

Flower morphology and leaf nutritive value in China Cherry and Kumbhi

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Abstract: Morphological characteristics of flower and proximate composition of leaves in China Cherry (*Muntingia calabura*) and Kumbhi (*Careya arborea*) were investigated between April and July, 2008. Flowers of China Cherry are regular, sepal and petal 5-6, polypetalous, stamen numerous, syncarpous superior ovary with 5-7 carpels. The average length of sepal and petal is about 0.80 ± 0.06 cm and 1.14 ± 0.08 cm, respectively and that of breadth is about 0.21 ± 0.04 cm and 0.86 ± 0.08 cm, respectively. The stamens are about 0.48 cm long in China Cherry. Flowers of Kumbhi, on the other hand, are medium to large, pink, clustered at the end of branches. Sepal and petals 4 or 5, polysepalous, sepals thick, dark green and persistent, petals pinkish green, stamen numerous, pink or white, ovary inferior, placentation axile, style long and persistent. The average length of sepal and petal is about 1.03 ± 0.09 cm and 4.68 ± 0.18 cm respectively and that of breadth is about 1.34 ± 0.07 cm and 2.14 ± 0.12 cm, respectively. The average number of stamens per flower is about 566.5 ± 1.86 and the mean stamen length is about 3.51 ± 0.11 cm. The style is persistent and the mean length 5.84 ± 0.19 cm. Leaves of both the species had considerable amount of ash, fibre and fat. The matured leaf of China Cherry and Kumbhi contained 16.25% and 9.3% crude protein, respectively.

Key words: Flower Morphology, *Muntingia calabura*, *Careya arborea*, Leaf proximate composition.

Introduction

China cherry (*Muntingia calabura* L.) is a minor but well-known tropical and edible fruit tree. The trees are highly ornamental and are grown as a multipurpose tree. It is a member of Muntingiaceae (Watson and Dallwitz, 1992). The very fast-growing tree reaches 7-12 m in height with spreading and nearly horizontal branches. The leaves are evergreen, alternate, lanceolate or oblong, long-pointed at the apex, oblique at the base; dark-green and minutely hairy on the upper surface and irregularly toothed. The flowers, borne singly or in cluster of two in the leaf axils, 1.25-2 cm wide with green sepals and white petals and many prominent yellow stamens. The petals last only one day and falling in the afternoon. Timber is used to make small boxes, casks and general carpentry. The tree grows in poor soil, tolerating both acid and alkaline conditions and quite drought tolerant. Because of its ability to grow quickly on unfertile soils and rapid dispersal by birds and bats, the Cherry tree is being considered as a candidate for reforestation for environmental protection. The evergreen leaves of the tree could be good alternatives to the common fodder of Bangladesh. The tree is ornamental and can also be used as fuel wood. The flowers are used as an antiseptic and to treat spasms. It is also considered to relieve headaches and colds.

Kumbhi (*Careya arborea*. Roxb.) is also another important fruit trees considering its foliage, shade and windbreak properties in the tropics and subtropics (Shastri *et al.*, 2002). The family (Lecythidaceae) is represented by tall to small trees and shrubs largely distributed in the moist lowland neotropics. Kumbhi is a medium-sized tree up to 20 m tall with spreading crown. Leaves arranged spirally, often clustered at the apices of twigs, simple, broadly obovate, tapering at base. Flowers are borne terminal with bisexual, large and whitish colour. Fruit large, many-seeded drupe characterized by the persistent sepals (Prance, 1998). The green leaf of the tree can be used as good source of fodder.

The canopy structure of the species represents their suitability in the agroforestry system (Fig. 3). China cherry has small round size canopy whereas Kumbhi has cylindrical type canopy structure. The litter fall from both the species may add considerable amount of organic

matter in the soil. Das and Alam (2001) described some of the morphological features of kumbhi. It is important to know feeding value of the leaves of both the species. There is only one report (Rahman, 2009) about the quantitative characters of the flower of China Cherry and Kumbhi. So, the present study was conducted to examine the flower morphology of China Cherry and Kumbhi and to determine the nutritive value of the leaves.

Materials and Methods

Six China cherry (*Muntingia calabura* L.) plants of 3-4 year age and five Kumbhi (*Careya arborea* Roxb.) trees of 5-6 year age were considered for the study in the Botanical Garden, Bangladesh Agricultural University, Mymensingh ($24^{\circ}26'$ & $24^{\circ}54'$ N and $90^{\circ}15'$ & $90^{\circ}30'$ E) between April and July in 2008. Ten opened flowers of both the species were randomly collected to study the flower morphology. The flowers were carefully examined under the simple microscope and the number of sepal, petals, and stamens were recorded. Arrangement of sepals, petals and stamens and their colour were also carefully observed. Cross section of the ovary was examined in the light microscope to observe the placentation and number of carpels. Magnifying glass was used to observe the minute structure. The length of 20 stamens and styles were measured using ruler. The length (L) and breadth (B) of 20 sepals and petals were also measured with a ruler. Sepal and petal area were also estimated by $L \times B$. The proximate constituents; Crude protein (CP), ether extract (EE), crude fibre (CF), total ash (TA), and nitrogen free extracts (NFE) of mature leaves of both the species were determined (AOAC, 1990). The completely randomized design (CRD) was followed with four replications. Computer software SPSS was used to analyse the data. The mean differences were compared by least significant difference (LSD) test (Gomez and Gomez, 1984).

Results

Inflorescence and flower

China Cherry: The inflorescence is solitary or clusters of two rarely three flowers. Bud arises from the axile of leaf and light green in colour. Flowers are regular, pedicellate, polysepalous hermaphrodite, epigynous, carpel 5-7 with

persistent stout capitates style. Small to medium size flower with light green sepal and creamy whitish petals (Fig 1). The details qualitative characters of inflorescence and flower of china cherry is shown in the Table 1. Sepal length of china cherry varied between 0.7 and 0.95 cm with a mean value of 0.80 ± 0.064 cm and that of breadth varied between 0.20 and 0.25 cm with an average of 0.216 ± 0.040 cm (Table 2). Sepal area varied between 0.14 and 0.20 cm^2 with a mean of $0.173 \pm 0.039 \text{ cm}^2$. Petal

length varied between 1.1 and 1.3 cm with mean magnitude of 1.14 ± 0.083 cm and that of breadth varied between 0.75 and 0.90 cm with average of 0.86 ± 0.086 cm. Petal area varied between 0.82 and 1.08 cm^2 with being magnitude of $0.98 \pm 0.11 \text{ cm}^2$. Number of stamens per flower varied between 102 and 151 with mean of 121.2 ± 1.95 and the stamen length varied between 0.4 and 0.6 cm with a mean of 0.48 ± 0.09 cm (Table 2).



Fig. 1. Inflorescence and floral parts of China Cherry: A) leaf and inflorescence; B) complete flower; C) different flower parts.

Table 1. Qualitative characters of the flower of China Cherry

Inflorescence	Flower	Calyx	Corolla	Androecium	Gynoecium	Fruit	Seed
Solitary or cluster of two, arises from leaf axile.	Hermaphrodite, regular, pedicellate, bud green, 1.25-2 cm wide.	Sepal 5-6, light green, polysepalous, aestivation valvate.	Petal 5-6, Whitish, Polypetalous, arise from the join of two sepals, aestivation valvate, last only one day.	Stamen numerous, free, filament long, anther lobed yellow in colour, glabrous at the base from where the stamen arise.	Carpel 5-7, syncarpous, ovary superior, style short or reduced. Stigma capitates, 5-7 lobed, persistent placentation axile.	Edible berry, numerous tiny seeded, green when immature but red or pink when ripe, juicy pulp sweet in taste.	Numerous minute, round, tiny, embedded in the pulp

Table 2. Floral morphology of China Cherry (quantitative)

	Sepal length (L) (cm)	Sepal breadth (B) (cm)	Sepal area (L×B) (cm^2)	Petal length (L) (cm)	Petal breadth (B) (cm)	Petal area (L×B) (cm^2)	Stamens/flower	Stamen length (cm)
Range	0.7-0.95	0.2-0.25	0.14-0.20	1.1-1.3	0.75-0.90	0.82-1.08	102-151	0.4-0.6
Mean	0.80	0.216	0.173	1.14	0.86	0.989	121.2	0.481
s.e.m	± 0.064	± 0.040	± 0.039	± 0.083	± 0.086	± 0.11	± 1.95	± 0.09

Kumbhi: The inflorescences appears at the end of March when the tree more or less leafless. Spike inflorescence appears clustered at the end of branches. Buds are dark green colour. Flower does not open completely and some shed shortly after opening. Flowers are medium to large, pinkish, hermaphrodite, regular, polysepalous, polypetalous, ovary inferior, carpel 4-5, placentation axile with thick and persistent calyx and possess a bad smell (Fig 2). The details of flower morphology is shown in the Table 3. Sepal length varied between 0.8 and 1.3 cm with mean of 1.03 ± 0.09 cm and that of breadth varied between 1.2 and 1.5 cm with average of 1.34 ± 0.07 cm (Table 4). The sepal area varied between 0.96 and 1.82 cm^2 depending on the sepal length and breadth with mean value of $1.39 \pm 0.13 \text{ cm}^2$. Petal length varied between 1.4

and 5.4 cm with a mean of 4.68 ± 0.18 cm and that of breadth varied between 1.7 and 2.5 cm with a mean of 2.14 ± 0.12 cm. The petal area varied between 6.12 and 14.31 cm^2 with a mean of $10.04 \pm 0.33 \text{ cm}^2$. Number of stamens per flower were between 510 to 615 with mean of 566.5 ± 1.86 and stamen length varied between 3.0 and 3.8 cm with a mean of 3.51 ± 0.11 cm. The style is persistent and the length varied between 4.9 and 6.1 cm with mean of 5.84 ± 0.19 cm (Table 4).

Proximate composition

China Cherry: Leaves of China Cherry had considerable amount of ash, crude fibre, crude protein and nitrogen free extracts. A 100g dry weight of mature green leaves of China Cherry consisted of 7.40g ash, 27.31g crude fibre, 16.25g crude protein, 7.72g crude fats and 41.31g nitrogen

free extracts (Table 5). The total organic matter content of the leaves was found 92.6% of its dry weight.

Kumbhi: Like the China Cherry, Kumbhi leaves also had higher amount of crude fibre, crude protein, ash and organic matter. A 100g dry weight of mature green leaves

of Kumbhi contained 5.23g ash, 21.26g crude fibre, 9.3g crude protein, 3.84g crude fats and 60.27g nitrogen free extracts (Table 5). The total organic matter content of the leaves was 94.77%.

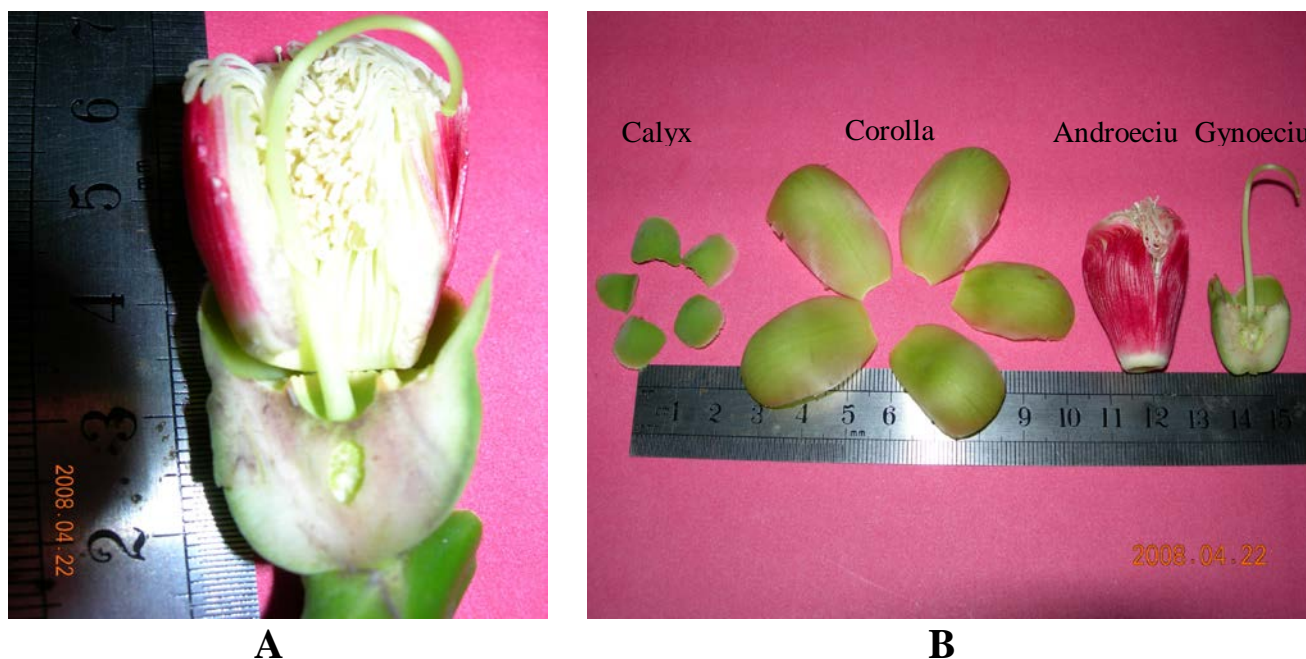


Fig 2. Size of flowers and its different parts of Kumbhi: A) LS of complete flower; B) Different parts of flower.

Table 3. Qualitative characters of the flower of Kumbhi

Inflorescence	Flower	Calyx	Corolla	Androecium	Gynoecium	Fruit	Seed
Spike, clustered at the terminal of the stem when the tree is more or less leafless.	Hermaphrodite Regular, Bud green.	Sepal 4 or 5, green, thick, triangular, polysepalous, aestivation valvate, persistent.	Petal 4 or 5, pinkish green, oval shaped, polypetalous, aestivation valvate,	Stamen numerous (>500), free, outer ones long and pinkish, inner ones short and whitish, filament long, anther bilobed, basifixed base of the stamen.	Carpel 4, rarely 5 syncarpous, ovary inferior, style long and persistent, stigma 4 lobed, placentation axile.	Berry, green, few (1-9) or no seeded, become juicy and light Green when ripe.	Round or oval, brown in colour, cotyledon absent

Table 4. Floral morphology of Kumbhi (quantitative)

	Sepal length (L) (cm)	Sepal breadth (B) (cm)	Sepal area (L×B) (cm ²)	Petal length (L) (cm)	Petal breadth (B) (cm)	Petal area (L×B) (cm ²)	Stamens/ flower	Stamen Length (cm)	Style Length (cm)
Range	0.8-1.3	1.2-1.5	0.961.82	3.4-5.4	1.7-2.5	6.12-14.31	510-615	3.0-3.8	4.9-6.1
Mean	1.03	1.34	1.39	4.68	2.14	10.04	566.5	3.51	5.84
s.e.m	±0.09	±0.07	±0.13	±0.18	±0.12	±0.33	±1.86	±0.11	±0.19

Discussion

Flower morphology was investigated by closely observing the flower. The flowers are small, white, borne singly or cluster of 2 or 3. Flowers are regular, sepal and petal 5-6, polypetalous, stamen numerous, syncarpous ovary

superior with 5-7 carpels (Table 1). The present findings are similar to Morton (1987) who also reported that the flowers of china cherry borne singly or in group of 2's or 3's in the leaf axils and 1.25-2 cm wide with many prominent stamens. Raman (2009) reported that flowers

borne singly or in groups of two in leaf axils with 5-6 green sepals and 5-6 white petals and many (>100)

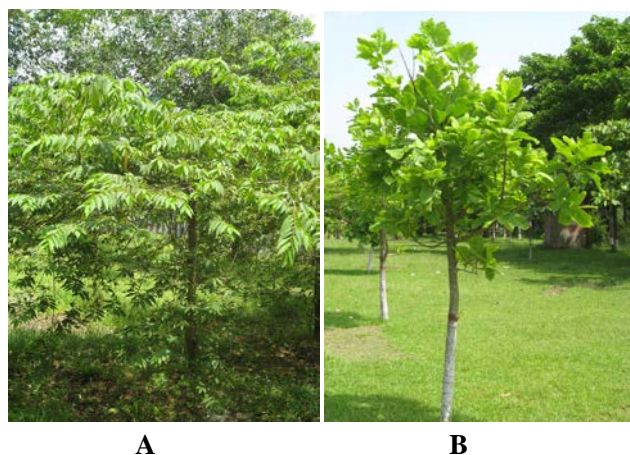


Fig 3. Canopy structure of the species A) China Cherry; B) Kumbhi

prominent yellow stamens, ovary superior with 5-7 syncarpous carpels and axile placentation. Previous researchers (Morton, 1987) described a few features of

flower. In the current study, detailed qualitative and quantitative floral characters are investigated (Tables 1, 2). Stone (1970) also reported that the petal of China Cherry is about 1.2 -1.3 cm long and the stamen is about 0.6 cm long. Flowers of Kumbhi are medium to large, pink clustered at the end of branches and had a bad smell. Sepal and petals 4 or 5, polysepalous, sepals thick and dark green, petals pinkish green, stamen numerous, pink or white, ovary inferior, placentation axile, style long and persistent (Table 4). Rahman (2009) also reported, the flowers of kumbhi borne in a cluster of raceme, bisexual, large, sepals 4-5, petals 4-5, free, stamen long and many (>500), stigma long, ovary 4-5 locular inferior with many ovules. Das and Alam (2001) also reported that flowers are large, 5-10 cm across, white and pink, with an unpleasant smell in few flowered clustered at the end of branches. Das and Alam (2001) described a few floral characters of Kumbhi but in the present study the detailed qualitative and quantitative floral characteristics are studied (Tables 3 and 4; Fig. 2). There are scanty information about the nutrient composition of Kumbhi and China Cherry leaves. Leaf of both the species also rich in protein and fibre contents and may be used as fodder (Rahman, 2009). The present finding would help to introduce the species as fodder.

Table 5. Proximate composition of fully matured green leaves of China Cherry and Kumbhi

Proximate composition of leaves (%)						
	Ash	Crude fibre	Crude protein	Crude fat	Total organic matter	Nitrogen free extract
China Cherry						
Mean	7.40	27.31	16.25	7.72	92.6	41.31
s.e.m	±0.035	±0.466	±0.19	±0.028	±0.035	±1.13
Kumbhi						
Mean	5.23	21.26	9.30	3.84	94.77	60.27
s.e.m	±0.033	±0.093	±0.016	±0.002	±0.033	±0.412

Acknowledgements: We are grateful to Curator, Botanical Garden, BAU for providing research facilities and Head, Department of Animal Nutrition, for providing Laboratory support in proximate analysis.

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