

Morphological Studies on Five Species of Genus *Camellia* and Their Economical Importance in Myanmar

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Abstract

In Myanmar, *Camellia* spp. are very important role in manufacturing tea products. This research was based on the inventory of important *Camellia* species to fulfil the knowledge gap of Myanmar, contributing to tea landscape of Asia Programme sponsored by ICOMOS (International Council on Monuments and Sites). It was conducted from 2015 to 2018 at Department of Botany, University of Mandalay in Myanmar. Five species of genus *Camellia* such as *Camellia irrawadiensis*(Barua) F.K.Ward, *Camellia drupifera* Loureiro, *Camellia kissi* Wallich, *Camellia oleifrea* C.Abel and *Camelliasinensis*(L.)Kuntze have been studied, out of eight species were reported to exist in Myanmar both of wild and cultivated ones. Among these species, *Camellia sinensis*(L.)Kuntze was the most cultivated species whereas *C. drupifera*, *C. irrawadiensis*, *C. kissi*, *C. olifera* were naturally existing species of Myanmar. *C. irrawadiensis* was also found to be endemic of Myanmar species. Collection of species was done in the distributed area of Kachin State, Shan State, Chin State, Upper Sagaing Region and Mandalay Region. The characteristics of the family, the morphological characters of genera and species were described with the relevant photographs. The artificial keys to species were also described. In addition, their localities, specific altitudes of their distribution, agronomy, local processing and economically potential species were also described.

Keywords: *Camellia*, inventory, localities, altitude, processing.

Introduction

Tea is derived from the leaves of *Camellia sinensis* L. and is considered by about half of the World's population. It has long been used in the orient as an item of commerce and as a social custom and that of China dates from the 5th century AD (Sammbanurthy and Subrahmanyam 1998).

The tea was considered to be a native of Assam and adjoining area of Upper Burma, and some regarded that it is to be a native of Southern Yunan and Upper Indo-China (Pandey 2000). But some of the authors stated that *Camellia sinensis* L. undoubtedly is native to China. Asians have many legends describing the first uses of tea. Tea has long been used in the orient at first probably medicinally. Its precise mode and date of origin are uncertain, but it was an item of commerce with the Mongols for thousand of years ago. Tea was introduced to Europe in 1610 by the Dutch, London in 1664, and Boston in 1714 (Schery 1972). The tea *camellia* has been known to man for a very long time *Camellia sinensis*, the commercially important Chinese tea plant. This particular *camellia* has been cultivated by the Chinese people for certainly more than 2000 years, not, as one might imagine, on large plantations, but on countless thousands of small plots of land where the bushes were numbered in dozens rather than acres. The Chinese certainly knew of the tea plant and its value for many years, and had discovered that the infusion of its leaves, if (it was) carefully processed, it could produce a very palatable drink. It is likely too, that the people in the Shan State of Burma and Siam had been using the leaves of the tea plant-at first for medicinal purposes, then as a beverage for as long as the Chinese (Willson and Clifford 1992).

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The first tea seeds to arrive in Ceylon, in December 1839, were sent by Dr Wallich of the Calcutta Botanical Gardens, and these were received at the Royal Botanic Gardens at Peradeniya, near Kandy, in 1839.

Among the Myanmar People, it is popularly known that favourite foods are pork in meat, mangoes in fruits, and tea in leaves. And, also, tea was essential to all the ceremonies. Tea was used to recognize a contract as Myanmar tradition and culture. Both the plaintiff and the defendant had to take pickled-tea together in front of the jury after the judgement. It was a remarkable agreement by the two people. After that, the judgement was over and there was no complication the next time and no need to appeal. Tea was also used in other social affairs and novitiation ceremonies. There was a custom that tea was packed and presented as gifts which was like sending invitation cards nowadays. The person who accepted the auspicious packed tea had to come to the ceremony without fail. If he could not come to the ceremony, he did not have to accept it.

The beverage prepared from the dried leaves of *Camellia* spp. (Theaceae) which is known in different parts of the world as tea, Chai, or te is the most popular non alcoholic drink in Asia. Tea plant is native to India (Assam) or China. Tea contains 2-5 percent theine, 13-18% tannin, a small amount of caffeine and volatile oil when an infusion is made with hot water, the alkaloid and the oil dissolve resulting in a beverage with characteristic taste and aroma and has a stimulating effect. The characteristic flavour and aroma of tea are provided by the essential oil theols, tannins, along with pectins and dextrans provide the colour and astringency (Sambamurthy and Subrahmanyam 1998).

The aim and objectives of this research are to identify and classify the plants of *Camellia* spp in Myanmar; to know valuable of traditional tea plantation and tea processing methods and to give some information of economically potential species.

Materials and methods

The specimens are collected from Mogok, Kyauk-me, Pyin-Oo-Lwin, Panglong, Puta O and Pin-ta-ya. A collecting pick, a strong knife is essential for digging uproots; the pruning shears are especially used in cutting woody material or root, stem, flowers and fruit. Field notes book are made of precise data of collection, location and of habitat types. Hand lens are used for identification of specimens in species level. According to the resulting morphological characteristics, the scientific name was identified or key out using the floristic literature or references. The name of the genus was referred according to the book of vascular plant families and genera written by Benson (1965), Hutchinson (1959) and Cronquist (1981). The valid name of the species has been based on A Revised Hand book to the Flora of Ceylon by Dassanayake (1996), Flora of Java by Backer (1965) and Flora of British India by Hooker (1885). The tea plantations were practiced by author in Pyin-Oo-Lwin and tea processing was recorded by observations in Mogok.

Results

Morphological Study

Characteristics of the Family Theaceae

Tree or shrub, evergreen or rarely deciduous, sometimes lianes. Leaves simple, alternate (or) spirally arranged leathery or membranaceous, often toothed, often serrate, usually coriaceous, exstipulate. Flowers axillary or subterminal, solitary or sometimes to 3 (- 10 or more) in a cluster or raceme, pedicellate or sessile, actinomorphic, bisexual, sometimes unisexual or polygamous. Bracteoles 2-8 or rarely more, persistent (or) caducous, sometimes undifferentiated from sepals. Sepals 5 (or 6) or rarely more, imbricate, free or basally connate,

the innermost often larger, sometimes persistent. Corolla white, red, or yellow. Petals 5, rarely 4-9, free or connate below, imbricate or contorted, sometimes not clearly distinguishable from sepals. Stamens 5- α , numerous, free or basally connate and then 1- or 5-adelphous, opposite and adnate to petals, often basally monadelphous, anther basifixed or versatile, longitudinally dehiscent rarely poricidal. Ovary superior rarely half inferior, sessile, mostly 3-5 loculed, placentation axile or rarely nearly basal. Ovules 2-many in each cell, rarely one in each cell. Styles distinct to basally connate, rarely completely united. Fruit usually a loculicidal capsule or indehiscent and drupaceous or baccate, often leaving a central column after dehiscence. Seeds few or many, globose, semiglobose, compressed oblong, ovoid or reniform, winged or wingless, testa bony, leathery, (or sometimes with a fleshy red outer layer or sarcotesta in *Anneslea* and *Ternstroemia*); endosperm scanty or 0; embryo large, straight or curved, cotyledons fleshy or thin.

Distribution: A Tropical and subtropical family of about 30 genera and 500 species, of which 200 species from 10 genera in the new World (Lawrence, 1964).

Characteristics of the Genus *Camellia*

Shrubs or small trees, rarely large trees, evergreen. Leaves petiolate or rarely sessile and amplexicaul; spirally arranged, alternate, chartaceous or coriaceous, thinly leathery, margin serrate, serrulate, or rarely entire. Flowers axillary or subterminal, solitary or aggregated 2-3 in a cluster, sessile, shortly pedicelate; bracteoles differentiated from sepals, 2-10, spirally arranged, persistent or caducous. Sepals 5-6, rarely numerous, very unequal, imbricate, persistent, distinct or basally connate, *Camellia* flowers apparently sessile, actually with a short stout pedicel completely covered by bracteoles and sepals at anthesis; bracteoles and sepals not differentiated, ca. 10, caducous or persistent. Petals 5-8 ($-\alpha$) white, red, or yellow basally \pm connate. Stamens numerous, free or outer ones connate below and adnate to the corolla; anthers versatile, dorsifixed, 2-loculed, longitudinally and laterally cleft. Ovary superior, 3-5 loculed, placentation axile, styles free to the base, or more or less united; ovules 4-6 in each cell, pendulous. Capsule woody, globose (or) oblate, 3-5 loculed, sometimes reduced to 1- or 2-loculed by abortion, loculicidal into (1-) 3-5 valves from apex; columella persistent or lacking. Seeds globose, semiglobose, or polygonal, rounded or plano-convex; testa hornlike; hilum umbilicate; cotyledons full and fleshy with high oil content; endosperm absent, embryo straight.

Distribution: The genus of about 120 species. Distributed in Bhutan, Cambodia, China, NE India, Indonesia, S Japan, S Korea, Lao, Malaysia, Myanmar, Nepal, Philippine, Thailand and Vietnam (Hungta and Shanxiang, 1998).

Characteristics of the species

1. *Camellia drupifera* Loureiro, Fl. Cochinch 2:411.1790. (Figure 1 A)

Shrubs or trees. Stem and branches cylindrical; internode 2.5 to 4.0 cm long, 2-3 mm wide, grayish-brown; current year branchlets reddish brown, glabrous. Leaves simple, alternate, exstipulate, petiolate; petiole 4-6 mm, glabrous. Leaf blade elliptic to broadly elliptic, 5.0-12.0 \times 3.5 cm, leathery, abaxially pale green and glabrous, adaxillary dark green, shiny and hirtellous along midvein, margin serrulate, apex acute shortly acuminate, base rounded to obtuse. Lateral veins 6-9 on each side of midvein. Flower, bisexual, actinomorphic, hypogynous, white, axillary, solitary, fragrant, 4-6 cm in diam, subsessile, ebracteate, bracteolate, pedicellate. Bracteoles and sepals 10-12 or more, caducous, glabrous, margin ciliolate. Petals 5-8 white, nearly distinct, obovate, 3-6 \times 1.5-3.5 cm, apically 2-parted for 7-9 mm. Stamen numerous, 0.7-1.7 cm, glabrous; outer filament whorl basally connate for 1-2 mm to nearly

distinct. Ovary globose, tomentose, 3-loculed. Style 3, 1-1.5 cm, glabrous, distinct nearly to base. Capsule globose to ovoid, 3- to 5-loculed with 1-4 seeds per locule; pericarp 5-7 mm thick. Seeds brown.

Flowering time : September to October

Fruiting time : December to January

Specimens examined : Ye-chan-oke village, Pyin-Oo-Lwintownship; 1070 m, 22° 2' 4.38" N 96° 27' 31.49" E, KyawKyawSann Coll. no. 10;
Gway-pin, Mogok township; ; 1162 m, 22° 55' N 96° 30' E,
KyawKyawSannColl. no. 7

2. *Camellia irrawadiensis* Barua *Camellian* 7 (4) : 18, pl. ?, f. 1-3-1956 (Figure 1 B)

Shrubs or small tree up to 4-5 meters, stem cylindrical; everygreen, bark brownish – white; currently year branchlet deep reddish-brown, pubescent. Leaves simple, alternate, exstipulate, petiolate; petiole 5-8 mm, pubescent. Leaf blade elliptic, oblong-elliptic, 4-8 × 2-3 cm, leathery; upper surface dark green, shiny and hirtellous along midvein, glabrous, lower surface pale green, pubescent, young leaves and young shoots brick-red, pellucid dots present, margin serrulate, apex acuminate with an obtuse tip, base broadly cuneate; secondary vein 6-8 on each side of midvein. Flowers bisexual, actinomorphic, hypogynous, creamy white, aromatic, axillary, solitary 3.5 cm in diameter; ebractate, bracteolate pedicellate; pedicel 5-8 mm, pubescent, thickened toward apex. Bracteoles 2, caducous, ovate, ca 1-2 mm; sepal 5 ovate to suborbicular, 3-5 mm, outside glabrous, inside sericeous; petal 6-9, creamy white, nearly distinct, obovate, 2 – 5 cm × 1.5 – 2 cm apically 2-parted for 6-9 mm. Stamen numerous, 1.2-1.5 cm, glabrous; outer filament whorl, basally connate. Ovary globose, tomentose, 5-8 loculed. Style 3-5, 1-1.5 cm to, glabrous, distinct nearly to base. Capsule globose to ovoid, mostly 5 to 8 locule, 1-4 seed per each locule; pericarp 3-5 mm thick. Seeds brown.

Flowering time : February to April

Fruiting time : May to June

Specimens examined : Non-mone, Puta O and Ma chanbaw, Puta O township; 477 m, 27° 19' 48" N 97° 25' 35" E
Kalaya Lu Coll. no. 15 and KyawKyawSann Coll. no. 16

3. *Camellia kissi* Wallich, *Asiat. Res.* 13:429.1820. (Figure 1 C)

Shrub or tree. Stem and branches cylindrical, internodes 1.5 to 4.0 cm long, 2-3 mm wide, grayish-brown, glabrous, densely gray pubescent to villous. Leaves simple, alternate, exstipulate, petiolate; petiole 4-7 mm densely pubescent to villous. Leaf blade oblong-elliptic, broadly elliptic, 5.0-13.5 × 1.5-5.0 cm coriaceous, abaxially pale green and sparsely villous or glabrescent, adaxially dark green, and hirtellous along midvein; margin serrulate, acute, acuminate, or caudate at the apex; base cuneate or broadly cuneate or obtuse. Lateral veins 6-8 on each side of midvein. Flowers bisexual, actinomorphic, hypogynous, white, axillary, solitary, 2.5 to 3.5 cm across the anthesis, ebractate, bracteolate, pedicellate; Bracteoles and sepals 7-9, caducous; outer bracteoles and sepals lunate, 1-2 mm, inner bracteoles and sepals broadly elliptic to suborbicular, to 7 mm, outside velutinous to subglabrous, inside glabrous. Petals 5-8, white, nearly distinct, obovate to ovate, 0.8-3.0 × 0.6-2.0 cm. Stamen numerous, 0.6-1.5 cm, glabrous; outer filament whorled, basally connate for 1-3 mm. Ovary globose, white tomentose, 3-loculed. Style 3, 3-7 mm, glabrous or basally tomentose, distinct to near base or basally connate and apically 3-parted to 3-lobed. Capsule subglobose to globose-pyriform, 1.4-2.5 × 1.5-2.0 cm, usually 1-3 loculed with 1 or 2 seeds per locule; pericarp ca 1.5 mm thick. Seeds brown.

Flowering time : September to October
 Fruiting time : November to December
 Specimens examined : Ball-lone lay village, Mogok township; 1162 m, 22° 55' N 96° 30' E, KyawKyawSann Coll. no. 3
 Wanmai village, near the Panglong University; 1366 m, 20° 59' 30" N 97° 31' 15" E, KyawKyawSann Coll. no. 15

4. *Camellia olifera* C. Abel, Narr. Journey China, 174. 1818. (Figure 1 D)

C. oleiferavar. monosperma Hung T. Chang.

C. drupifera Lour. f. *biflora* (Hayata) S.S. Ying.

Thea biflora Hayata

T. oleifera (C. Abel) Rehder & E.H. Wilson

T. podogyna H. Leveille

T. sasanqua (Thunberg) Cels var. *lqueiroi* Pierre.

Shrub or trees. Stem and branches cylindrical; internodes 2.0 to 3.0 cm long, 2-4 mm wide, grayish-brown; currently year branchlets reddish brown, pubescent. Leaves simple, alternate, exstipulate, petiolate; petiole 5-10 mm, pubescent. Leaf blade elliptic, oblong-elliptic, or obovate, 3-10 × 2-4 cm. Leathery, abaxially pale green, glabrous and adaxially dark green, shiny and hirtellous along midvein, margins serrate to serrulate, apex acute to acuminate with an obtuse tip, base broadly cuneate to cuneate. Secondary veins 5-8 on each side of midvein. Flowers bisexual, actinomorphic, hypogynous, white, axillary, solitary, fragrant, subsessile, ebracteate, bracteolate, pedicellate; bracteoles and sepals 8-11, caducous, inner bracteoles and sepals obovate to suborbicular, 0.9-1.2 cm, outer bracteoles and sepals lunate to semiorbicular, scale like, 1-3 mm, glabrous or subglabrous; outside yellow tomentose, inside glabrous, margin membranous and ciliolate. Petals 5-7, white, oblong to oblanceolate, 2.5-3.5 × 1.5-2.5 cm, apically 2-parted. Stamens numerous, ca. 1.5 cm, glabrous; outer filament whorled, basally connate for ca. 5 mm. Ovary globose, white tomentose, 3-loculed. Style 0.8-1.2 cm, glabrous or base tomentose, apically 3-lobed to 3 parted. Capsule globose to ellipsoid, 2-4 cm in diam, 3-loculed with 1 or 2 seeds per locule; pericarp 3-6 mm thick. Seeds brown.

Flowering time : September to October
 Fruiting time : December to January
 Specimens examined : Kyu-yone village, Panglong township; 1366 m, 20° 59' 30" N 97° 31' 15" E, KyawKyawSann Coll. no. 18
 Near the Pin-ta-ya Cave, Pin-ta-ya township; 1286 m, 20° 40' N 96° 38' E, KyawKyawSann Coll. no. 20

5. *Camellia sinensis* (L.) Kuntze, Trudy Imp, S. Peter-burgsk. Bot. Sada 10:195. 1887. (Figure 1 E)

Shrubs or trees. Stem and branches cylindrical, internodes 2.0 to 3.5 cm long, 2-4 mm wide, grayish-brown, white-pubescent. Leaves simple, alternate, exstipulate, petiolate; petiole terete, 4-7 mm, green, pubescent, glabrescent. Leaf blade oblong-elliptic, leathery 5-14 × 2.0-8.0 cm, abaxially pale green and glabrous or pubescent, adaxially dark green, shiny, and glabrous midvein, serrate to serrulate along the margin, acute to acuminate at the apex, with an obtuse tip, base cuneate to broadly cuneate. Lateral nerves 6-9 on each side of midvein, reticulate veins visible on both surfaces. Flowers bisexual, actinomorphic, hypogynous, white, axillary, solitary 2 to 4 cm across at anthesis, ebracteate, bracteolate, pedicellate; pedicel 5-10 mm, recurved pubescent or glabrous, thickened toward apex. Bracteoles 2, caducous, ovate, ca. 2 mm; sepals 5, broadly ovate to suborbicular, 3-5 mm, outside glabrous or white pubescent, inside white sericeous, margin ciliolate. Petals 5-8, white; outer 1-3 petals sepaloid; inner petals obovate to broadly obovate, 1.5-2.0 × 1.2-2.5 cm, basally connate, apex rounded. Stamen

numerous, 0.8-1.3 cm, glabrous; outer filament whorl basally connate for about 2 mm. Ovary globose, densely white pubescent, tomentose or subglabrous, 3-loculed. Style about 1 cm, glabrous or base pubescent, apically 3-lobed. Capsule, oblate, rarely globose, 1.0-2.0×1.5-3.5 cm, 1 or 2-loculed with 1-2 seeds per locule; pericarp about 1 mm thick. Seeds brown.

Flowering time : August to October

Fruiting time : October to February

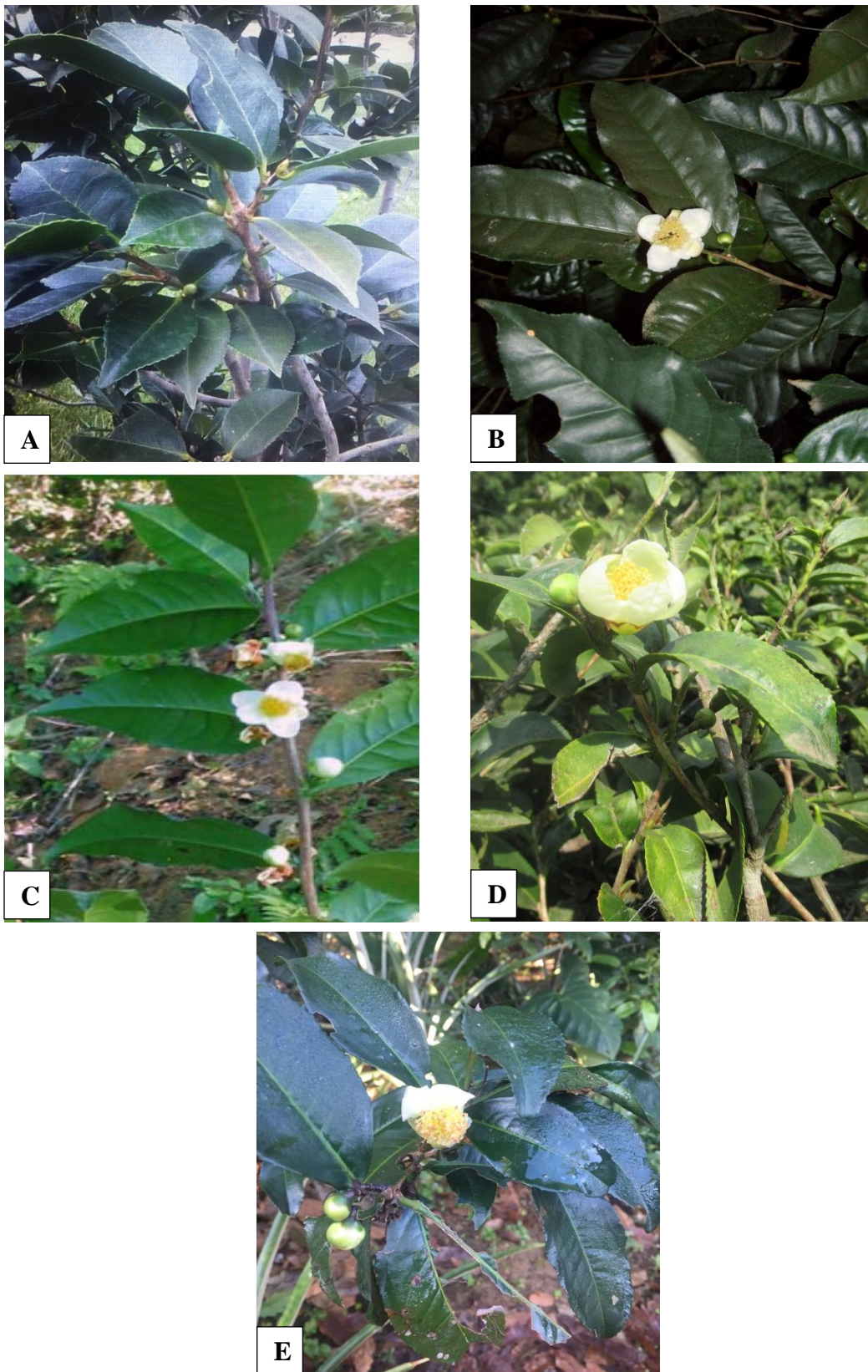
Specimens examined : Western part of Mogok, Mogok township; 1162 m, 22° 55' N 96° 30' E, KyawKyawSann Coll. no. 5
Mong-lon – Kyaukme road side, Kyaukmetownship; 775 m, 23° 32' 21" N 97° 1' 42" E, KyawKyawSann Coll. no. 8
Sin-lane, Pyin-Oo-Lwintownship; 1070 m, 22° 2' 4.38" N 96° 27' 31.49" E, KyawKyawSann Coll. no. 11

Tea Plantation and Tea Processing

The seeds are usually collected in May-June. In December-February, they are sown in moist soil, after the 24 hours soaking in water. Sowing seeds is done in nurseries, which should be properly shaded. The seedling plants germinate within 1-3 months after sowing. Generally seedling plants of 1 to 1 ½ year olds are transplanted to the fields (or) the hill sides in the months of April to October. The land used for planting is cleared by removing forest growth, taking care to prevent soil erosion. Pits of a convenient size, generally 30-45 cm deep and 24 cm wide, are dug and then these seedling plants can be grown in these sites. After transplanting the young plant should be covered by the soil and tri-pod to avoid the enemies of animals. The old seedling plants are planted at 6 ft away from another seedling plants in a row. The orientation of the plant in next row is in alternate manner of the plant from first row. Therefore the plants are in zig-zag arrangement and they are very suitable for plucking of tea leaves.

Picking of leaves can be started when tea plants, are 3 (or) 4 years old. Harvesting can be done at intervals of 15 to 30 days from April to December. Plucking is generally done by hand and the leaves are collected in baskets worn at the waist or the back. When harvesting the leaves only the terminal two leaves are plucked. Before the rainfalls in April, the best quality tea leaves can be plucked. These tea leaves suitable for green tea are also called 'Shwe-phe'. And the next month is called 'Char-kan'. Third month is called 'Khar-watt' and fourth month, 'Khar-nai'. Plucked plants stimulated new shoot growth, permitting next plucking in about 2 weeks. And then the leaves are dried in the sun about one day and packed. Harvested tea leaves may be treated into either of these three products, to produce green tea, black tea, and fermented tea (Laphet-so).

In preparing green tea, the fresh leaves (or) harvested tea leaves were steamed for about 1 minute (or) allowed to wilt. And then twisting was manually worked out by hand-rolling the leaves on a hard surface or bamboo-mat. Rolling and twisting and pressing the leaves secrete the yellowish-juice. And then, these leaves were dried in sun within a day. The resulting product was green tea leaf. In preparing Laphet so, the fresh leaves (or) harvested tea leaves were steamed for about 1 minute (or) allowed to wilt. And then twisting was done by manually worked out by hand-rolling the leaves on a hard surface (or) bamboo-mat. Rolling and twisting of the leaves secrete the yellowish color liquid. And then the leaves were washed with water and put into the bags (or) basket. The products were pressed by stone or men. The resulting product was fermented tea or Laphet-so (Figure 2 A to E).



**Figure 1. A. *Camellia drupifera* Loureiro
B. *Camellia irrawadiensis* Barua
C. *Camellia kissi* Wallich
D. *Camellia olifera* C. Abel
E. *Camellia sinensis* (L.) Kuntze**



Figure 2.A. Harvesting of Tea Leaves
B. Steaming of Tea Leaves in Pots
C. Twisting and Rolling of Leaves by hand
D. Sun Drying of Tea Leaves
E. Packing the fermented tea leaves in Bags for Transporting

Table 1. Comparison of Distinct Characters in Five Species of Genus *Camellia*

Distinct Characters	<i>Camelliadrupifer a</i>	<i>Camellia irrawadiensis</i>	<i>Camellia kissi</i>	<i>Camellia sinensis</i>	<i>Camellia sinensis</i>
Young branch	grayish-brown	reddish-brown	grayish-brown	grayish-brown	grayish-yellow
Petiole	4-6 mm glabrous	5-8 mm pubescent	3-7 mm densely pubescent to villous	5-10 mm pubescent	4-7 mm pubescent glabrescent
Leaf blade	5-12 × 3-5 cm elliptic to broadly elliptic	4-8 × 2-3 cm elliptic-oblong elliptic	5.0-13.5 × 1.5-5 cm elliptic-oblong elliptic	3-10 × 2-4 cm elliptic-oblong elliptic	5-14 × 2.0-8.0 cm elliptic-oblong elliptic
Abaxially	pale green & glabrous	dark green, shiny	pale green glabrescent	pale green, glabrous	pale green, glabrous, pubescent
Adaxially	dark green, shiny	pale green	dark green, hirtellous	dark green	dark green, shiny
Margin	serrulate	serrulate	serrulate	serrate to serrulate	serrate to serrulate
Leaf apex	acuminate, obtuse tip	acuminate, obtuse tip	acuminate, blunt tip	acuminate, obtuse tip	acuminate, obtuse tip
Leaf base	round to obtuse	cuneate	obtuse	cuneate	cuneate
Sepal	glabrous, margin ciliolate	glabrous, insidesericeous	caducous, glabrous	caducous, margin ciliolate	persistent margin ciliolate
Petal	obovate	obovate	obovate to ovate	obovate	broadly ovate to suborbicular
Stamen connection	basally connate for 1-2 mm	basally connate	basally connate for 1-3 mm	basally connate for 1-5mm	basally connate for 1-2 mm
Style	3	3-5	3	3	3
Capsule	globose to ovoid, 1-4 seed par locule	globose to ovoid, 1-4 seed par locule	subglobose to globose, 1 seed par locule	globose to ellipsoid, 1-2 seed par locule	oblate, 1 seed par locule
Seed	brown	brown	brown	brown to reddish brown	brown

Discussion and Conclusion

The result of this study, revealed that five species of tea plants are distributed in Mogok, Kyaukme, Pyin-Oo-Lwin, Panglong, Puta O and Pin-ta-ya areas. The collected species are identified and compared with each other. In *C. drupifera*, *C. kissi* and *C. oleifera* the young branch are grayish-brown, *C. sinensis* is grayish-yellow and *C. irrawadiensis* is reddish-brown. *C. irrawadiensis*, *C. kissi*, *C. oleifera* and *C. sinensis* are pubescent on the petiole but only *C. drupifera* is glabrous. *C. irrawadiensis*, *C. kissi*, *C. oleifera* and *C. sinensis*, the leaf blade are oblong to elliptic and *C. drupifera* is elliptic to broadly elliptic. The leaf apex of *Camellia* spp. is caudate and blunt tip in *C. kissi* and the leaf apex of the rest species are acuminate and obtuse tip. The leaf base of *C. irrawadiensis*, *C. oleifera* and *C. sinensis* are cuneate, and the rest two species are round to obtuse. The stamen connation is up to 5 mm in *C. oleifera* and 1-3 mm in *C. irrawadiensis*, *C. drupifera*, *C. kissi* and *C. sinensis*. The styles are apically 3 lobed in *C. drupifera*, *C. kissi*, *C. oleifera* and *C. sinensis*, but the 3-5 lobed near to the base in *C. irrawadiensis*.

Barua and Wight, 1958 stated that *C. irrawadiensis* is characterized by presence of brick-red young shoots and numerous pellucid punctuations on leaves. Styles 3-5 in number, biochemically it only contains theine but any other species other species contain both of theine and caffeine. So it can be distinguished any others *Camellia* spp. by mean of biochemical composition.

In Myanmar custom of tea drinking and chewing of fermented tea leaves as culture started from Shan State about 2000 years ago. In northern Shan State, hot and humid summer followed by heavy rain fall, ranging from 80-120 in and cold summer create species climate, topography and edaphic condition constitute the northern Shan state as tea region. Mostly are cultivated in local varieties with traditional method. Recently, high yielding varieties were exported from China. Pan Kum tea is most famous for its flavor and aroma known as "Shwe Phe Moe Lut". Among the various types of tea, Shwe Phe Moe Lut has been drawing public people's attention since the Bagan period, 11st century AD. Due to its remarkable flavor, taste and colour. Estimatedly about (10000) acre tea plantation allocated in Pan Kum area, 500 tons of fermented tea are produced yearly from this area. A combination of culture and tradition among the Tai people of former Lanna Kingdom must have created the traditional method of fermented tea production for the production of tea leaves. Among the Tai people of Myanmar, chewing fermented tea leaves was the most common habit for the elderly people at Shan state. But it has become less common and in northern Thailand chewing fermented tea leaves has disappeared. Mogok tea is famous for its special flavor and long leaves producing strong flavor. Mogok is also famous for producing traditional fermented tea leaves known as Mogok tea leaves.

The objective of tea Myanmar agriculture sector is to fulfill the domestic consumption needs; to export the surplus of agriculture products, to earn foreign exchange and to support rural development through agricultural development. The key factors for development are: the creation to profitable and sustainable market for tea formers the utilization of good quality seeds to produce quality products with higher price and the adaptation of good agricultural practices. Therefore, the development of tea production is necessary in the context of modern agriculture because tea cultivation and production has great potential for generation foreign currency. Myanmar still has large and extensive area for cultivation of tea. In addition, there are much diversity of native tea species with good ecological adaptation to local climate condition. They also have fair value chain, supply chain and provide sustainable employments to a large number standardization in international trade. The role of research and development

sector should be accelerated to fulfill that knowledge gap. In cultivated in any other tea exporting countries but in Myanmar. Among these species *C. irrawadiensis* regards as a non-tea species lack of caffeine make its flavor weaker. However, it has become the more potential than any other *Camellia* spp. for the isolation of theine. Nowadays, it is more potential than any other species for isolation of theine which can contribute in medical purposes. Cultivation of *C. irrawadiensis* it has become not only regionally but also nationally important for future manufacturing of Myanmar medicinal tea. Moreover, traditionally fermented tea should be considered to designate (GI) or geographical indication of Myanmar for getting brighter future for exporting. This is also require as systematic high quality handing management all along the supply chain.

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