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STUDIES IN CAPSICUM.*

I. ANTHESIS, POLLINATION AND FERTILISATION

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Introduction. Chillies, though broadly classified under condiments and spices stand next in importance to the staple food crops in India. The crop in spite of its being an introduced one from South America (Watt. 8.) has established very well in the country and created a special taste for the people at large. The necessity for chillies is all the more felt in the Madras Presidency as it forms one of the daily requirements of both the rich and the poor alike. The value of the crop is enhanced further by the discovery of Quinn, Burtis and Milner (5) of the presence of vitamins A, B and C in the green chillies. Considering the deterioration of the crop to an alarming extent in the Guntur district both in the quantity and quality, work on the improvement of this essential crop was taken up at the Agricultural Research Station, Guntur. A definite knowledge as to the anthesis, methods of pollination and the occurrence of cross-fertilisation is necessary for the improvement of any crop. The process of anthesis is a delicate one and it invariably varies with the weather conditions such that the

* Paper which won the Ramasastrulu-Munagala Medal, 1933.

observations recorded at one place might not hold good at another. An accurate information on the above phases facilitates the choice of the methods of improvement to be adopted, the testing of the new varieties as well as the combating of the insect pests and plant diseases by evolving disease-resistant types.

Material. The investigations were started in the year 1931-32 and were continued in the next season so as to confirm the findings of the previous year. The first year's observations were restricted to *Nallapadu* type of chillies, (*Capsicum annuum*) and the same were extended to some more species during the year 1932-33 as given below. In all, four species and six types of chillies were examined of which the first three types are cultivated in the Gantur District.

Particulars.	Pedicel.	Colour of fruit		Type of fruit	Habit of the matured fruit
		Green	Ripe		
1. <i>C. annuum</i> :-					
(a) Bellary chillies	Solitary	Green	Red	Broad & long	Pendent
(b) Nallapadu „	Do.	Dark Green	Red	Narrow & long	Do.
(c) Local „	Do.	Do.	Red	Stout & short	Do.
2. <i>C. annuum</i> -var- <i>acuminata pendula</i> :-					
(d) Yellow chillies	Do.	Light green	Yellow	Medium broad and long to short	Do.
3. <i>C. annuum</i> -var- <i>nigra</i> :-					
(e) Black chillies	Do.	Black	Red	Thin & short	Erect
4. <i>C. frutescens</i> :-					
(f) Needle chillies	Twos & Threes	Green	Red	Very thin & small	Do.

Method. In the first year of observations the period of anthesis was determined by labelling a certain number of well developed flower buds that are to open on the next day and the progress of flowering was noted at intervals of one hour from 2-0 a. m. till all the buds opened. The study was made at the end of every month from November to February but in the succeeding year it was felt that if the observations were to be limited to individual plants the results obtained will give a better insight into the subject. With this end in view, five plants from each of the above mentioned six types were selected for the purpose. The observations on anthesis were attended to throughout the night and day at intervals of one hour while the details of anthesis were made once in a week. The identity of the observed flowers was maintained by tagging the flowers with their respective serial numbers and the date of opening.

Biology of the Flower. Before getting into the details of the subject, the general description of the *Capsicum annuum* flower is given

below. The description given by Duthie (1) and Erwin (2) are consulted though the one given by Shaw (6) is very closely followed.

- Flower.* The flower is one pedicelled; axillary; solitary and regular.
- Calyx.* Campanulate; minutely 5 or 6 lobed, much shorter than the fruit and completely covers the base of the bud
- Corolla.* Rotate, Five lobed and valvate in bud. Lobed three veined, and curved at the tips.
- Stamens.* Five or six as the case may be, adnate and are attached near the base of the corolla.
- Anthers.* Not connivent in cone, not longer than the filaments, dehiscing longitudinally by lateral slits.
- Style.* Linear.
- Stigma.* Sub capitate and bi-fid.
- Ovary.* Two celled with the connate carpels.

Observations made at Guntur indicate that flowers with five lobes are common with a variation of ± 1 in 2 per cent of the flowers produced per plant. In addition to the above, cases of flowers having unequal number of stamens to the number of corolla lobes were also noticed. The difference found was one, being always on the reduction side.

Floral Secretion. During the course of anthesis studies in 1931, the writer observed several insects hovering in the chilli plot as early as 4 a. m. The attraction of insects to the chilli flowers in spite of their being non-odorous, un-attractive, pendent, and partly hidden by foliage created a curiosity for examining the flowers for floral secretions if any. On careful examination small globules of sweet liquid were noticed on the inner side of the petals as well as at the places where the filaments are attached to the corolla. Usually the secretion commences by about 4 a. m. No mention of such secretion in chilli flowers is made by the other workers in India but Erwin (2) states that the phenomenon was noted by him at Iowa about the same time. On analysis he found the Osazone of dextrose in the nectar secreted by the chilli flowers.

Details of Floral Parts :—

(a) *Pedicel.* Usually in the common forms of chilli plant the pedicel is solitary and axillary but in some species they arise in numbers. The matured pedicel is either erect or pendent. The length and size of the pedicel varies with the type of chilli plant. In almost all the cases it is green but in a few cases it is either streaked with purple or remains completely violet.

(b) *Calyx.* In the tender stages of the bud, the calyx completely encloses the flower bud in most of the cases. As the bud develops the calyx widens leaving space for the developing bud to come up. Like the pedicel the calyx is green in colour but in a few cases it is either streaked with purple or remains completely purple. In the majority of cases it is persistent and remains attached with the fruit while in a few cases it is loose and comes off easily either at the time of collection or storing.

(c) *Corolla*. The colour of the petals is white in general but in some types it is either dirty white to yellowish green or violet with varying intensities as in the case of black chillies.

(d) *Filaments*. These are either white or pigmented and are as long as the anthers or even slightly longer.

(e) *Anthers*. The general hue is green but cases of light green and violet coloured anthers are also present in some types of chillies.

(f) *Style*. The style is of different lengths in flowers produced by a single plant on the same day. It is either light yellowish green or purple. Cases of bent styles are also reported by Shaw (6).

(g) *Stigma*. This may be coloured purple or remains light green according to the types of the chilli plant. The number of stigmatic lobes in their turn vary with the species and as many as two to three lobes were observed by the writer in the six types of chillies under consideration.

Appearance of the first Flower. The appearance of the first flower in the chilli crop commences from the sixth week after sowing and is usually found in the nurseries. The production of the first flower varies with the type and vigour of the plant. For a chilli cultivator the appearance of the first flower is a signal to get his nurseries topped.

Development of the Flower-bud. To start with, the bud is minute and appears as a green speck between to linear lanceolate leaves. The bud takes two to three days for the formation of the pedicel. The calyx remains closed till the bud attains the fifth day when a bend forms in the pedicel either at the base or just below the calyx. In another two or three days the corolla pushes out and takes seven to eight days for opening. The relative positions of the stigma and anthers vary in the bud. In the young bud the anthers and the stigma are at the same level but the style grows more rapidly than the stamens and hence in an open flower the style is found to be 1 to 2 mm. longer than the stamens. By the time the flower opens the development of the anthers and stigma will be completed as no further growth in size was noticed under the Guntur conditions. On the same plant we come across flowers having styles longer than the staminal column, styles flush with the staminal column and styles shorter than the staminal column. Counts taken from the flowers produced by the same plant throughout the flowering season gave the following results:—

Type of Chilli plant,	Nature of style.			Total.
	Longer.	Flush.	Shorter.	
Bellary	67	56	19	142
Nallapadu	104	39	7	150
Local	81	59	11	151
Yellow	187	20	10	217
Black	51	12	4	67
Needle	151	8	5	164

Of the six types of chillies only the flowers of Needle chillies have a greater percentage of longer styles.

Order of Flowering. Flowers in the chilli crop arise from the axils and no definite order of opening can be specified as the branching is dichotomous. The earliest flowers appear among the older (i. e.) on the lower branches and the younger flowers occur on the branches nearer the apex of the stem. In a branch the flowering follows the same order, the older ones being nearer the main stem.

Duration of Flowering. The transplanting of the seedlings is usually done in September and the flowering commences from October and extends up to February. Stray flowers do appear till the end of February. In general, the flowering extends over a period of three months with the maximum flush occurring between the end of November and the beginning of December (Fig. 1). The maximum variation in the flowering period of the six types under consideration was eight days and the mean was eighty-six days. Of the six types, Bellary and Black chillies had the minimum period of eighty-one days and the Local had the maximum of eighty-nine days.

Progress of Flowering in a day. Shaw & Khan (6) mention that under Bihar conditions chilli flowers open at about 7-30 a. m. and continue opening till 1 p. m. with the majority of the buds opening between 8 and 10 a. m. They further state that in a few cases the opening extends up to 3 p. m. while some buds remain in an unopened or partially opened condition which in their turn open fully earlier than the buds that are to open the next day.

Shrivatsava (7) working on chillies in Bihar and Central Provinces found that in the month of October on a clear day all the flower buds observed by him opened between 4 and 7 a. m. He added further that on a cloudy morning the flower buds prolong their opening and continue opening till 9 a. m. In a few cases he noticed them to open as early as 1 a. m. and as late as 12 noon.

Erwin (2) working at Iowa states that the period of anthesis in chillies is comparatively short and in most cases less than a full day. His observations were made on 18-8-31 by noting the flower opening at half hour intervals starting just after sun rise (i. e.) 5-15 a. m. and continued till 10 a. m.

Chilli flowers as observed at Guntur commenced opening as early as 2 a. m. and continue up to 4 a. m. as indicated below. Of the total number of flowers that open on any one day, the major part of them blossom by 6 a. m. and only in a very few cases the opening is delayed. Dewy nights and cloudy atmospheric conditions retard the normal progress of anthesis and cause the buds to open late. Cases of buds opening late in the evening and the unopened buds of a particular day opening earlier to the flower buds that are to open on the next day were also noticed. The opening of such buds usually takes place between 0 and 1 a. m. as given below. The following table gives the

total number of flower buds observed under each type of plant and the distribution of the anthesis activity. Though the observations were made in 5 plants under each of the types the results of a single typical plant are given for having a clear and definite idea of the time.

Type of Chilli plant.	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-4	Total
	A. M.												P. M.	
Nallapadu	1931-32.												9	240
	9	28	39	58	43	31	10	8	3	2	...	...
	1932-33.													
Bellary	6	36	36	34	23	13	14	3	8	2	2	...	5	182
Nallapadu	7	30	32	41	21	22	3	2	...	...	...	...	2	160
Local	9	56	41	32	22	12	2	10	6	4	...	...	6	200
Yellow	10	17	37	65	59	39	7	14	4	...	...	...	11	263
Black	2	7	13	23	24	12	2	14	3	6	4	1	2	113
Needle	15	23	24	40	60	51	12	16	5	8	3	3	20	289

N. B:— The number of buds given under 0-1 a. m. are the immature buds opened on the next day.

Of the six types of chillies examined, the flowers of Black and Needle chillies open comparatively late, but in general the maximum activity of anthesis occurs between 2 and 6 a. m. Table II in the annexed appendix gives the fuller details of the anthesis energy at fortnight intervals. A cursory glance at Tables I and II in the appendix indicate that the vigour of the anthesis is directly controlled by the atmospheric conditions.

Dehiscence of anthers at Guntur was found to follow rather than be simultaneous with the opening of the flowers. The following table gives the rate of anther dehiscence under each type of chilli flowers.

Type of chilli plant.	6-7	7-8	8-9	9-10	10-11	11-12	Immature.	Total.
	A.M.	A.M.	A.M.	A.M.	A.M.	Noon.		
Nallapadu	1931-32						9	240
	56	87	63	19	6	...		
	1932-33							
Bellary	47	50	37	11	19	6	12	182
Nallapadu	32	35	46	31	4	2	10	160
Local	36	53	56	26	12	3	14	200
Yellow	34	89	64	30	22	2	22	263
Black	...	27	30	26	12	11	6	113
Needle	1	24	65	44	61	53	32	289

Similar to the flower opening the anther dehiscence in Black and Needle chillies commence late. In general, the dehiscence starts only after sun rise and this indicates that the atmospheric temperature is the determining factor for the activity of anther dehiscence. For fuller details (vide) Table III.

General Anthesis. Fully matured chilli bud appears like a knob and just when the bud commences to open, an aperture is formed at the top of the bud (i. e.) the junction at which all the corolla lobes meet. The aperture gradually increases in size and extends top

downwards along the margins of the lobes. The slit extends right down to the bottom whereby the corolla lobes get separate, one from the other. After some time, the lobes spread themselves flat and re-curve upwards by about 8 a. m. It is by this time that the majority of anthers dehisce. The bursting of anthers invariably begins from top and runs downwards along the edge of the anthers. After the dehiscence, the edges of the pollen sacs gradually get folded outwards exposing the pollen grain fully. Even the slightest touch causes the pollen to fall freely and on a windy day in about half an hour after the opening, all the sacs become empty. To a certain extent bees are also responsible for removing the pollen from the burst anthers.

The flowers commence closing from about 5 p. m. on the day of opening and remain closed during the night. Once again they commence opening from 4 a. m. on the next day and close finally by the evening. The corolla along with the stamens sheds in the course of another twelve hours. The stigma remains attached to the fertilised ovary for some days or even dries up and sheds in a day or two according to the prevailing weather conditions.

Shaw (6) mentions that in Pusa, chilli flowers remain open for two or three days without closing. In Bihar and Central Provinces the chilli flowers were observed by Shrivatsava (7) to remain fully open and turgid till 4 p. m. and get closed on the day of opening. The closed flowers were said to open once again between 4 and 7 a. m. on the next day and remain fresh and turgid as before and finally get closed at 6 p. m.

Details of Anthesis:—Two plants from each of the six types of chillies were selected and the detailed observations of anthesis were attended to on week ending Saturdays. The observations were carried throughout the flowering season and the details of a typical single flower of Bellary chillies are given below:—

Particulars.	Actual timing.	Interval from the opening of flower.	Date.
		Hours.	
1. Commencement of corolla opening	2-00 a. m.	—	5-11-32
2. Separation of corolla lobes	5-00 "	3-00	"
3. Secretion of nectar	5-00 "	3-00	"
4. Recurving of corolla lobes	8-00 "	6-00	"
5. Commencement of anther dehiscence	7-15 "	5-15	"
6. Do in all the anthers	8-50 "	6-50	"
7. Completion of dehiscence	10-00 "	8-00	"
8. Folding of corolla lobes	4-45 p. m.	14-45	"
9. Opening of corolla	5-00 p. m.	27-00	6-11-32
10. Final folding of corolla	4-00 p. m.	38-00	"
11. Shedding of corolla	Night.		"
12. Drying of style and stigma	3-00 a. m.	61-00	7-11-32
13. Shedding of style and stigma	10-00 a. m.	80-00	8-11-32

The details of the other types are given in Table IV in the annexed appendix.

With a view to see whether the time of the opening has got anything to do with the other phases of anthesis, flowers opened on the same plant at different hours on the same day were examined and the results are given in Table No. V of the appendix. The effect as can be seen from the table is significant (i. e.) the time interval is inversely proportional to the time of opening of the flower buds. Observations made at different ages of plants also showed marked difference in the time interval of the different phases of anthesis having the time of opening of the flower as the basis. As in the above cases, the time intervals diminish with the age of the plant.

Pollination. The study of pollination enunciated the factors contributing to fertilisation. Observations made at Guntur indicate that the pollination in chilli crop is effected by several natural agencies such as wind, Thrips (*Scirtothrips dorsalis* Hood), Bugs (*Nezara viridula*), Bees (*Apis florea*), Butterflies (*Papilio demoleus*, *Terias hecabe*, *Papilio aristolochae*) and small black ants (*Camponotus compressus*). Every one of them in its turn contributes its quota for the general role of pollination and fertilisation. The activity of the agencies commences as early as 4 a. m. and continues till about 12 noon or even later. The position of the stigma in chilli flowers suggests that the flowers are self pollinated as the flowers are either pendent or half-pendent due to the bending of the pedicel. The style is usually straight and longer than the stamens and hence the chances for the stigma are many for receiving the pollen of the anthers of the same flower.

Shaw (6) points out that in many varieties of chillies a certain percentage of the flowers possess curved styles instead of straight ones and that these shorten the distance between stigma and anthers whereby the stigma will be placed in a more favourable position for receiving the pollen of its own flower. The writer did not come across such bent styles in the several varieties grown at Guntur during the two seasons. Shrivatsav (7) pronounces that the chilli flowers are ordinarily self-pollinated.

Cross Fertilisation. Cross fertilisation in chillies is not uncommon for the fact that anther dehiscence starts much later than the opening of the flowers. Besides this, in some flowers the anthers do not burst due to some unfavourable physiological conditions. In such instances the only resort for the stigma is to depend on the pollen of other flowers.

Hector (4) found the chilli flowers to favour a certain amount of cross fertilisation. Erwin (2) mentions that chilli plant being a nectar bearing one attracts insects and as a result of that cross pollination is likely to occur. Shrivatsava (7) mentions that the anther sacs burst simultaneously with the opening of the flower but the observations recorded by Shaw (6) and the writer in 1931 & 32 indicate that the

anther dehiscence takes place at least an hour after the opening of the flower which in its turn depends on the diurnal atmospheric conditions. The interval varies from 1 to 10 hours as given below. In very few cases the anthers were found to remain in an unburst state. The delay in the bursting of anthers as expressed by Shaw (6) favours cross fertilisation.

Type of chilli plant.	Interval of anther dehiscence from the time of flower opening.										Total.
	1	2	3	4	5	6	7	8	9	10	
Bellary	16	16	30	32	45	15	11	1	...	2	168
Nallapadu	7	4	13	46	46	18	9	6	2	...	151
Local	5	13	17	36	52	35	20	4	1	1	184
Yellow	8	23	43	55	49	16	5	1	...	...	201
Black	2	5	16	25	28	14	7	1	...	...	98
Needle	7	4	13	46	46	18	9	6	2	...	151

The above figures indicate that the maximum bursting of anthers takes place between 3 to 5 hours since the opening of the flower.

Percentage of Natural Crossing. For determining this, a ready method was devised whereby the flower buds that are to open on the next day were bagged with tissue paper covers at about 6 p. m. The protected buds were emasculated early next morning at 5-30 a. m before the anthers could possibly dehisce. These were allowed to be cross pollinated and the setting of the same was examined on the seventh day. The observations were carried out at the end of every month in the two seasons. The details of the results are given in Table No. VI. On an average it was found to be seven per cent under the Guntur conditions. Shrivatsava (7) noted the percentage of of natural crossing in chillies as two to five per cent. Shaw (6) found that out of the ninety seven naturally fertilised cultures seventy five were found to be splitting for the parental characters. Erwin (2) mentions that he found eighty per cent of open pollination. Out of the thirty cultures raised by the writer in 1932 from the produce of single plants, two were found to be impure for parental characters. Though the figure obtained is low yet it is in conformity with the one mentioned by Shrivatsava (7)

Receptivity of Stigma and longevity of Pollen. A knowledge on this subject of the concerned crop is of vital importance for a plant breeder. Detailed observations were carried out for the last two seasons and as the subject forms a separate paper the matter is not dilated on at the present stage. The experiences gained so far indicate that the stigma in a chilli crop remains receptive for about twenty-four hours from the time of opening and the viability of the pollen lasts for twenty-four hours under the field conditions at Guntur.

Fertilisation. It is evident from the above fact that in chillies both cross and self fertilisation take place. Usually the setting of the early

formed flowers is very low due to the dewy nights and heavy rainfall in the Guntur District (Gopalaratnam 3). Flowering period in chillies extends well nigh over a period of three months. *Mutatis mutandis* the fruiting period also extends from December to March.

Percentage of Shedding and Setting. As the space is limited only a meagre sketch of the work done in this direction is given below. *Capsicum annum* alone was selected for the purpose and the investigations were made in the first two types of chillies. Five representative plants of the two types were selected in the field and the daily census of flower production was recorded throughout the flowering season but given as weekly totals per plant in Table VII. The flowers were tagged with the dated labels, and counts of the developed chillies were taken from time to time. The percentage of setting in the two types was found to be as low as 6 per cent on the average.

Maturation Period of the Fruit. This, like any other economic character varies with the variety and the age of the plant. Shaw (6) recorded that the ripening of the chilli fruit takes 2 to 2½ months. At Guntur the observations made in all the six types gave the following results.

Type of chilli plant.	Number of days taken for the chilli fruit to mature.		
	Mean.	Minimum.	Maximum.
Bellary	59	49	77
Nallapadu	57	49	62
Local	56	50	62
Yellow	60	52	70
Black	57	51	70
Needle	51	47	55

The above table indicates that the Needle chillies have the minimum maturation period of forty-seven days and the Bellary chillies have the maximum maturation period of seventy-seven days while the mean maturation period among the six types ranges from fifty one to sixty days as given in Table VIII. It was also found that the maturation period is directly correlated with the age of the plant, the coefficient of correlation (r) being 0.41 and P. E. 0.05 for all the six types of chillies examined.

Summary. 1. Chilli flowers commence opening as early as 2 a.m. and continue till 4 p.m. with the maximum rush of anthesis occurring between 3 and 6 a.m.

2. Anther dehiscence commences at least an hour after the opening of any flower but the mode of dehiscence can be noticed between three and five hours after the flowers open.

3. The activity of anthesis and anther dehiscence are directly influenced by the diurnal atmospheric conditions.

4. The time intervals of the different phases of anthesis diminish with the advancement of the age of the plant and the time of flowering.
5. Chilli flowers commence to secrete nectar by about 4 a.m.
6. Chilli flowers are both self and cross pollinated with the percentage of natural crossing working to seven under the Guntur conditions.
7. The receptivity of the stigma and the viability of the pollen in chilli plants lasts for twenty-four hours under the field conditions of Agricultural Research Station, Guntur.
8. The percentage of setting to the number of flowers produced per plant is found to be six on an average.
9. Maturation period of the chilli fruit varies from forty-seven to seventy-seven days in all the six types of chillies examined and is directly correlated with the age of the plant.

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APPENDIX

Table I.

Details of Atmospheric Temperature and Rainfall.

Particulars.	Temperature in degrees Fahrenheit.											Av. Mini.	Av. Maxi.	Rainfall.
	2	3	4	5	6	7	8	9	10	11	12			
	1931-'32.													
Novr. 30th.	76	77	78	79	80	86	87	89	90	92	94	82	93	Nil.
Decr. 31st.	75	76	77	77	78	79	81	83	85	86	88	76	88	Nil.
Jan. 31st.	62	63	65	67	68	70	72	75	76	77	78	72	79	Nil.
	1932-'33.													
Novr. 1st.	81	82	83	84	85	87	89	89	90	90	91	80	91	0.08"
Novr. 15th.	77	78	79	80	80	81	82	83	86	87	87	76	88	0.10"
Decr. 1st.	76	77	78	78	79	79	80	81	84	83	85	77	86	0.19"
Decr. 15th.	73	74	75	76	76	78	79	81	82	83	85	70	85	Nil.
Jan. 1st.	71	70	71	73	69	71	77	79	81	84	88	68	87	Nil.
Jan. 15th.	71	70	69	71	68	69	76	80	82	83	85	68	88	Nil.

Table II.
Details of Anthracis energy at fortnightly intervals.

Period.	0-1 a. m.	1-2 a. m.	2-3 a. m.	3-4 a. m.	4-5 a. m.	5-6 a. m.	6-7 a. m.	7-8 a. m.	8-9 a. m.	9-10 a. m.	10-11 a. m.	11-12 Noon.	12-4 p. m.	Total.	Variety of Chilli.
	1931-'32.														
30th Nov.	5	2	2	16	25	16	7	2	2	2			5	84	Nallapadu.
31st Dec.	4	18	25	31	15	13	2	5	1				3	117	
31st Jan.	-	8	12	11	3	2	1	1					1	39	
Total.	9	28	39	58	43	31	10	8	3	2			9	240	
	1932-'33.														
1st Nov.	1	-	6	2	1	-	2						-	12	Bellary.
15th Nov.	2	5	8	16	9	4	-						1	45	
1st Dec.	1	22	17	10	8	7	-						3	68	
15th Dec.	2	-	3	3	1	1	3	3	5	2	2		1	16	
1st Jan.	-	6	2	3	4	2	8	-	-	-	-		-	35	
15th Jan.	-	3	-	-	-	-	3	-	-	-	-		-	6	
Total.	6	36	36	34	23	13	14	3	8	2	2		5	182	
	1933-'34.														
1st Nov.	-	-	-	-	2								-	2	Nallapadu.
15th Nov.	1	6	10	22	9	6	1						-	55	
1st Dec.	3	22	19	19	8	15	2	2					1	89	
15th Dec.	1	1	3	-	2	-	-	2					1	10	
1st Jan.	2	-	-	-	-	-	-	-					-	2	
15th Jan.	-	1	-	-	-	1	-	-					-	2	
Total.	7	30	32	41	21	22	3	2	8	2			2	160	
	1934-'35.														
1st Nov.	1	2	2	4	2	1	-	1					1	14	Local.
15th Nov.	2	10	16	10	5	-	-	-					2	45	
1st Dec.	3	26	15	14	7	7	1	7	2	1			1	74	
15th Dec.	2	8	7	2	3	1	1	7	2	4	3		2	35	
1st Jan.	1	3	-	-	3	2	1	2	4	3			-	19	
15th Jan.	-	7	1	2	2	1	-	-					-	13	
Total.	9	55	41	32	22	12	2	10	6	4			6	200	

Table II. (Contd.)
Details of Anthesis energy at fortnightly intervals.

Period.	0-1 1-2 2-3 3-4 4-5 5-6 6-7 7-8 8-9 9-10 10-11 11-12 12-4														Total.	Variety of Chilli.					
	a. m. a. m. a. m. a. m. a. m. a. m. a. m. a. m. a. m. a. m. a. m. p. m.																				
1st Nov.	2	4	9	8	6	1	-	-	-	-	-	-	-	-	-	-	-	2	32	Yellow.	
15th Nov.	1	-	5	11	3	8	1	-	-	-	-	-	-	-	-	-	-	3	32		
1st Dec.	4	1	13	21	17	5	-	-	-	-	-	-	-	-	-	-	-	4	65		
15th Dec.	-	3	3	7	11	14	6	8	3	-	-	-	-	-	-	-	-	-	55		
1st Jan.	3	3	3	12	12	6	-	5	1	-	-	-	-	-	-	-	-	2	47		
15th Jan.	-	6	4	6	10	5	-	1	-	-	-	-	-	-	-	-	-	-	32		
Total.	10	17	37	65	59	39	7	14	4	-	-	-	-	-	-	-	-	11	263		
1st Nov.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Black.
15th Nov.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	
1st Dec.	1	4	12	10	5	5	-	-	-	1	1	-	-	-	-	-	-	1	41		
15th Dec.	-	1	-	12	13	2	-	7	3	2	2	1	-	-	-	-	-	1	44		
1st Jan.	-	-	-	-	2	2	-	3	-	1	-	-	-	-	-	-	-	-	6		
15th Jan.	1	2	1	1	4	5	2	4	-	-	-	-	-	-	-	-	-	-	20		
Total.	2	7	13	23	24	12	2	14	3	6	4	1	-	-	-	-	-	2	113		
1st Nov.	2	1	5	10	5	6	-	4	-	-	-	-	-	-	-	-	-	5	38	Needle.	
15th Nov.	8	2	2	6	21	7	5	1	-	1	-	-	-	-	-	-	-	2	55		
1st Dec.	1	1	-	4	8	14	-	-	-	2	1	2	-	-	-	-	-	6	39		
15th Dec.	3	-	2	5	9	2	2	8	3	3	1	1	-	-	-	-	-	4	43		
1st Jan.	1	8	7	9	13	19	5	3	2	1	1	-	-	-	-	-	-	3	72		
15th Jan.	-	11	8	6	4	5	-	-	-	1	-	-	-	-	-	-	-	-	35		
Total.	15	23	24	40	60	53	12	16	5	8	3	3	-	-	-	-	-	20	282		

Table III.

Details of Anther dehiscence.

Particulars,	6-7 a. m.	7-8 a. m.	8-9 a. m.	9-10 a. m.	10-11 a. m.	11-12 Noon	Imma- ture.	Total	Type of Chilli.
1931-32									
30th Nov.	22	33	22	2	2	...	3	84	Nallapadu
31st Dec.	24	35	34	16	3	...	5	117	
31st Jan.	10	9	7	1	1	...	1	39	
Total.	56	87	63	19	6	...	9	240	
1932-33									
1st Nov.	...	10	1	2	13	Bellary.
15th Nov.	20	7	12	2	...	...	1	42
1st Dec.	26	24	12	...	2	...	6	70	
15th Dec.	...	...	6	5	3	...	3	17
1st Jan.	1	8	2	3	14	6	...	44	
15th Jan.	...	1	4	1	...	...	...	6
Total.	47	50	37	11	19	6	12	182	
1st Nov.	...	1	...	1	2	Nallapadu.
15th Nov.	6	13	19	16	...	...	3	57
1st Dec.	26	20	24	9	3	2	4	88	
15th Dec.	...	1	3	2	1	...	2	9	
1st Jan.	...	...	...	...	...	...	...	...
15th Jan.	...	...	...	3	...	...	1	4
Total.	32	35	46	31	4	2	10	160	
1st Nov.	...	8	3	1	12	Local.
15th Nov.	17	9	11	4	...	...	2	43
1st Dec.	18	27	14	7	6	...	7	79	
15th Dec.	1	5	16	8	1	...	1	32	
1st Jan.	...	...	5	6	5	2	4	22
15th Jan.	...	4	7	...	...	1	...	12
Total.	36	53	56	26	12	3	14	200	
1st Nov.	6	20	2	28	Yellow.
15th Nov.	7	14	15	1	1	...	9	47	
1st Dec.	12	26	19	7	10	...	5	79	
15th Dec.	...	13	10	9	11	...	6	49	
1st Jan.	6	8	8	8	...	1	1	32	
15th Jan.	3	8	10	5	...	1	1	28	
Total.	34	89	64	30	22	2	22	263	
1st Nov.	Black.
15th Nov.	...	...	...	...	...	...	...	...
1st Dec.	...	28	17	17	...	6	3	71	
15th Dec.	...	...	5	...	7	1	1	14
1st Jan.	...	...	1	...	2	2	1	6
15th Jan.	...	...	7	9	3	2	1	22
Total.	...	28	30	26	12	11	6	113	
1st Nov.	...	4	8	1	11	4	1	32	Needle.
15th Nov.	1	15	29	16	14	9	15	99	
1st Dec.	...	1	25	18	7	6	19	67	
15th Dec.	...	...	...	2	4	8	3	17
1st Jan.	...	1	...	4	15	14	2	36	
15th Jan.	...	3	3	...	10	12	1	29	
Total.	1	24	65	44	61	53	32	280	

Table IV.

Details of the different phases of anthesis in the six types of Chillies.

Particulars.	Actual time.						Day of opening.
	Bellary.	Nalla-padu.	Local.	Yellow.	Black.	Needle.	
1. Commencement of corolla opening.	2-00 a.m.	3-00 a.m.	4-00 a.m.	2-00 a.m.	5-00 a.m.	4-00 a.m.	1st day.
2. Separation of corolla lobes.	5-00 a.m.	6-00 a.m.	6-30 a.m.	5-15 a.m.	6-30 a.m.	6-30 a.m.	do.
3. Secretion of Nectar.	5-00 a.m.	5-30 a.m.	5-30 a.m.	4-30 a.m.	6-00 a.m.	6-30 a.m.	do.
4. Recurving of corolla lobes.	8-00 a.m.	7-30 a.m.	8-00 a.m.	7-30 a.m.	7-00 a.m.	9-30 a.m.	do.
5. Commencement of anther dehiscence.	7-15 a.m.	9-15 a.m.	8-15 a.m.	7-10 a.m.	9-00 a.m.	10-30 a.m.	do.
6. Do. in all the anthers.	8-50 a.m.	9-45 a.m.	8-50 a.m.	8-15 a.m.	9-30 a.m.	11-30 a.m.	do.
7. Completion of dehiscence.	10-00 a.m.	11-00 a.m.	10-00 a.m.	11-00 a.m.	11-30 a.m.	12-00 Noon.	do.
8. Folding of corolla lobes.	4-45 p.m.	5-00 p.m.	5-00 p.m.	5-00 p.m.	8-00 p.m.	7-30 p.m.	do.
9. Opening of corolla.	5-00 a.m.	6-00 a.m.	6-00 a.m.	7-00 a.m.	7-00 a.m.	8-00 a.m.	2nd day.
10. Final shedding of corolla.	4-00 p.m.	5-00 p.m.	5-30 p.m.	6-00 p.m.	4-00 p.m.	6-30 p.m.	do.
11. Shedding of corolla.	Night.	Night.	Night.	Night.	Night.	Night.	
12. Drying of style and stigma.	3-00 p.m.	4-00 p.m.	12-00 Noon.	4-00 p.m.	12-00 Noon.	10-00 a.m.	3rd day.
13. Shedding of style and stigma.	10-00 a.m.	7-00 a.m.	6-00 a.m.	5-00 a.m.	4-00 a.m.	9-00 a.m.	4th day.

Table V.
Details of the Time Intervals of the Different Phases of Anthesis.

Particulars.	Date.	Time of opening of flowers.											
		2-0 A. M.		3-0 A. M.		4-0 A. M.		5-0 A. M.					
		Actual	Interval	Actual	Interval	Actual	Interval	Actual	Interval				
1. Commencement of corolla opening	29/10	H. M. 5-00 A.M.	H. M. 3-00	H. M. 5-15 A.M.	H. M. 2-15	H. M. 5-30 A.M.	H. M. 1-30	H. M. 6-15 A.M.	H. M. 1-15	H. M. 6-00 A.M.	H. M. 1-15	H. M. 6-00 A.M.	H. M. 1-15
2. Secretion of Nectar	"	5-00 "	3-00	5-30 "	2-30	5-30 "	1-30	5-30 "	0-30	5-30 "	0-30	5-30 "	0-30
3. Separation of corolla lobes	"	7-15 "	5-15	7-30 "	4-30	7-30 "	3-30	7-30 "	2-30	7-30 "	2-30	7-30 "	2-30
4. Recurving of corolla lobes	"	8-00 "	6-00	8-00 "	5-00	8-15 "	4-15	8-20 "	3-20	8-20 "	3-20	8-20 "	3-20
5. Commencement of anther dehiscence	"	7-15 "	5-15	7-15 "	4-15	7-15 "	3-15	8-00 "	3-00	8-00 "	3-00	8-00 "	3-00
6. do, in all anthers	"	8-50 "	6-50	9-00 "	6-00	9-15 "	5-15	10-00 "	5-00	10-00 "	5-00	10-00 "	5-00
7. Completion of anther dehiscence	"	10-00 "	8-00	11-30 "	8-30	11-00 "	7-00	11-30 "	7-30	11-30 "	7-30	11-30 "	7-30
8. Folding of corolla lobes	"	4-45 P.M.	14-45	4-45 P.M.	14-00	5-00 P.M.	13-00	5-00 P.M.	12-00	5-00 P.M.	12-00	5-00 P.M.	12-00
9. Opening of corolla lobes	30/10	5-00 A.M.	27-00	6-00 A.M.	27-00	6-00 A.M.	26-00	6-00 A.M.	25-00	6-00 A.M.	25-00	6-00 A.M.	25-00
10. Final folding of corolla lobes	"	4-00 P.M.	38-00	4-00 P.M.	37-00	4-00 P.M.	36-00	4-00 P.M.	36-00	4-00 P.M.	36-00	4-00 P.M.	36-00
11. Shedding of corolla	"	Night	...	Night	...	Night	...	Night	...	Night	...	Night	...
12. Drying of style and stigma	31/10	3-00 P.M.	61-00	4-00 P.M.	61-00	5-00 P.M.	61-00	5-00 P.M.	60-00	5-00 P.M.	60-00	5-00 P.M.	60-00
13. Shedding of style and stigma	1/11	10 A.M.	80-00	2-00 A.M.	71-00	2-00 A.M.	70-00	2-00 A.M.	69-00	2-00 A.M.	69-00	2-00 A.M.	69-00

Table VI.
Details of the percentage of natural crossing.

Month.	1931-'32.			1932-'33.		
	No. of buds emasculated.	No. of buds set.	% of Natural crossing.	No. of buds emasculated.	No. of buds set.	% of Natural crossing.
Oct.	50	3	6	50	4	8
Nov.	50	4	8	50	3	6
Dec.	50	4	8	50	5	10
Jan.	50	4	8	50	3	6
Feb.	50	3	6	50	3	6
Average.			7.2			7.2

Table VII
Details of flower and fruit production.

Weeks.	No. flowers produced per plant.		No. of chillies collected per plant.	
	Bellary	Nallapadu	Bellary.	Nallapodu.
16-10-32	1	7		
22-10-32	11	17		
30-10-32	22	50		
6-11-32	23	54		
13-11-32	67	50		
20-11-32	86	54		
27-11-32	72	47		
4-12-32	81	81		
11-12-32	68	30		
18-12-32	25	48		
25-12-32	32	42	...	1
1-1-33	7	46	2	6
8-1-33	...	37	2	2
15-1-33	...	14	...	4
22-1-33	...	9	3	1
29-1-33	...	5	3	2
5-2-33	...	3	10	7
12-2-33	...	...	12	7
19-2-33	...	...	...	4
26-2-33	...	...	2	1
Total,	405	574	34	35
% of setting	6.9	5.9		

Table VIII.
Statistical details of maturation period.

Particulars	No. of Determinations.	Mean	Standard Deviation. σ	Coefficient of variation.
Bellary	64	59	± 5.98	9.34
Nallapadu	33	57	± 3.70	11.21
Local	35	56	± 3.22	8.90
Yellow	25	60	± 5.94	23.80
Black	37	57	± 4.95	35.36
Needle	60	51	± 3.05	15.25