A Study on Floral Morphology of *Camellia japonica* L. (Tea Rose) in Sri Lanka

J.H.C.M. Fernando, and L.M.H.R. Alwis

***Abstract*—** Tea Rose *Camellia japonica* L. is one of best known species in genus *Camellia* having economic importance in hill country of Sri Lanka. Tea Rose cultivars with pink and white flowers were morphologically studied to evaluate its natural propagation ability and to identify classification. Floral morphology revealed that white flower was larger and consisted of higher number of petals than pink flower. Geniculate stigma and superior ovary were in middle of petaloids of pink flower and anthers attached to filament from its basal point. Fully developed and opened pink flowers were identified as Class 04 Peony. White flowers with reduced reproductive structures were identified as Class 06 Formal Double or Double Imbricated. Pollen germination at 31.7% in 10% sugar solution showed low viability of pollens and reduced reproductive structures cause to absence of sexual propagation and eventually no formation of fruits and seeds of Tea Rose in Sri Lanka.

***Keywords*—**Tea rose, Floral morphology, Sexual propagation

I. Introduction

THE Tea Rose *Camellia japonica* is one of the best known species of the genus *Camellia* which comprises of more than 200 species, includes evergreen shrubs and trees belonging to the family Theaceae. Among the *Camellia* species, the economic value of the *C. japonica* ranks the highest due to its beautiful ornamental flowers [1] and its long life span.

Sexual propagation may cause to develop vigorous plants with higher genetic variability as well as a continuous revolution. Flower is the main component in sexual propagation. Seeds are produced through the union of pollen and female gametes in the flower.

The study of floral morphology is very important when discussing the sexual propagation of *C. japonica*. Wendel and Parks (1979) [2] reported that usually, this species has relatively high out crossing rate. Kunitake *et al*. (2004) [3] showed that birds can enhance pollen transfer between plants and cause to increase the outcrossing rate. This species is having several types of flowers which are consisted with single, double and semi double petal whorls. Further, arrangement of male and female reproductive organs and the functioning are also important in the studies of floral morphology. Morphological characteristics may provide an array of information to decide about the pollination system of a particular flower and its adaptations.

Although the flower of *C. japonica* is having high ornamental value and it is a popular plant in landscaping in hill country of Sri Lanka, there is hardly studied on this Tea Rose plant and its flower. No scientific reports were published before. Therefore, this preliminary study was done in order to identify the morphological characters of flowers and the natural propagation success of *C. japonica*.

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II. Procedure

The Tea Rose (*C. japonica)* cultivars having two different flower colors in pink and white and more commonly found in hill country of Sri Lanka were selected for the study. The flowers were collected from the Victoria Park, Nuwara Eliya in Sri Lanka. The floral morphology of *C. japonica* was studied using Descriptors for Tea *Camellia sinensis* in IPGRI (1997) [4]. The flowering behaviour / habit, flower bud size (length, width and diameter), fully opened flower size (length, width and diameter), pedicel colour and length, bracteoles number and position, gynoecium and androecium characteristics were considered for the study of floral morphology of *C. japonica*.

The pollens collected from pink flowers of Tea Rose at the Victoria Park were stored inside silica jell crystals and taken to the laboratory at Uva Wellassa University, Badulla, Sri Lanka as the procedure described in the Camellia Web Express (2013) [5]. Then the pollens were germinated in 10%, 1%, 0.1% and 0.01% sugar solutions to study the viability of pollen by keeping the pollens in those solutions for one hour in hanging drop method. The number of pollen germinated was counted separately under the microscopic mid power (X10).

III. Results And Discussion

Both pink and white flowers of Tea Rose consisted with axillary flowering behavior as they were born from the axillary buds in main and axillary branches of the plant. There were clusters of flower buds initially, but only one bloomed in that cluster as a solitary flower born axillary. Usually, three to four flower buds were found in a cluster. The

size of flower buds of white flowers was recorded as 2.0 cm to 2.5 cm (Plate 1) while the size of pink flowers was recorded as 2.5 cm to 3.2 cm (Plate 2).

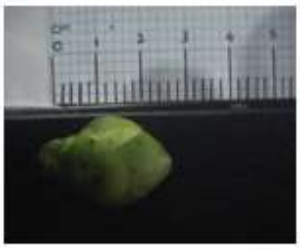

Plate 1: White Flower Bud

Plate 2: Pink Flower Bud

The diameter of fully opened white flower was ranged from 5 cm to 11 cm while the diameter of fully opened pink flower was ranged from 4 cm to 7 cm. Therefore, white flowers were identified as comparatively lager than pink flowers (Plate 3).

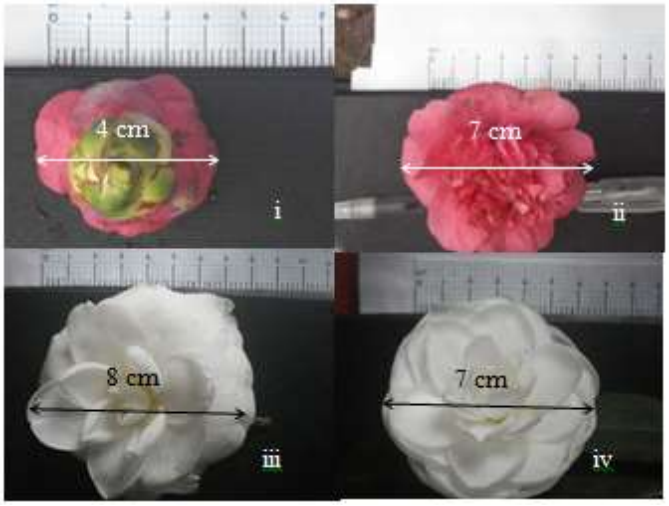

Plate 3: (i) and (ii) Diameters of Pink Flower and (iii) and (iv) Diameters of White Flower

The Plates 4 and 5 show that the pedicels of both flowers were green in colour and the pedicel length of white flower was recorded as 5 mm to 8 mm while the pedicel length of pink flower was recorded as 4 mm to 5 mm.

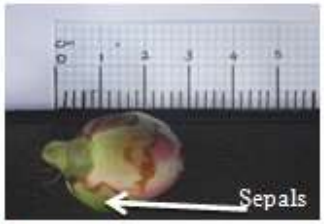

Plate 4: Pink Flower Bud with Sepals

Plate 5: White Flower Bud with Sepals

The calyx of both flowers were recorded few differences in morphological characters. The number of sepals in the white color flower was five and in the pink color flower, the number of sepals was eight. Though the pink flower was comparatively small, number of sepals was higher than in the white flower. The calyx margins were normal entire margins. The sepals in the white flower were light green than the sepals in the pink flower.

The receptacle shape of both white and pink color flowers were observed as globose and they were very narrow in diameter, which was ranged from 2 mm to 3 mm.

The corolla of both these flowers showed some highly different characteristics. The corolla color of completely developed, fully opened pink flower of Tea Rose cultivar showed a reddish pink color while the corolla color of completely developed, fully opened white flower of Tea Rose cultivar showed a bright pure white color. The shape of the petals of both pink and white flowers were sub-orbicular (almost orbicular or circular) as shown in Plate 6 and 7.

The both pink and white flowers of Tea Rose cultivars consisted of multi whorl petals. The white flower consisted only with peal whorls, but there were some unopened petals in the middle of every fully opened flower (Plate 8). The pink flower consisted with large number of florets or petaloids in the middle. Therefore, the inner whorls of flower, the sexual organs such as the androecium and the gynoecium were not opened to the outside.

Plate 6: White Petals of White Flower

Plate 7: Pink Petal and Petaloid of Pink Flower

The length and the width of white color petals were 4.5 cm to 5cm and 3.5 cm to 4.0 cm while the length and width of pink color petals were 3.5 cm to 4.1 cm and 3.1 cm to 3.4 cm respectively. The length of petaloids of pink flower was ranged from 3.0 cm to 3.2 cm. The number of petals was around 45 to 50 in white flower and 12 to14 in pink flower. There were more than 65 florets in the pink flower.

The sexual organs, androecium and gynoecium of the white color flower could not be seen to the naked eye and they were reduced structures. The flower as the reproductive part of the plant was observed as beautiful and colourful but no fruits and seeds were found in Tea Rose. The reduced structures or the absence of both male and female organs in white flower of Tea Rose was the obvious reason for the absence of sexual reproduction and eventually, no formation of fruits and seeds.

As the clear structures of androecium and gynoecium, the sexual organs were observed in pink color flowers. There were about 53 stamens counted and the anthers were attached to the filament at the base of the anther. The anther length measured was 3 mm to 5 mm (Plate 10), and the filament length was 1.5 cm to 2.5 cm (Plate 11). Considering the relative heights of androecium and gynoecium, the anther

position was higher than the position of stigma (Plate 12), but there were some exceptional cases as shown in Plate 13.

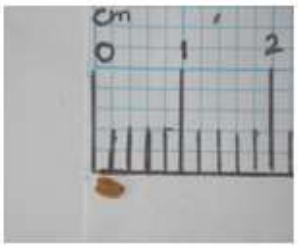

Plate 12: Higher Anther Position

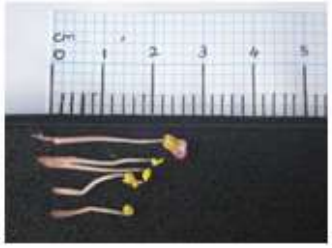

Plate 13: Lower Anther Position

Plate 14: Geniculate Stigma of Pink Flowers

Superior Ovary

Plate 15: Superior Ovary of Pink Flower

The style of the gynoecium was geniculate type (Plate 14) and a superior ovary was in the gynoecium of pink flower as shown in the Plate 15. The petal arrangements of both pink and white flowers and their buds are shown in Plates 16 and 17.

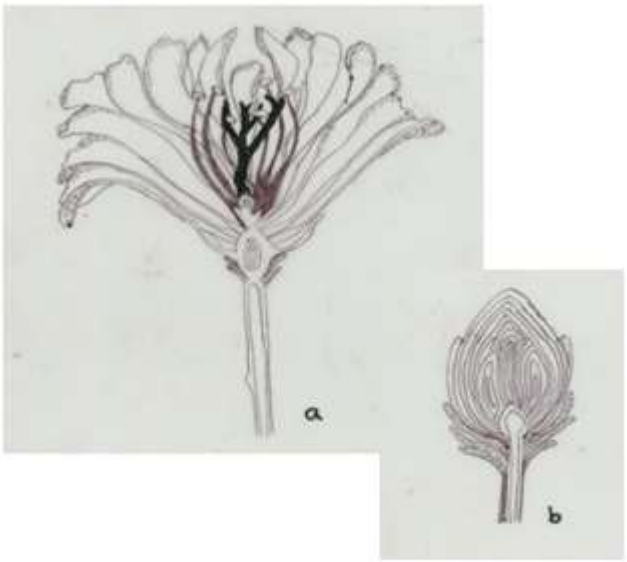

Plate 16: Longitudinal Section of Pink Flower (a) and Bud (b) of Tea Rose

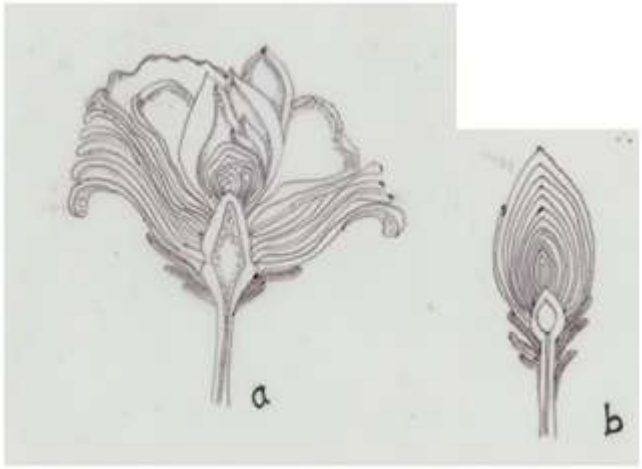

Plate 17: Longitudinal Section of White Flower (a) and Bud (b) of Tea Rose

The results revealed that the pink color flower has intermingled petaloids and stamens in the middle of the flower. The similar characteristics were described in the classification of American Camellia Society as Class 04 named Peony [6]. Therefore, it can be considered that *C. japonica* with pink flowers found in hill country of Sri Lanka belongs to the Class 04 Peony in the classification. The Plant Description of *C. japonica* in Italy [7] also shows that the Sri Lankan Tea Rose having pink flowers belongs to the Peony form.

According to the classification of American Camellia Society, *C. japonica* with white flowers in hill country of Sri Lanka is related to the Class 06 named Formal Double. The Plant Description of *C. japonica* in Italy described these similar characteristics as Double Imbricated.

The germinated and non-germinated pollens were shown in Plate 18. The highest germination rate (31.7%) was recorded in which the pollens were in 10% sugar solution. Therefore, the pollen viability of pink flower was around 31.7%. Fully developed and opened flower was the only stage in which viable pollens were available but at poor level.

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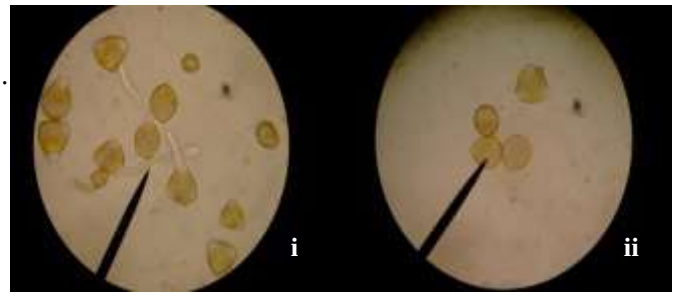

Plate 18: Microscopic View of Germinated (i) and Non-germinated (ii) Pollens in 10% Sugar Solution

The Tea Rose *Camellia japonica* cultivars found commonly in hill country of Sri Lanka can be identified as two forms considering floral morphology. Accordingly, Tea Rose cultivar with pink flowers can be classified as Class

Peony and Tea Rose cultivar with white flowers can be classified as Formal Double or Double Imbricated.

When considering the natural propagation of Tea Rose *C. japonica* cultivars in Sri Lanka, the pollen germination and viability was very low and thus it performs poorly in natural propagation, and consequently, no formation of fruits and seeds.

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