Morphological Characteristics of *Camellia sinensis* (L.) Kuntze from Seven Localities in Myanmar

Yi Yi Naing[1], Win Win Khaing[2] and Thein Kywe[3]

Abstract

Morphological characteristics of *Camellia sinensis* (L.) Kuntze belonging to the family Thaeceae were studied. In Myanmar, *Camellia sinensis* (L.) Kuntze is known as "laphet or tea". The plant specimens were collected from seven localities of Pyin Oo Lwin and Mogok Townships of Mandalay Region; Naung Cho Township of Northern Shan State; Pinlaung, Panglong, Pindaya and Ywangan Townships of Southern Shan State in Myanmar from 2017 to 2019. The plants were shrubs to small trees and leaf scars were present on the stems from seven localities. The shapes and colour of leaves were the same inall localities.The sizes of leaves, petioles and flowers were varied from one locality to another. The flowers were creamy white or pale yellow, showy and fragrant. Sepals were 5 and persistentinall localities. The numbers of petals were slightly different from one locality to another. The capsules were woody and 3-5 seeded in all localities. The similarities and differencesof morphological characteristics of this study would be useful for species confirmation and verification of certain plant identification rapidly and easily.

Keywords: Camellia sinensis (L.), Tea, Laphet

Introduction

The genus *Camellia* includes shrubs and trees belonging to the family Theaceae and is native to eastern Asia. The economic importance of the genus *Camellia* is largely due to *Camellia sinensis* (L.) Kuntze, whose young leaves are used to prepare tea. This single species is the economic backbone of several South Asian countries including India, China, Japan, Korea, Sri Lanka, Indonesia, and African countries such as Malawi, Kenya, etc. (Mondal 2011).

Camellia sinensis (L.) Kuntze, tea was first introduced into the country by King Alaungsithu of Bagan (1112-1167). Myanmar is one of several Asian countries that have cultivated tea since the early nineteenth century. In Myanmar, tea production is through to have originated from the Palaung people on the Shan Plateau, parts of which are more than 6000 feet above sea level (So Pyay Thar 2016).

Tea is the second most commonly consumed beverage after water. Myanmar green tea, black tea and pickled tea haveantioxidant activity. Tea contains a number of constituents like caffeine (1-5%), xanthines, theobromine and tannins. Tea extract exhibits numerous properties such as antimutagenic, antitumour, antioxidant, anticoagulant, antiviral, blood pressure and cholesterol lowering activity (Nair 2010).

Laphet, tea is a popular and important in Myanmar culture, as well as the drinking of tea. It is served during special occasions and traditional ceremonies like: Judicial affairs; engagement, wedding and funeral ceremonies and so on. It is known as "Lord leaves" or "Lord Medicine" because of its usefulness for health. It is believed that eating tea increases life for as long as 120 years (Pyie Phyo Maung *et al*. 2012).

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Myanmar fermented tea leaf is a common signature and national ancient food that is eaten by all people in the country, regardless of race or religion, at get-togethers in family homes, in monasteries, and in the traditional celebrations. The consumption of tea leaves around the world is in three forms: green tea, black tea, oblong tea (Shukla 2007).

The main objective of this research is to study the similarities and differences of morphological characteristics of *Camellia sinensis* (L.) Kuntze from seven localities in Myanmar.

Materials and Methods

The species of *Camellia sinensis* (L.) Kuntze were collected from Sin Lan village (22°03'32.73"N and 96°27'16.76"E), Pyin Oo Lwin Township and Kyatpyin (22° 54' 47.14" N and 96° 29'49.10" E), Mogok Township, Mandalay Region, Kangyi village (22° 13' 05.58" N and 93° 50' 34.34" E), Naung Cho Township, Northern Shan State, Loimaung mountain (20° 8.145' N and 96° 46.769' E), Pinlaung Township, Loitup village (20°59.180'N and 97°31.015'E), Panglong Township, Ohntonpin village (20° 53.54' N and 96° 34.896' E), Pindaya Township and Yagyi village (20°56.125'N and 96°40.015'E),Ywangan Township, Southern Shan State in Myanmar,from 2017 to 2018. The plants grown in natural habit, vegetative and reproductive parts were recorded. The collected specimens were studied and identified at the Department of Botany, University of Mandalay with the help of literatures (Hooker 1885; Backer 1963 and Dassanayake 1987).

Results

1. Morphological Studies

Scientific Name - *Camellia sinensis* (L.)Kuntze Sp. Pl. 1, 1:698.1753.
Family - Theaceae
English Name - Tea
Myanmar Name - Laphet
Flowering period - August to November

1.1 Morphological Characteristics of *Camellia sinensis* (L.) Kuntze from Pyin Oo Lwin Township (Table 1 & Figure 1)

Perennial shrubs to small trees, 3 - 5 m high. Stems terete, stout, leaf scar present. Leaves simple, alternate, exstipulate, petioles 0.2-0.9 cm by 0.2-0.3 cm; leaf blades ovate or oblong elliptic, 3.6-14.5 cm by 3.5-5.6 cm, dark green; serrate along the margin; cunerate at the base; acuminate at the apex. Inflorescences axillary cluster of cyme; 1to 3 flowered; peduncles short, dark green and glabrous. Flowers bisexual, actinomorphic, hypogynous, creamy white or pale yellow, 2.0- 4.0cm in diameter, showy, fragrant; pedicels short, dark green glabrous; bracts small and caducous. Sepals 5, concave, 0.4 cm in diameter, dark green, glabrous on both surfaces, persistent. Petals 6-7, obovate, 0.7-1.0 cm in diameter, free in two whorls, the outer whorls smaller than the inner, green patches present at the tip of outer petals, glabrous.Stamens numerous, free, filament filiform, the inner filaments slightly shorter than the outer; the outer filaments slightly connate at the base; anthers dithecous, dorsifixed, yellow, dehiscing longitudinally. Carpels 3, fused; ovary superior, ovoid, 0.2 cm in diameter, trilocular or sometimes bilocular, 1 or 2 ovules in each locule on the axile placentae, silky tomentose; styles stout, 0.4-0.6 cm long, glabrous; stigmas trified. Capsules woody, subglobose, 2.0- 3.7 cm by 1.5 -3.5 cm. Seeds rounded or plano- convex, about 1.8 cm by about 1.7 cm, pale brown, nonendospermic.

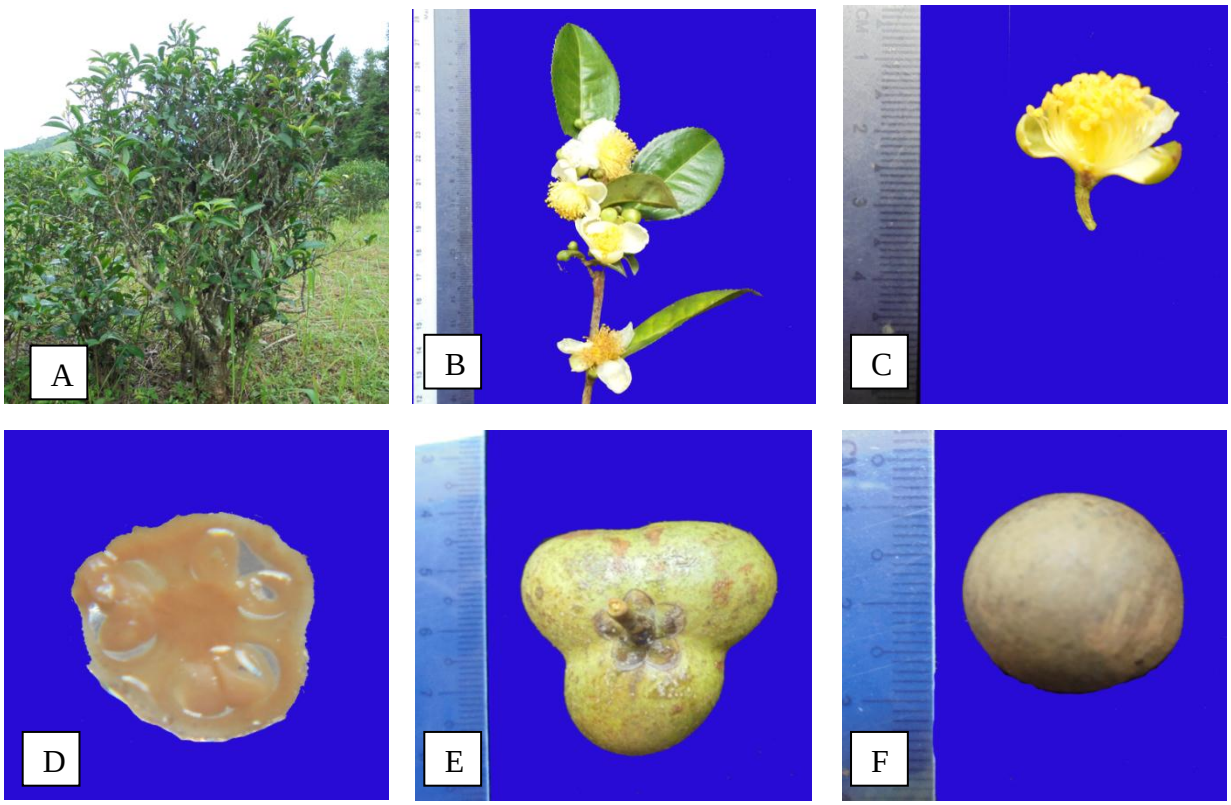

Figure.1 Morphological characters of *Camellia sinensis* (L.) Kuntze from Pyin Oo Lwin Township

A. Habit. B. Inflorescence. C. L.S of flower. D. T.S of ovary. E. Fruit . F. Seed.

1.2 Morphological Characteristics of *Camellia sinensis* (L.) Kuntze from Mogok Township (Table 1 & Figure 2)

Perennial shrubs to small trees, 5-8 m high. Stems terete, stout, leaf scar present. Leaves simple, alternate, exstipulate, petioles 0.2-0.8 by 0.2-0.3 cm; leaf blades ovate or oblong elliptic, 6.0-17.7 cm by 2.9-7.3 cm, dark green glabrous on both surface; serrate along the margin; cunerate at the base; acuminate at the apex. Inflorescences axillary cluster of 1-3 flowered; peduncles short, dark green and glabrous. Flowers bisexual, actinomorphic, hypogynous, creamy white or pale yellow, 3.0- 4.0 cm in diameter, showy, fragrant; pedicels short, dark green glabrous; bracts small and caducous. Sepals 5, concave, about 0.4 cm in diameter, dark green,glabrous on both surfaces, persistent. Petals 6-7, obovate, 0.7-1.0 cm in diameter, free in two whorls, the outer whorls smaller than the inner, green patches present at the tipof outer petals, glabrous. Stamens numerous, free, filament filiform, the inner filaments slightly shorter than the outer; the outer filaments slightly connate at the base; anthers dithecous, dorsifixed, yellow, dehiscing longitudinally. Carpels 3, fused; ovary superior, ovoid, about 0.2 cm in diameter, trilocular or sometimes bilocular, 1 or 2 ovules in each locule on the axile placentae, silky tomentose; styles stout, 0.4-0.6 cm long, glabrous; stigmas trifid. Capsules, woody, subglobose, 2.0-3.0 cm by 1.5-3.5 cm. Seeds rounded or plano- convex, 1.5-2.5 cm by 1.2-2.2 cm, reddish brown.

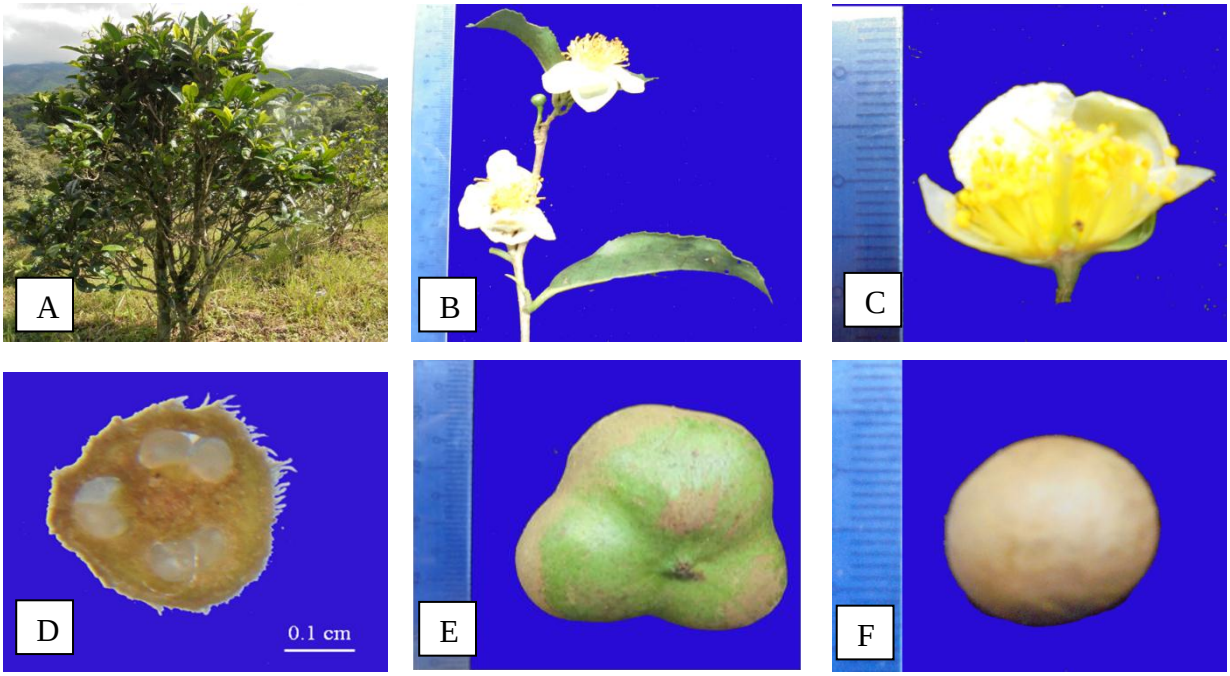

Figure.2 Morphological characters of *Camellia sinensis* (L.) Kuntze from Mogok Township

A. Habit. B. Inflorescence. C. L.S of flower. D. T.S of ovary. E. Fruit . F. Seed.

1.3 Morphological Characteristics of *Camellia sinensis* (L.)Kuntze from Naung Cho Township (Table 1 & Figure 3)

Perennial shrubs to small trees, 3-5 m high. Stems terete, stout, leaf scar present. Leaves simple, alternate, exstipulate, petioles 0.3-0.8 cm by 0.2-0.3 cm; leaf blades ovate or oblong elliptic, 5.3-16.9 cm by 3.5-8.5 cm, dark green; serrate along the margin; cunerate at the base; acuminate at the apex. Inflorescences axillary cluster of cyme; 1to 3 flowered; peduncles short, dark green and glabrous. Flowers bisexual, actinomorphic, hypogynous, creamy white or pale yellow, 2.0-4.0 cm in diameter, showy, fragrant; pedicels short, dark green, glabrous; bracts small and caducous. Sepals 5, concave, 0.5 cm in diameter, dark green, glabrous on both surfaces, persistent. Petals 5-7, obovate, 1.0-1.5 cm in diameter, free in two whorls, the outer whorls smaller than the inner, green patches present at the tip of outer petals, glabrous.Stamens numerous, free, filament filiform, the inner filaments slightly shorter than the outer; the outer filaments slightly connate at the base; anthers dithecous, dorsifixed, yellow, dehiscing longitudinally. Carpels 3, fused; ovary superior, ovoid, 0.2 cm long, trilocular or sometimes bilocular, 1 or 2 ovules in each locule on the axile placentae, silky tomentose; styles stout, 0.4-0.6 cm long, glabrous; stigmas trifid. Capsules woody, subglobose, 2.0-3.7 cm by 1.5-3.5 cm. Seeds rounded or plano- convex, 1.8 cm by 1.7 cm, pale brown, nonendospermic.

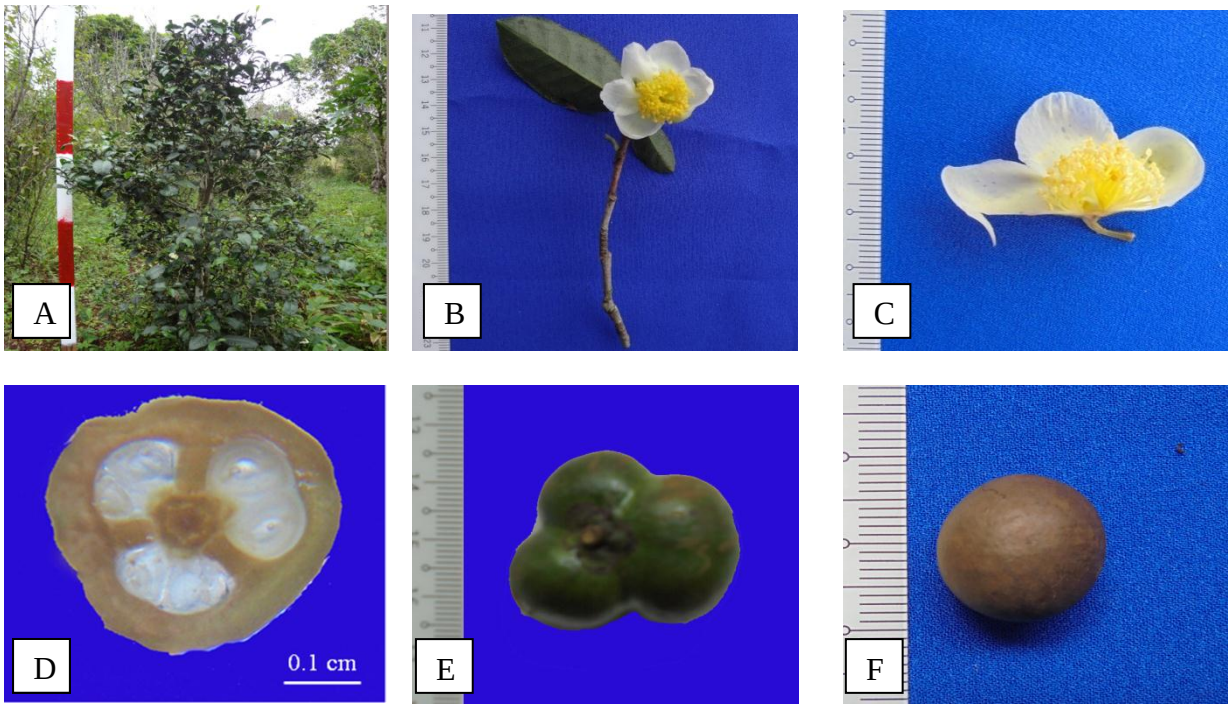

Figure.3 Morphological characters of *Camellia sinensis* (L.) Kuntze from Naung Cho Township

A. Habit. B. Inflorescence. C. L.S of flower. D.T.S of ovary. E. Fruit . F. Seed.

1.4 Morphological Characteristics of *Camellia sinensis* (L.) Kuntze from Pinlaung Township (Table 1 & Figure 4)

Perennial shrubs to small trees, 1.5-3 m high. Stems terete, stout, leaf scar presents. Leaves simple, alternate, exstipulate, petioles 0.3-0.7 cm by 0.1-0.2 cm; leaf blades ovate or oblong elliptic, 4.2-17.3 cm by 2.0-6.8 cm, dark green; serrate along the margin; cunerate at the base; acuminate at the apex. Inflorescences axillary cluster of cyme; 1-3 flowered; peduncles short, dark green and glabrous. Flowers bisexual, actinomorphic, hypogynous, creamy white or pale yellow, 3.3-4.0 cm in diameter, showy, fragrant; pedicels short, dark green, glabrous; bracts small and caducous. Sepals 5, concave, about 0.5cm in diameter, dark green, glabrous on both surfaces, persistent.Petals 6 - 8, obovate, 0.4-2.2 cm in diameter, free in two whorls, the outer whorls smaller than the inner, green patches present at the tip of outer petals, glabrous.Stamens numerous, free, filament filiform, the inner filaments slightly shorter than the outer; the outer filaments slightly connate at the base; anthers dithecous, dorsifixed, yellow, dehiscing longitudinally. Carpels 3, fused; ovary superior, ovoid, 0.2 cm long, trilocular or sometimes bilocular, 1 or 2 ovules in each locule on the axile placentae, silky tomentose; styles stout, 0.6 -0.9 cm long, glabrous; stigmas trifid. Capsules woody, subglobose, 2.0-3.5 cm by 1.3-3.5 cm. Seeds rounded or plano-convex, 1.2-1.6 by 1.2-1.8 cm, pale brown, nonendospermic.

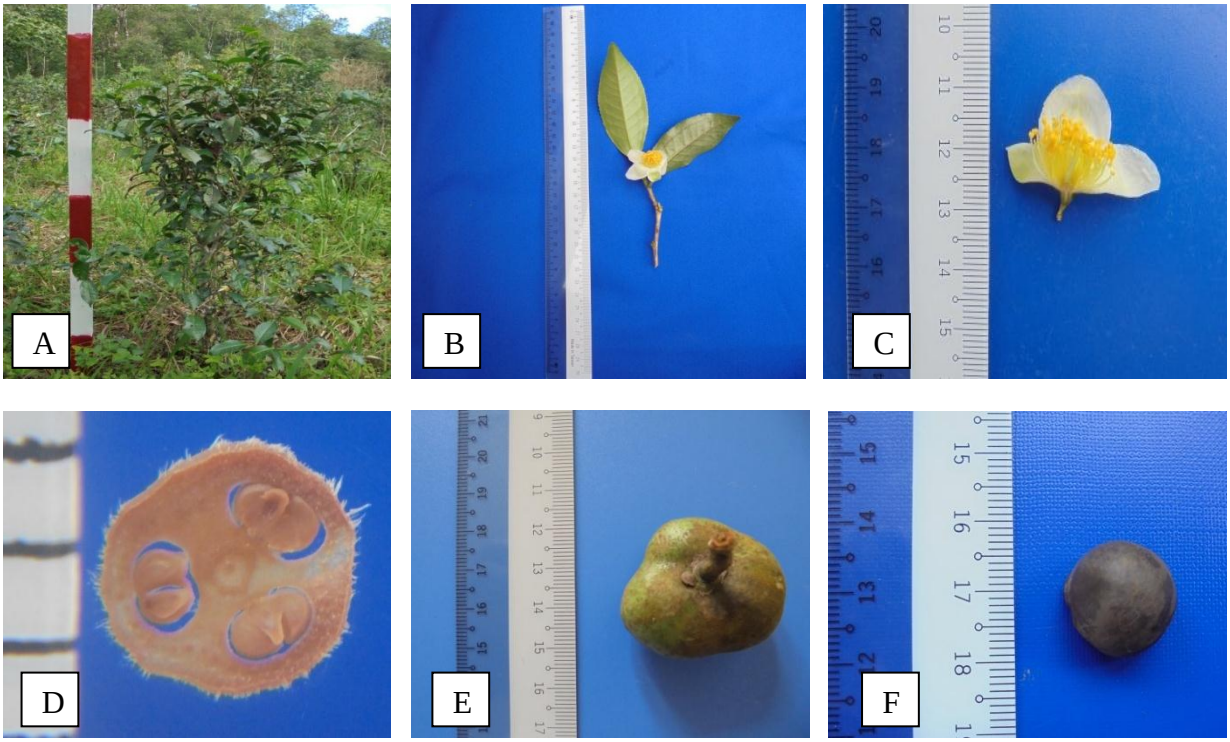

Figure.4 Morphological characters of *Camellia sinensis* (L.) Kuntze from Pinlaung Township

A. Habit. B. Inflorescence. C. L.S of flower. D. T.S of ovary. E. Fruit. F. Seed.

1.5 Morphological Characteristics of *Camellia sinensis* (L.) Kuntze from Panglong Township (Table 1 & Figure 5)

Perennial shrubs to small trees, 2-5 m high. Stems terete, stout, leaf scar presents. Leaves simple, alternate, exstipulate, petioles 0.2-0.9 cm by 0.2-0.3 cm; leaf blades ovate or oblong elliptic, 4.3-15.0 cm by 1.8-9.5 cm, dark green; serrate along the margin; cunerate at the base; acuminate at the apex. Inflorescences axillary cluster of cyme; 1-3 flowered; peduncles short, dark green and glabrous. Flowers bisexual, actinomorphic, hypogynous, creamy white or pale yellow, 3.3-5.5 cm in diameter, showy, fragrant; pedicels short, dark green, glabrous; bracts small and caducous. Sepals 5, concave, about 0.3-0.6 cm in diameter, dark green, glabrous on both surfaces, persistent. Petals 6-9, obovate, 0.6-2.6 cm in diameter, free in twowhorls, the outer whorls smaller than the inner, green patches present at the tip of outer petals, glabrous.Stamens numerous, free, filament filiform, the inner filaments slightly shorter than the outer; the outer filaments slightly connate at the base; anthers dithecous, dorsifixed, yellow, dehiscing longitudinally. Carpels 3, fused; ovary superior, ovoid, 0.2 cm long, trilocular or sometimes bilocular, 1 or 2 ovules in each locule on the axile placentae, silky tomentose; styles stout, 0.6-0.9 cm long, glabrous; stigmas trifid. Capsules woody, subglobose, 1.9-2.5 cm by 2.1-3.4 cm. Seeds rounded or plano-convex, 1.0-1.8 cm by 1.0-1.9 cm, pale brown, nonendospermic.

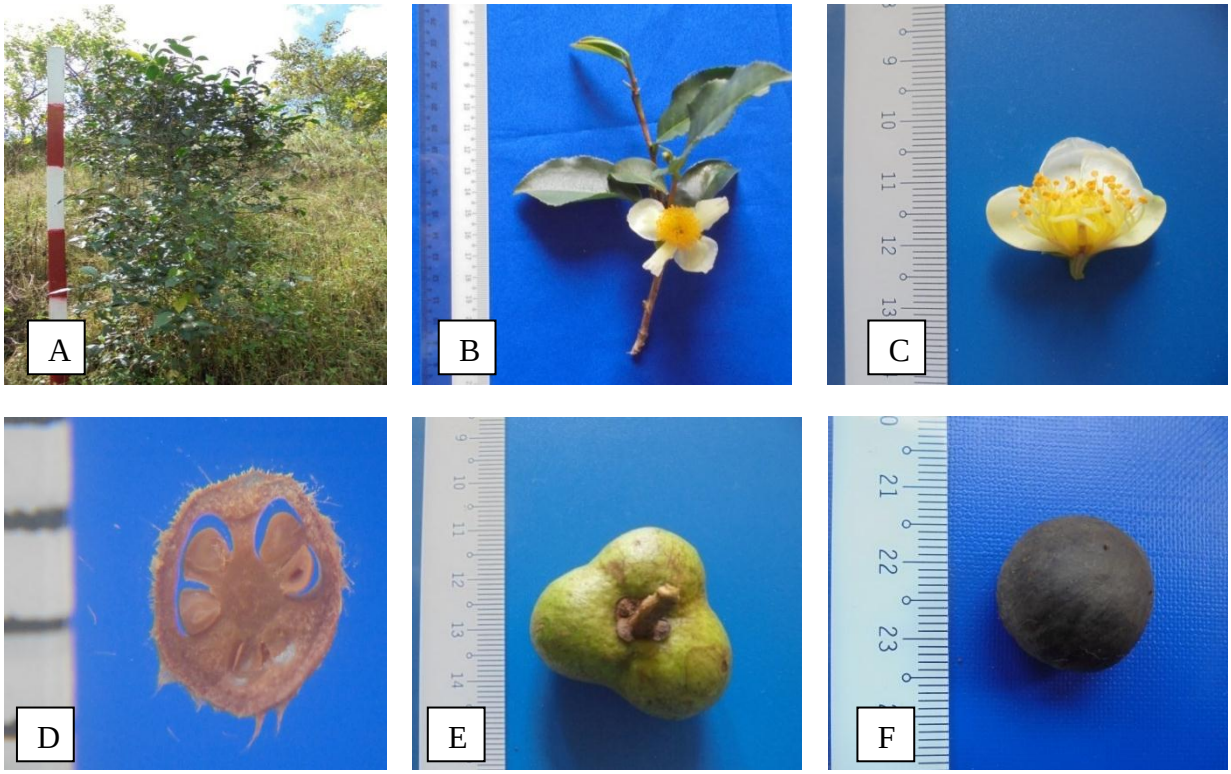

Figure.5 Morphological characters of *Camellia sinensis* (L.) Kuntze from Panglong Township

A. Habit. B. Inflorescence. C. L.S of flower. D. T.S of ovary. E. Fruit . F. Seed.

1.6 Morphological Characteristics of *Camellia sinensis* (L.) Kuntze from Pindaya Township (Table 1 & Figure 6)

Perennial shrubs to small trees, 1-3 m high. Stems terete, stout, leaf scar presents. Leaves simple, alternate, exstipulate, petioles 0.3-1.0 cm by 0.2-0.8 cm; leaf blades ovate or oblong elliptic, 3.6-19.8 cm by 1.8-9.0 cm, dark green; serrate along the margin; cunerate at the base; acuminate at the apex. Inflorescences axillary cluster of cyme; 1-3 flowered; peduncles short, dark green and glabrous. Flowers bisexual, actinomorphic, hypogynous, creamy white or pale yellow, 2.0-3.5 cm in diameter, showy, fragrant; pedicels short, dark green, glabrous; bracts small and caducous. Sepals 5, concave, about 0.4 cm in diameter, dark green, glabrous on both surfaces, persistent. Petals 7-8, obovate, 0.5-2.0 cm in diameter, free in two whorls, the outer whorls smaller than the inner, green patches present at the tip of outer petals, glabrous.Stamens numerous, free, filament filiform, the inner filaments slightly shorter than the outer;the outer filaments slightly connate at the base; anthers dithecous, dorsifixed, yellow, dehiscing longitudinally. Carpels 3, fused; ovary superior, ovoid, 0.2 cm long, trilocular or sometimes bilocular, 1 or 2 ovules in each locule on the axile placentae, silky tomentose; styles stout, 0.5 - 0.8 cm long, glabrous; stigmas trifid. Capsules woody, subglobose, 1.5- 2.0 cm by 2.0-3.3 cm. Seeds rounded or plano-convex, 1.0-1.8 cm by 1.2-2.0 cm, pale brown, nonendospermic.

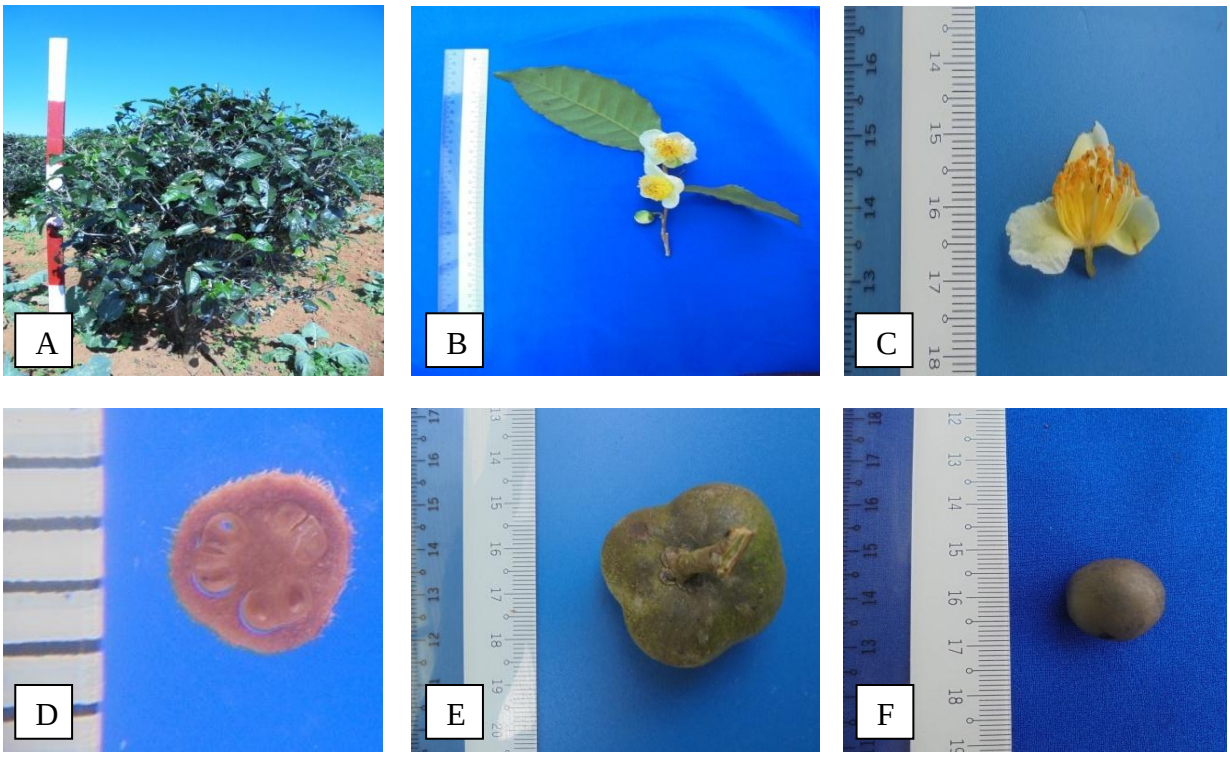

Figure.6 Morphological characters of *Camellia sinensis* (L.) Kuntze from Pindaya Township

A. Habit. B. Inflorescence. C. L.S of flower. D.T.S of ovary. E.Fruit. F. Seed.

1.7 Morphological characteristics of *Camellia sinensis* (L.) Kuntze from Ywangan Township (Table 1 & Figure 7)

Perennial shrubs to small trees, 1-3 m high. Stems terete, stout, leaf scar presents. Leaves simple, alternate, exstipulate, petioles 0.3-0.7 cm by 0.1-0.4 cm; leaf blades ovate or oblong elliptic, 3.8-18.1 cm by 1.8-8.2 cm, dark green; serrate along the margin; cunerate at the base; acuminate at the apex. Inflorescences axillary cluster of cyme; 1-3 flowered; peduncles short, dark green and glabrous. Flowers bisexual, actinomorphic, hypogynous, creamy white or pale yellow, 3.0-3.5 cm in diameter, showy, fragrant; pedicels short, dark green, glabrous; bracts small and caducous. Sepals 5, concave, about 0.5 cm in diameter, dark green, glabrous on both surfaces, persistent. Petals 6-7, obovate, 0.8-2.0 cm in diameter, free in two whorls, the outer whorls smaller than the inner, green patches present at the tip of outer petals, glabrous.Stamens numerous, free, filament filiform, the inner filaments slightly shorter than the outer;the outer filaments slightly connate at the base; anthers dithecous, dorsifixed, yellow, dehiscing longitudinally. Carpels 3, fused; ovary superior, ovoid, about 0.2 cm long, trilocular or sometimes bilocular, 1 or 2 ovules in each locule on the axile placentae, silky tomentose; styles stout, 0.5-0.8 cm long, glabrous; stigmas trifid. Capsules woody, subglobose, 1.7- 2.0 cm by 1.8-3.2 cm. Seeds rounded or plano-convex, 1.4-1.6 cm by 1.4-1.7cm, pale brown, nonendospermic.

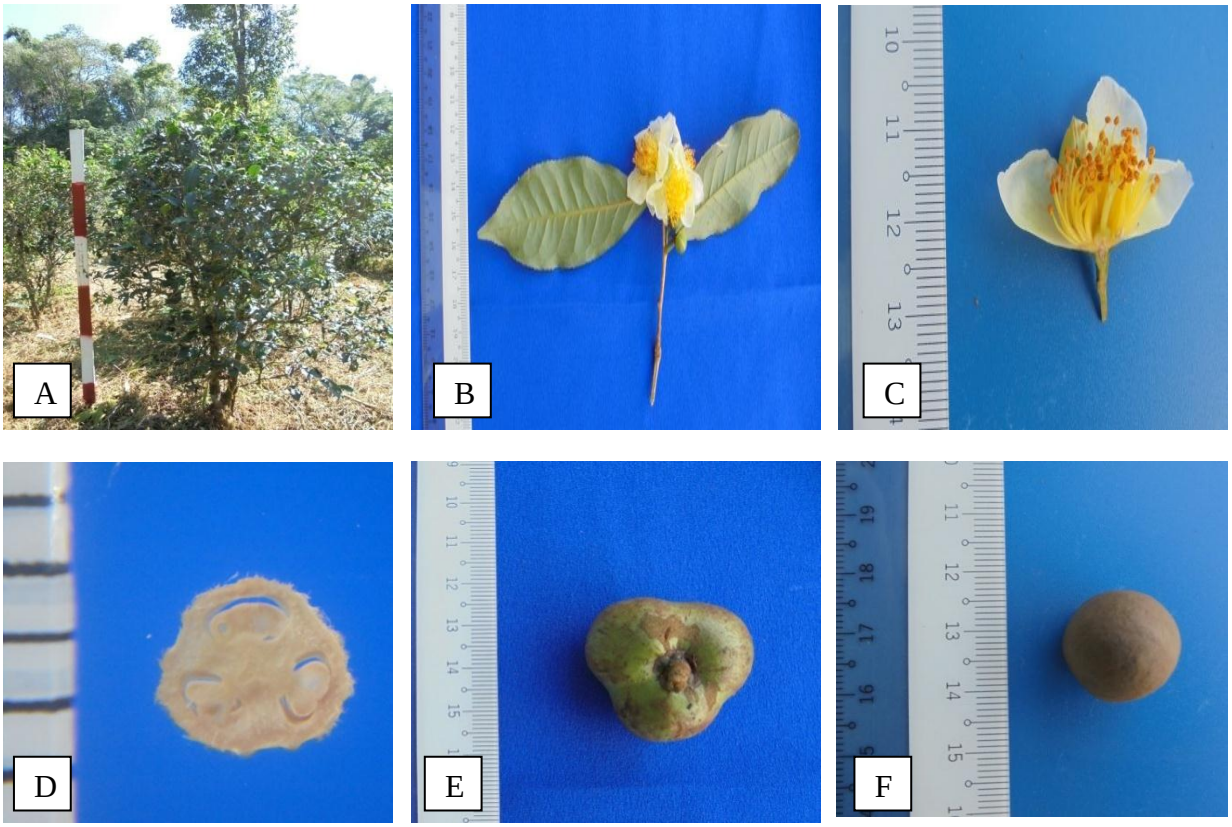

Figure.7 Morphological characters of *Camellia sinensis*(L.) Kuntze from Ywangan Township

A. Habit. B. Inflorescence. C. L.S of flower. D. T.S of ovary. E. Fruit . F. Seed.

Table .1 Quantitative morphological characteristics of *Camellia sinensis*(L.)Kuntze from Seven localities

Locality	Shape of leaves	Size of Leaves (cm)	Size of Petiole (cm)	Size of Flower (cm)	No. of Sepals	No. of Petals	Size of Petals (cm)
Naung Cho	Ovate or oblong-elliptic	5.3-16.9 by 3.5-8.5	0.3-0.8 by 0.2-0.3	2.0-4.0 in daimeter	5	5 – 7	1.0-1.5 in diameter
Pyin Oo Lwin	Ovate or oblong-elliptic	3.6-14.5 by 3.5-5.6	0.2-0.9 by 0.2-0.3	2.0-4.0 in diameter	5	6 - 7	0.7-1.0 in diameter
Mogok	Ovate or oblong-elliptic	6.0-17.7 by 2.9-7.3	0.2-0.8 by 0.2-0.3	3.0-4.0 in diameter	5	6 - 7	0.7-1.0 in diameter
Pindaya	Ovate or oblong-elliptic	3.6 – 19.8 by 1.8- 9.0	0.3- 1.0 by 0.2- 0.8	2.0- 3.5 in diameter	5	7-8	0.5- 2.0 in diameter
Pinlaung	Ovate or oblong-elliptic	4.2-17.3 by 2.0- 6.8	0.3-0.7 by 0.1- 0.2	3.3- 4.0 in diameter	5	6-8	0.4- 2.2 in diameter
Panglong	Ovate or oblong-elliptic	4.3- 15.0 by 1.8- 9.5	0.2-0.9 by 0.2- 0.3	3.3-5.5 in diameter	5	6 - 9	0.6- 2.6 in diameter
Ywangan	Ovate or oblong-elliptic	3.8- 18.1 by 1.8 – 8.2	0.3- 0.7 by 0.1- 0.4	3.0- 3.5 in diameter	5	6-7	0.8- 2.0 in diameter

Discussion and Conclusion

The morphological characteristics of *Camellia sinensis* (L.) Kuntze belong to family Theaceae from seven localities were studied. The specimens were collected from Pyin Oo Lwin and Mogok Townships of Mandalay Region; Naung Cho Township of Northern Shan State; Pinlaung, Panglong, Pindaya and Ywangan Townships of Southern Shan State in Myanmar.

All the plants were shrubs to small trees. The leaves were simple, alternate, ovate or oblong-elliptic, margin serrate and exstipulate from seven localities. These characters were agreed with Hooker (1885), Backer (1963), Dassanayake (1987) and Mondal (2011). The sizes of leaves were variable from one locality to another. The largest size of leaves was observed in Pindaya and smallest in Pyin Oo Lwin. The sizes of petioles were also variable from one locality to another. The size of petioles of Pindaya was slightly larger than the others.

Inflorescences were axillary cluster of cymes. The flowers were bisexual, actinomorphic, hypogynous, creamy white or pale yellow, showy and fragrant. These characters were agreed with Hooker (1885), Backer (1963), Dassanayake (1987) and Mondal (2011). The sizes of flowers were variable from one locality to another. The largest size of flowers was observed in Panglong and smallest in Pindaya. Sepals were 5, concave about 0.5 cm in diameter, dark green, glabrous on both surfaces, persistent in all localities. These characters were agreed with those mentioned by Backer (1963). The numbers of petals were slightly different from one locality to another. The petals were obovate, free in two whorls, the outer whorls smaller than the inner, green patches present at the tip of outer petals, glabrous. These characters were agreed with Hooker (1885), Backer (1963), Dassanayake (1987) and Wu *et al*. (2007). The numbers of petals of Panglong were more than the others, and the sizes of petals were also larger than the others. Capsules were woody and subglobose. Seeds were rounded or plano-convex. These characters were agreed with Hooker (1885), Backer (1963), Dassanayake (1987) and Crane (2005). The sizes of capsules and seeds were slightly different from one locality to another.

In this research, the morphological characteristics of *Camellia sinensis* (L.) Kuntze from seven localities were basically similar in structure but numbers of petals and the sizes of leaves, petioles and flowers were variable from one locality to another. According to the results of present study, the similarities and differences of morphological characteristics would be useful for species confirmation and verification of certain plant identification rapidly and easily.

Acknowledgements

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