% (Table 1)

Recently, Myanmar's Deputy Minister for Agriculture and Irrigation supported the proposal for an extension of tea plantation area in the Northern Shan State to increase tea production (Win Nyunt Lwin 2004). In 2003, National International Commercial Enterprise Ltd., a large tea producing company of Myanmar, reported that the total area of tea was 74,143 hectares, with 22,159 metric tones production, averaging an yield of just 300 kg / ha.

PLANT TYPE

There are different species in the genus *Camellia*, the main being *Camellia sinensis* (China variety) and *C.sinensis var. assamica* (Assam variety). Typically the China variety is a shrub with stems arising near the ground, 1.0 to 3.0 meter tall, with relatively small,

Table (1) FAO report on tea production in Myanmar

Year	Harvested area (1000ha)	Yield(kg/ha)	Production (1000MT)
1992	57.9	249	14.4
2000	66.9	284	19.0
2002	67.1	298	20.0
Annual growth rate (%)	1.8	1.5	3.4

hard, dark green leaves, 3 to 6 cm long, with a dull surface. The Assam variety is single-stemmed, many-branched tree, 10-15 meters tall, with large light leaves, 15-20 cm long, with a glossy surface (Wight W. 1959). Myanmar's indigenous species, *Camellia irrawadiensis*, is found along the Irrawaddy valley of Myanmar. It is an evergreen rounded shrub with leathery and glabrous leaves (Barua, *et al.*, 1958). The interesting property of this species of tea is lack of caffeine (Chu D.C 1997), while theobromine, the major purine alkaloid, is present in the leaves of this species (Ashihara *et al.*, 2004). Theophylline metabolism in young, mature and aged leaves of *C. sinensis* and *C. irrawadiensis* were investigated by Ito *et al.* (1997). They reported that degradation of theophylline to CO₂ was more extensive in young leaves of *C. irrawadiensis* and declined as the leaf aged, which is the opposite of what occurs in *C. sinensis*. As a result, there is less caffeine in young leaves and the mature and aged leaves of *C. irrawadiensis* lack caffeine. Chromatographic analysis (Wood D.J. *et al.*, 1958) shows that the major phenolic constituents of *C. irrawadiensis* are different from *C. sinensis* and *C. sinensis* var. *assamica*. It may be of particular interest as caffeine-free beverages are becoming popular. These plant types will provide a valuable gene bank to develop suitable caffeine free varieties by plant biotechnology. The ethnobotanical aspects of *C. irrawadiensis* should also be investigated, as theobromine has bronchodilator effects, which may be a pharmaceutical benefit for people with asthma (Simons F.E., *et al.*, 1985)

TEA PRODUCTS

Three kinds of tea are produced in Myanmar, pickled tea (fermented wet green tea or Laphet So), green tea and black tea. In 2003, the volume of production of Green tea, Black

tea and pickled tea was 8,003 MT, 4,224 MT and 9,932 MT, respectively. The domestic production of pickled tea stands at 44% of all tea, followed by green tea and black tea in Myanmar.

The production techniques of each tea are different, giving their characteristic taste and properties. Green tea is produced by a traditional pan-frying method (Kato M. *et al* 2001). Plucked tea leaves are placed into a large pan and heated to stop enzymatic reaction; thereby keeping the polyphenols intact. Heated leaves are placed on a table and rolled by hand, followed by sun drying. Household industries in Myanmar have been using this traditional method for over 100 years. This traditional method is still the major processing method of green tea in Myanmar; however, a few companies are using machine processing. Black tea is produced by machine processing. Manufacture of pickled tea is described later in this paper.

PICKLED TEA IN SOCIAL CULTURE OF MYANMAR

Pickled tea has an important role in the social life of the people of Myanmar. Unlike Japan Myanmar does not have a tea ceremony. However, tea plays an essential role in many other ceremonies. Pickled tea is one of the offerings at celebrations, especially at religious functions, weddings, welcoming and social gatherings. Tea is offered in religious ceremonies to pay respect to Buddhist monks. In Shan State, green tea and sweet candy are offered to guests at the beginning of engagement ceremonies. Myanmar's young and old often have get-togethers, which start with chatting and eating pickled tea dishes served with a cup of green tea.

Table 2 - Tea processing in Myanmar

	Species/Variety	Production Method		
MGT	<i>Camellia sinensis</i> <i>var. sinensis</i>	Roller fried (Heated by roller)	Machine rolled	Roller dry
MPT	<i>Camellia sinensis</i> <i>var. assamica</i>	Pan fried (Heated by pan)	Rolled by hand	Sun dry
MBT	<i>Camellia sinensis</i> <i>var. assamica</i>	Roller Machinery process	Crush, tear, curl	Heated to dry
MLS	<i>Camellia sinensis</i> <i>var. assamica</i>	Steam and fermentation process	Steamed and rolled by hand	Keep in underground container for fermentation

MGT-Myanmar Nara green tea, MPT-Myanmar Pin Laung green tea, MBT-Myanmar Black tea, MLS-Myanmar pickled tea (fermented wet green tea).

The tradition of eating pickled tea is good for facilitating communication at home, at work and at clubs during afternoon break or in holiday gatherings. There is a Myanmar saying handed down through the centuries that goes:

“of all fruits, mango is the best, of all meats, pork is above all else, of all leaves, tea excels the rest”.

It is known that pickled tea gives a fresh and alert feeling for work and study. It is said that it could give satisfaction when taken after a meal. Myanmar's elders used to have pickled tea after meals like a dessert.

TEA-LEAF EATING HABIT

It is important to consider pickled tea in the overall context of eating the whole leaf of tea rather than using only its extract as a

beverage. While pickled tea is eaten as a snack in Myanmar, whole-tea leaf eating habit seems to be in practice in other countries also, like Thailand (minority communities in northern part), northern part of Laos, (Matsushita, 1998), and Saharan Africa (Krishna et al., 2004). Eating tea means using whole leaves for food, which may have some benefits: it provides major nutrients like carbohydrates, minerals, amino acids, proteins and even vitamins and co-enzymes.

There are three different ways of consuming whole tea leaves. First, consumption of tea leaves after infusion of tea in Saharan Africa. Second, whole tea leaves made into a powder, which is called “Macha” (or Matcha) in Japan. It is dissolved with hot water and consumed whole. Macha is also used in various food preparations like steamed bread, cakes, cookies, rice toppings and is mixed with milk and ice cream in Japan. Third, consumption of fermented wet green

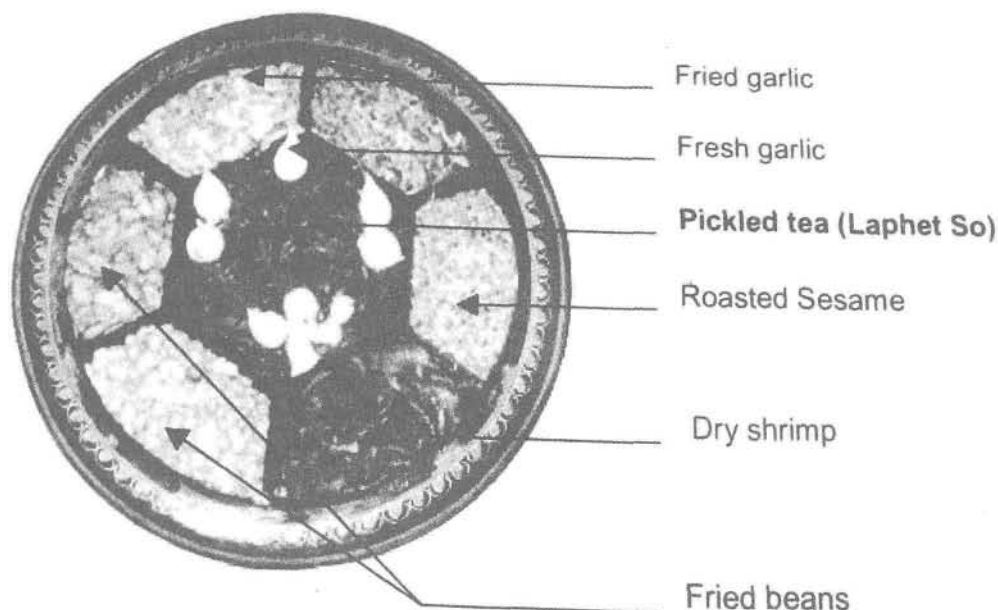


Figure 2: Myanmar's traditional pickled tea is served in lacquer ware

tea leaves (Pickled Tea) as in Myanmar and Thailand. The first and second types of whole-leaf tea consumption provides nearly the same nutrients which are inherent in the tea leaves. In addition pickled tea provides vitamins and coenzymes, which are produced during fermentation by natural microbes.

METHOD OF MAKING PICKLED TEA

Plucking of tea leaves begin in April. A bud and two leaves below it on a shoot are steamed in a wooden steamer for five minutes to stop the enzymatic reaction. Steamed leaves are spread on a table and

Table 3 - Antioxidant activity of tea infusions measured by DPPH radical scavenging colorimetric assay

	3 minute infusion		30 minute infusion	
	Dilution factor*	Strength of tea infusion** equivalent to ascorbic acid (mM)	Dilution factor*	Strength of tea infusion** equivalent to ascorbic acid (mM)
MGT	0.016	27	0.0048	89
MPT	0.017	25	0.0053	81
MBT	0.048	9	0.023	19
MLS	0.14	3	0.061	7

The dilution factor* is the dilution of the tea infusion that gives 50% inhibition of DPPH that is equivalent to the IC₅₀ of ascorbic acid (IC₅₀ (AA)=0.43mM). The strength of the tea infusion** is for the original infusion equivalent to ascorbic acid mM.

MGT. Mvanmar Nara areen tea; MPT. Mvanmar Pin Laund areen tea; MBT. Mvanmar

rolled by hand. After rolling, leaves are placed in a plastic-lined basket and sealed to allow for natural fermentation. The basket is then placed in an underground container (2 x 2 m diameter) and covered with heavy stones for pressure. The tea leaves are kept weighted down for two months; the leaves then become soft. The fermentation time varies in different places. In some areas the leaves are kept for fermentation for more than one year. After fermentation, soft tea leaves are separated from hard leaves. The final product is then ready to be packaged and put on the market shelves.

CONSUMPTION OF PICKLED TEA

There are many recipes for pickled tea, which differ from place to place in Myanmar. The traditional way of preparation is to garnish the pickled tea with salt and sesame oil and eat it in combination with a variety of fried beans, dried shrimp, fried garlic, roasted peanuts and sesame seeds. It is usually served in a decorated lacquer ware container having different compartments for each ingredient with the central compartment containing the pickled tea (Fig 2).

This dish is always served with a cup of green tea. Another popular recipe is called Laphet Thoke, which is seasoned or marinated pickled tea with vegetables such as cabbage, tomatoes, or green chillies and a variety of fried beans. Although the seasoning varies, it basically consists of sesame oil, salt and lime or lemon juice.

HEALTH PROPERTIES OF PICKLED TEA

The health properties of drinking tea have been largely investigated and are known to have potent antioxidant effect in prevention of several chronic ailments like cardiovascular diseases and several types of cancers (Zheng et al., 2004, Garbisa et al., 2001,

Curin et al., 2005). Pickled tea confers all these health benefits in addition to providing coenzymes and vitamins, generated during microbial fermentation process. A comparison of different tea extracts in their antioxidant activity is shown in the analysis represented in table below:

Antioxidant activity of Myanmar green tea, black tea and pickled tea were determined by colorimetric analysis using 1,1-diphenyl-2-picrylhydrazyl (DPPH) at the absorbance of 517 nm. (Yamaguchi, et.al). 3g of each tea were prepared by hot water infusion for 3 min and 30 min. Ascorbic acid was used for a standard and measured the radical scavenging activity at the concentration of 50% inhibition (IC₅₀) of DPPH. Each tea infusion was serially diluted and DPPH radical scavenging activity was analyzed. The dilution factor, which gave equivalent inhibition of ascorbic acid to DPPH radical and the strength of original tea infusion was calculated (table 3). This study shows that Myanmar way of green tea infusion for 30 min has 3 time higher antioxidant capacity than 3min infusion. In regard to the antioxidant activity of MLS, pickled tea is normally eaten whole. However, in this experiment, the tea was put in a water infusion and the water was examined for antioxidant activity. Therefore, it is difficult to extrapolate the whole leaf antioxidant activity from this data. The different types of tea processing, which may play a role in antioxidant activity and taste, is depicted in table 2.

CONCLUSIONS

The folklore in the country and philology of the name of tea "Let ta phet" shows that tea is indigenous to Myanmar. Tea occupies >70,000 hectares area with a production of about 22,000 MT, averaging merely 300 Kg / ha yield which is one of the lowest in the

world. The reason is the traditional way of culture from tea seed without using chemical fertilizers in soil preparation, by small holders and even on large holding areas. Low yield is not only due to low fertilizer use but also due to poor knowledge of plantation, nurturing, production and marketing. A focus on the application of field technology is required in Myanmar to increase tea productivity, as has happened in areas of almost abandoned tea in Himachal Pradesh in India (Jain, 1999). Very little information is available on the status of soil and cropping systems or the status of agrotechnological R&D in Myanmar. What is evident is that for this increased productivity is to be sustained, it will be possible only by developing a good center of field research in Myanmar.

This paper has reported the existence of a unique species of the genus *Camellia* in Myanmar. This plant *C. irrawediensis* is low in caffeine and rich in theobromine, which is a broncho-dilator. This genome offers a gold mine of opportunity for pharmaceutical industry as well as meets the requirements of a caffeine-free tea beverage.

Pickled tea accounts for 44% of the total production in Myanmar. Used as snack or dessert by the people of Myanmar, it plays an important role in social and economic life of its people. The customary 30-minute brew and pickled tea provide a very large quantity of health-giving anti-oxidants in the diet of the people of Myanmar. The traditional belief, of the benefit of consuming pickled tea has not been scientifically proven. Sweetness after eating pickled tea and satisfaction after meal could be attributed to the amino acid and theanine contents of tea leaves. Natural fermentation that occurs in tea leaves by some microorganisms may result in production of vitamins or coenzymes for health, which should be studied.

REFERENCES

- Ashihara H. Suzuki T. (2004). Distribution and biosynthesis of caffeine in plants. *Front Biosci* 2004.May 1(9):1864-76.
- Barua P.K.; Wight ,W. (1958). Leaf sclereids in the taxonomy of *Thea Camellias*-I.Wilson's and related *Camellias*. *Phytomorphology*. 1958;8(3): 257-264.
- Chu D.C. (1997). Green Tea- Its cultivation, processing of the leaves for drinking material and kinds of Green Tea. *Chemistry and Applications of Green Tea*.1997 edited by Yamamoto Takehiko, CRC Press LLC Chapter 1 ; 1-11.
- Curin Y.; Andriantsitohaina R.(2005). Polyphenols as potential therapeutical agents against cardiovascular diseases. *Pharmacol Report* 2005;57 suppl:97-107.
- FAO (2003). Selected indicators of food and agriculture development in Asia-Pacific Region 1992-2002. Food and Agriculture Organization of the United Nations region office for Asia and the Pacific, Bangkok. RAP publication 2003 ;Oct; 108-110.
- Garbisa S.; Sartor L.; Biggin S.; Salvato B.;Benelli R.; Albini A. (2001). Tumor gelatinases and ivasion inhibited by the green tea flavonol epigallocatechin-3-gallate. *Cancer*. 2001;91-822-32.
- Ito E.; Crozier A.; and Ashihara H.(1997). Theophylline metabolism in higher plants. *Biochimica et Biophysica Acta*. 1997; 1336:323-330.
- Jain, N.K. (1999) Impact of global advances in tea science & technology on economic parameters of tea industry *in* *Global Advances in Tea Science* Ed.

- Jain, N.K. Aravalli Books International New Delhi. Pp 265-296.
- Kato M.; and Shibamoto T. (2001). Variation of Major Volatile Constituents in Various Green Teas from Southeast Asia. *J. Agric. Food. Chem.* 2001; 49:1394-1396.
- Krishna, K.V.S.; Ramaswamy, S and Jain, N.K (2004). Eating infusion tea leaves in Saharan Africa, *International Journal of tea Science.* 2004; 133
- Matsushita Satoru (1998). Cha no minzokushi; Sub title; Seicha bunka no genryu. (Japanese) Yuzankaku publication Co. Ltd. Japan 1998 March: 17-18
- Noorma Wati Haron (1998). Tea, coffee and cocoa. *Encyclopedia of Malaysia, on plant* edited by Dr. E Soepadmo (Singapore: Archipelago press,1998. 96)
- Robert L.Gutmen; Beung- Ho Ryu (1996). *Rediscovering Tea: An Exploration of the Scientific Literature.* HerbalGram. 1996; 37: 33-42.
- Simons F.E; BeckerA.B.; Simons K.J; Gillespie C.A. (1985). The bronchodilator effect and pharmacokinetics of theobromoine in young patients with asthma. *J.Allergy Clin Immunol.* 1985 Nov; 76(5): 703-707.
- Thaw Kaung (2001). The legend of how the tea leaf was given to Myanmar. *Myanmar perspectives;* 2001; 4(2): 10-12.
- Win Nyunt Lwin (2004). Tea Production up, says official. *The Myanmar times.* 2004. July 12 (225): 19-25.
- Wight W. (1959). Nomenclature and classification of the tea plant. *Nature.*1959.June 20 (183):1726-1728.
- Wood D.J.; Barua P.K. (1958).Species hybrids of tea. *Nature.* 1958.June 14 (181): 1674-1675.
- Yamaguchi T.; Takamura H.; Matoba T.; Terao J.(1998). HPLC method for evaluation of the free radical-scavenging activity of foods by using 1,1-diphenyl-2-picrylhydrazyl.*Biosci.Biotechnol.Biochem.*1998; 2(6), 1201-1204.
- Zheng Y.; Song HJ.; Kim CH.; Kim HS.; Kim EG.; Sachnidis A.; Ahn HY.(2004) . Inhibitory effect of epigallocatechin 3-O-gallate on vascular smooth muscle cell hypertrophy induced by angiotensin II. *J Cardiovasc Pharmacol.* 2004; 43:200-208.