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Botany

A STUDY ON REPRODUCTIVE INFLORESCENCE OF PHENOLOGY IN *Caralluma umbellata* HAW.

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ABSTRACT The reproductive inflorescence of phenology in *C. umbellata* on Vivekanandha College Campus in Elayampalayam, Tiruchengode (TK). Namakkal (DT), Tamil Nadu, India. The reproductive phenology of spike inflorescence in observed on Bud stages on (Bud location, Date, bud initiation, bud maturity, bud color, bud open and bud longevity). The flower observed during the flower periods on (first flower observed in date, location, flower color, flower length, breadth, shape, petals, sepals, pollinium, gynoecium, longevity, last flower). The fruit observation in periods on (fruit date, location, fruit initiation, fruit maturity, fruit color, fruit open, fruit length, breadth, fruit shape, fruit dry, seed weight, seed color, seed length, seed breadth, seed dispersal) in all stages observed the reproductive inflorescence as present.

KEYWORDS :

Introduction

The phenology is the observation and measurement of events in time. This phenology term first introduced in 1853 by the Belgian botanist Charles morren and is derived from the Greek world phaino meaning to appear, phenology is the science that measures the timing of life cycle events for plants, the phenophases include leaf budburst, first flower, last flower, first ripe fruit and leaf shedding, among other phenophases commonly observed (Sakamoto *et al*., 2005).

The basic knowledge of phenology has a long history of application in agriculture and forest. In 18th century Europe has the longest scientific phenological observation (Leinonen and Hanninen, 2002; Luterbacher *et al*., 2007). In North America, however, Thomas Mikesell started the earliest systematic phenology observation between 1883 and 1921, about a century later, and recorded about 25 species during that period of time (Lechowicz, 1995). Swedish biologist Carolus Linnaeus and a British landowner Robert Marsham in the 18th century started modern phenological recording (Lechowicz, 2001). The historical recorder still contributes for today's research (Sparks and Carey, 1995) Since then, records of explicit phenological observations were phenological species was observed in leaves, stem, flower, fruit, and seed the field observation, digital camera, aerial photo (Carrieras *et al*., 2006) into the studying of phenology. The importance of phenology in plants from food chain as environment. It is important because our food supply depends on the timing of phenological events.

Flowering phenology variation of environment with climate geographical ranges (Richardson *et al.*, 2013). The Climate affects the sequence of different reproductive stages flowering to seed production (Alizoti *et al*., 2010). The phenology of plants may be modified by the environment (Lieth, 1975) and this effect is intensified at higher elevations because of seasonal variation of temperature (Hansens et al., 1981; Smith *et al*., 1999). Knowledge of patterns of flowering and fruiting in alpine environments provides an important baseline against which responses future global warming can be measured. The reproductive phenology of a plant species is the set of biological events frequency occurring related to their flowering or fruiting. Phenological events can be temperature, humidity and moisture contents and by biotic factors such as pollinators. Knowledge of the reproductive phenology of species is important to elucidate different aspects related to the dynamics of tropical ecosystem. The plant biological events such as budburst and swelling, shoots growth and increments in trunk diameter, root dynamics as well as reproductive growth like flowers initiation, fruits setting, and fruits maturing. It has been observed that reproductive biology is very important to the Bud phenology, flowering phenology, pollination, fruit phenology and seed phenology (Kukade and Tidke, 2013). Pungamhas lot of variability in terms of flowering phenology, fruits color and fruits maturity and seed maturity period between the ecological in observed in species (Raut *et al*., 2011). A clear understanding of phonological behavior on time of a thesis time and duration of stigma receptivity, fertilization, mode of pollination, seed development is necessary for breeding programmes to obtain better traits (Rout *et al*., 2009).

Materials and Methods

Study Area

The study was conducted plant *Caralluma umbellata* Haw. phenology of Vivekanandha college campus in Elayampalayam. The plant was identified from located near to Tiruchengode. It's about 30km of Namakkal city. The Elayampalayam climate maximum temperature is 29°C to 36°C. The average rainfall of area is 85mm and the relative humidity of the area is 58%.

Plant Identification

The plant was *Caralluma umbellata*. Haw. identified in Flora of the Presidency of Madras by j.s.Gamble volume-ii.

Inflorescences Phenology

The number of flowers per inflorescence was counted, and the size of inflorescence was measured as a distance from lower most and upper most flower. The size and length of sprouting stages flowering also recorded. The first bud initiation of flowering peak (largest floral display). The time, flower bud initiation, longevity of flower, last flower, flower (color change) (Rout *et al*., 2009). The fruit formation specific period for fruit formation, fruit (color change) to dehiscence and the flower that produced fruit and their position in the inflorescence were recorded, fruit production and seed dispersal was calculated as a ratio between the number of fruits produced and the number of available flowers(Owens *et al*., 2001).

Bud Phenology

Bud was observed daily throughout the period on (Bud initiation, Bud maturity, Bud open, Longevity of bud in bud periods) Yang *et al*., (2014). The bud observed in location, bud recorded the date, bud initiation, bud maturity, bud color, bud open in observed daily. The bud stages are photographed daily.

Flower Phenology

One inflorescence on each of one selected individuals were marked for the flowering phenology patterns. Bud was observed daily throughout the period on (Flowers open, flowers dry, flowers longevity in flowering periods) were then observed daily during the flower periods. The one or more flowers completely open on the plants. The first flowers observed in location, each flower recorded the date, flowers stages ,flower color, flower length, flower breadth, flower shape flower sepals, petals Last flowers polonium gynoecium is observed in daily

(Sakai, 2002). A single inflorescence and single flowers from each individual's stage in photographed daily.

Fruit Phenology

Fruit was observed daily in the period on (Fruit initiation, fruit maturity, seed dispersal). The fruit was recorded location, date fruit initiation on fruit maturity, fruit color, fruit open, fruit length(cm), fruit breadth (cm), fruit shape, fruit dry, fruit moisture content(%), seed quality, seed weight and seed color in the observed daily(Srimathi et al, 2001). The all the stages in photographed daily.

RESULT AND DISCUSSION

The *Caralluma umbellate* Haw on habit as Annual herb and habitat in terrestrial plant. The plant inflorescence in spike inflorescence .The flower is duration season in summer. The flower is terminal umbel in brown color. The flower corolla (5 petals), calyx (5 sepals), pollinium(5), gynoecium, flower length (3.6cm), breadth (2.6cm). The fruit is cylindrical in green with pink color .fruit length (24.1cm), breadth (0.4cm). The seed is brown with silky with white hairs, seed length (5.9cm), seed breadth (0.4cm), seed weight (0.37cm)in present of plant.

RESULT

Inflorescence to Bud Initiation

It was observed that *Caralluma umbellata* Haw. Initiated the buds from April to mid of August. The data showed that on buds were observed per florescence in 1st day initiated in 10 buds and pale yellow color; the 2nd day observed in 20 buds in pale yellow color, the 3rd day observed in 50 buds pale yellow color, the 4th day observed in pale yellow color. The data on days 1, 2, 3 and 4 in 52 buds were small sized on in matured of inflorescence. After 5 days 52 buds are matured, the color changes in matured buds on pale yellow color in to brown color. The 52 buds longevity of 2 days on inflorescence and not bud drop per inflorescence (Rout et al., 2009).

Flower

It was observed that *C. umbellata* initiated flower buds from April to August. The data showed that on an average of 52 Flowers were observed per inflorescence. The data observed in 1st day on 8 flowers opened in brown color, the 2nd day on 10 flowers and brown color, the 3rd day on 43 flowers and brown color, the 4th day on observed, 5th day on flowers and brown color per inflorescence. The inflorescence in 52 flowers on observed in daily process on petals length (3.6 cm), breadth (2.6 cm), sepals, pollinium and gynoecium is recorded for inflorescence. The inflorescence for 1st to 5th has no change in color. The 52 flowers longevity on 2 days present on inflorescences. The 52 flowers after 5 days on observation the flowers were dry. The flowers color changes on brown color in to black color. The buds initiation to flowers initiation in duration of 14 days from inflorescence. The observed from first bud to last flowers in duration of 20 days present per inflorescence.

Pollination to Fertilization

The phenophase changes pollination and fertilization has takes place in 52 buds developed 52 flowers in 49 flowers in drops. The 3 fruits have a developed cylindrical in green with pink color in developed in seed are brown with silky white hairs (Gassama *et al.*, 2003).

Fruit

The inflorescence daily observation on flowers revealed that the flowers ended with the 26 day of phenol phase fruit initiated in green with pink color. The out of 52 buds, 49 flowers is bloosm and from this 3 fruits have to be developed. Initially the fruit is green with pale yellow color income of development it changes into green with pink color. The after 15 days on fruit color changes light pink color. The after 10 days on color changes light pink color into white color. The finally fruit color is white color. The fruit is cylindrical shaped and developed seed on 7 days of inflorescence. The dispersal of seed with help of wind, the color is brown with silky white hairs in inflorescence (Dhillon *et al*., 2009).

Discussion

The investigation of *Caralluma umbellata* Haw on reproductive inflorescence in spike. The *C.umbellata* on herbaceous plant with reroductive parts from buds, flowers, fruits and seeds. The first reproductive stages on buds in 52 buds on developed. The 2 stages has a present in inmatured buds and matured buds in present. The immatured buds in 4th day is small size and pale yellow color.The matured buds in after 5 days in developed, the matured buds has light brown in color. The 8th day matured buds as light brown into changes dark brown color. The bud length, bud breadth, bud drops, bud color, bud location in recorded in plant. The flower duration season in summer on April to August. The flower in 52 flowers has be developed .The flowers is brown color, flower length (3.6cm), flower breadth (2.6cm), flower in star shaped, flower in corolla (5 petals), calyx (5 sepals), pollinium(5), and Gynoecium in flowers is observed. The flowers maturation of duration from 11days as present. The 4 inflorescencence of phenology totally from 6 fruits has be developed .The fruit on initiated length (3.4cm), fruit breadth (0.4cm), Fruit color in green with pale yellow color.The large fruit in length (24.1cm), breadth (0.4cm), color green with pink color.The totally dryed fruit in white color. The 1 fruit has be developed in totally on 12 seeds in present. The seeds color on brown with silky white hairs color. The seed length (5.9cm), seed breadth (0.4cm) and seed weight in (0.37g) as present on inflorescence in plant (Dhillon *et al*., 2009).

TABLE –1 Flowering and fruiting phenophase of inflorescence

Inflorescence	Bud	Bud Drop	Flower	Flower Drop	Longevity of Flower	Fruit	Fruit Drop
1	52	-	52	-	2 days	4	3
2	52	-	52	-	2 days	4	3
3	52	-	52	-	1 day	4	1
4	45	-	45	-	1 day	3	2

Conclusion

The reproductive phenology of spike inflorescence in observed on Bud stages on (Bud location, Date, bud initiation, bud maturity, bud color, bud open and bud longevity). The flower observed during the flower periods on (first flower observed in date, location, flower color, flower length, breadth, shape, petals, sepals, pollinium, gynoecium, longevity, last flower). The fruit observation in periods on (fruit date, location, fruit initiation, fruit maturity, fruit color, fruit open, fruit length, breadth, fruit shape, fruit dry, seed weight, seed color, seed length, seed breadth, seed dispersal) in all stages observed the reproductive inflorescence as present.

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