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To study the floral biology of cucumber (*Cucumis sativus* L.) flower

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Abstract

Flowering phenology of cucurbits ensures better cross- pollination for higher fruit set and yield. The flowers of cucurbits are usually monoecious as they produce male and female flowers separately on the same plant at different internodes. The time of anthesis was started from 07 00 h and continued up to 08 10 h while that of stigma emergence started at 07 15 h and continued up to 08 20 h during 2018, whereas during 2019, time of anthesis and time of stigma emergence, observed that the anthesis was started from 07 00 h and continued up to 08 05 h while that of stigma emergence started at 07 10 h and continued up to 08 15 h in natural pollination. The time of anthesis was started from 07 20 h and continued up to 08 45 h, whereas, that of the stigma emergence was started from 07 35 h and continued up to 08 50 h during 2018, whereas, during 2019, the time of anthesis was started from 07 15 h and continued up to 08 25 h while, that of the stigma emergence was started from 07 23 h and continued up to 08 25 h in pollination without insect. The experiment to study the floral biology of cucumber was undertaken at farmer field during summer, 2018 & 2019.

Keywords: Cucumber, floral biology, natural pollination and pollination without insect

Introduction

Cucumber (*Cucumis sativa* L.) is a widely cultivated summer vegetable crop in the gourd family Cucurbitaceae. It is a monoecious annual climber that has been cultivated for more 3,000 years and is still widely cultivated till today (Adetula O, Denton L, 2003) ^[1]. Flowering phenology of cucumber ensures better cross pollination, as it produces male and female flowers separately on the same plant at different internodes. Flowering phenology of cucumber ensures better cross- pollination for higher fruit set and yield. The pistillate and staminate flowers open on the same day. But, the male flowers are borne first, a fortnight earlier than the female flowers. Both type flowers arise singly from different internodes. Melon and cucumber flowers are pollinated exclusively by honey bee and other insect pollinators. They are not wind or self pollinated. Insects are required for pollen transfer because of the large sized pollen grain, their stickiness and the way they are released from the anthers. The flowers of cucurbits remain open only for a single day. If they are not pollinated during that time, the flowers abort and drop from the vine. When incomplete pollination occurs, fruit do not develop properly. Because many seeds from within each fruit and each pollen grain is responsible for the development of a single seed, inadequate pollination results in small or misshapen fruit and low yields of marketable fruit (Laurie and Fred, 2007) ^[5]. The female flowers borne on ovary, the inferior ovary and stigma remains irrespective throughout the day. In male flowers, anthers dehiscence when the corolla expands but the pollens remains on the anther as a sticky mass. The maximum pollination occurs in the afternoon as the female flower closes in the afternoon and never reopens whether or not pollination has taken place further. The highest per cent of fruit set resulted from deposition of pollen on the stigma between 09 00 to 12 00 h of the day (Bailey, 1949) ^[2].

Materials and Methods

To understand the mechanism of cross pollination, the studies on floral biology were made. The field experiment was laid out at farmer field during Summer-2018 and 2019 chikhali, (Gujarat), India. For the purpose, ten flowers (each of male and female flowers) were tagged with initiation of flower buds. The observations on process of flower opening, time of anthesis and time of stigma emergence were recorded from selected flowers.

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Results and Discussion

The studies on floral biology of cucumber were carried out during summer 2018 and summer 2019. For the purpose, ten flowers per plot were tagged with initiation of flower bud and observation on process of flower opening, time of anthesis and time of stigma emergence were recorded and presented in Table 1 and Table 2. The cucumber is a monoecious crop in which both the staminate and pistillate flowers were found on the same plant but the male flower appeared earlier than female flowers.

In the present study, it was observed that first male flower appeared much earlier than female flower. The first male flower appeared 35 days after plating while first female flower appeared 45 days after planting, and it followed definite sequence throughout flowering period. Male flowers were produced in cluster of three to five flowers on the plant, with each flower on a slender stem and having three stamens, whereas female flowers are solitary. The petals of male and female flowers are yellow in colour. The female flower easily identified by the small fruit (ovary) below the petals. A higher number of male flowers per plant were observed than female flowers. Male flowers consist of four to six petals, five sepals and three anthers, while female flowers have five petals, five sepals, stigma, style and inferior ovary.

The data presented on time of anthesis and time of stigma emergence during 2018 (Table 1), indicated that the anthesis was started from 07 00 h and continued up to 8.10 h while that of stigma emergence started at 07 15 h and continued up to 08 20 h in natural pollination plot. During 2019 (Table 1), time of anthesis and time of stigma emergence, observed that the anthesis was started from 07 00 h and continued up to 08 05 h while that of stigma emergence started at 07 10 h and continued up to 08 15 h in natural pollination plot.

The time of anthesis was started from 07 20 h and continued up to 08 45 h, whereas, that of the stigma emergence was started from 07 35 h and continued up to 08 50 h during

summer 2018 (Table 2) whereas, during summer 2019, the time of anthesis was started from 07 15 h and continued up to 08 25 h while, that of the stigma emergence was started from 07 23 h and continued up to 08 25 h in pollination without insect plot (Table 2).

Chand *et al.*, (1990) ^[4] recorded that anthesis started at 05 00 h and was completed by 08 00h with the maximum anthesis occurring in between 06 00- 07 00h in cucumber. Stanghellini *et al.* (2002) ^[11] observed that the staminate and pistillate flowers of both gynoecious cultivar of cucumber, 'Calypso' (picking) and 'Dasher II' (slicing), and monoecious pollinizer, Sumter opened between 06 55h and closed between 13 30- 13 45h. Santos *et al.* (2008) ^[9] observed that the cucumber flowers started to open at 08 00h and by 11 30h usually all of them had opened. Rubina (2010) ^[8] observed that the cucumber flowers opened at 07 30h and remained open up to 16 00h in male and 18 00 h in female flowers. Sathesha (2010) ^[10] recorded that the cucumber flower opens at 06 00h and remained up to 18 00h. Anther dehiscence initiated at 06 00h with the opening of flower and maximum number of flowers (93.33%) opened during early hours of the day (06 00- 07 00 h). Anthesis of remaining buds continued for another five hours, while no anthesis was observed before 06 00h and after 11 00h. Balachandran *et al.* (2017) ^[3] observed that anthesis started at 06 00h in cucumber. Neha (2017) ^[6] observed that anthesis started at 06 00 h and completed by 08 00h with the maximum anthesis between 06 00 -07 00h in monoecious varieties of cucumber. The present investigation on period of flower opening and time of anthesis is more or less similar to previous findings. The slight variation may be due to prevailing weather condition during particular season at particular locations. Patel (2019) ^[7], observed in cucumber flower biology that the anthesis started at from 07 10 h and continued upto 08 00 h while that of stigma emergence started at 07 30h and continued up to 08 30 h in *A. cerana* pollinated plot under cage condition.

Table 1: Studies on floral biology of cucumber in natural pollination

Flower No.	Process of flower opening (h)		Time of anthesis (h)		Time of stigma emergence (h)	
	2018	2019	2018	2019	2018	2019
1	6.40	6.20	7.45	7.10	7.50	7.50
2	6.35	6.18	7.36	7.00	8.10	7.10
3	6.20	6.20	7.10	7.00	7.50	7.45
4	6.30	6.40	7.33	7.45	7.30	7.55
5	7.35	6.20	8.10	7.45	8.20	7.50
6	6.18	6.15	7.00	7.30	7.15	7.25
7	6.20	7.30	7.45	8.05	7.50	8.15
8	6.12	6.20	7.00	7.15	7.45	7.40
9	6.12	6.35	7.15	7.36	7.40	8.10
10	6.15	6.30	7.30	7.33	7.25	7.30
Min.	6.12	6.15	7.00	7.00	7.15	7.10
Max.	7.35	7.30	8.10	8.05	8.20	8.15

Table 2: Studies on floral biology of cucumber in cage condition without pollinators

Flower No.	Process of flower opening (h)		Time of anthesis (h)		Time of stigma emergence (h)	
	2018	2019	2018	2019	2018	2019
1	6.40	6.40	7.30	7.20	7.40	7.23
2	6.35	6.35	8.20	8.20	8.10	8.15
3	6.40	6.40	8.23	7.40	8.25	8.15
4	6.20	6.30	7.20	7.15	7.35	7.53
5	7.00	6.20	8.30	7.30	8.40	7.40
6	7.50	7.35	8.45	8.12	8.50	8.20
7	7.15	7.15	8.15	8.15	8.20	8.20
8	6.43	7.30	7.30	7.45	7.45	7.44
9	7.10	7.10	8.25	8.10	8.20	8.22
10	7.30	7.30	8.25	8.25	8.25	8.25
Min.	6.20	6.20	7.20	7.15	7.35	7.23
Max.	7.50	7.35	8.45	8.25	8.50	8.25

Conclusion

In the present study, it was observed that during summer 2018, the anthesis was started from 07 00 h and continued up to 08 10 h while that of stigma emergence started at 07 15 h and continued up to 08 20 h in natural pollination plot. During summer 2019, time of anthesis and time of stigma emergence, observed that the anthesis was started from 07 00 h and continued up to 08 05 h while that of stigma emergence started at 07 10 h and continued up to 08 15 h in natural pollinated plot. The time of anthesis was started from 07 20 h and continued up to 08 45 h, whereas, that of the stigma emergence was started from 07 35 h and continued up to 08 50 h during summer 2018, whereas, during summer 2019, the time of anthesis was started from 07 15 h and continued up to 08 25 h while, that of the stigma emergence was started from 07 23 h and continued up to 08 25 h in pollination without insect plot.

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