Agri. Res. J. Kerala, 1979, 17 (2) 200—203

ANTHESIS IN INDIAN LEMONGRASS *CYMBOPOGON FLEXUOSUS*, STAPF

S. T, MERCY, V. GOPINATHAN NAIR and LUCKINS C. BABU

College of Agriculture, Vellayani, Kerafa

Indian lemongrass, the chief source of lemongrass oil, is cultivated extensively in Kerala. The oil is a valuable ingredient of perfumes and cosmetics in addition to being a source of vitamin A. Research on varietal improvement of this species is being conducted at the Lemongrass Research Station, Odakklai. The present study was undertaken with a view to providing additional information on the mechanism of anthesis of this important grass,

Materials and Methods.

Detailed observations were made on the onset, spread and peak period of anthesis in inflorescences of lemongrass var. 0. D.19. As the number of spikelets in art inflorescence is too large, a spike consisting of 5 to 11 spikelets, was taken as a unit in making these observations. The spikes coming 10 anthesis on the first day on each inflorescence are counted and clipped off. Similarly spikes in anthesis on subsequent days are also counted and clipped off. This process is continued till anthesis is completed in all spikes. The time of opening and closing of the spikelet, the various stages of anthesis in individual spikelets and the sequence in which the different parts of a spikelet open, have also been studied.

Results and Discussion

Lemongrass being a short day plant, flowers during December—January. The inflorescence is a highly branched terminal panicle bearing paired spikes on tertiary branches. The spikes bear spikelets in pairs of which one is sessile and the other pedicellate. However, at the tip of the spike, the spikelets are in groups of three, of which the central one is sessile and the laterals are pedicellate. The sessile spikelet is owned with four glumes and a bisexual floret whereas the pedicellate one is ownless with three glumes and a stamin ate floret.

Terminal inflorescence of 8 plants selected at random were continuously observed from begining to completion of anthesis. Opening of spikelets begin at the base of a primary branch in the middle of the panicle. On subsequent days anthesis moves both towards the upper and lower regions of the inflorscence. In sugarcane and Sorghum anthesis starts at the tip of the inflorscence and proceeds downwards (Poehlman and Borthakur, 1969). Within a spike, the

Table 1 Distribution of anthesis in lemongrass panicles (Number of spikes in anthesis on different days)

Days of Anthesis	Panicles								Total	Percentage
	1	2	3	4	5	6	7	8		
1	8	5	6	7	5	4	14	22	71	0.224
2	23	31	33	23	35	30	28	56	259	0.818
3	35	59	104	44	95	74	120	158	689	2.177
4	41	90	157	210	165	151	166	182	1162	3.671
5	52	266	41	171	294	151	248	336	1559	4.925
6	97	253	287	194	100	311	350	340	1932	6.103
7	262	220	7	32	461	141	456	516	2095	6.618
8	131	259	290	256	450	514	632	568	3100	9.793
9	185	373	Z03	290	363	390	666	630	2806	8.865
10	24	350	12	60	514	287	558	570	2375	7.503
11	216	305	371	299	194	419	43i	496	2738	8.650
12	196	184	63	137	223	188	420	314	1730	5.465
13	114	173	186	190	108	256	362	260	1649	5.209
14	134	120	123	165	137	197	312	232	1420	4.486
15	102	173	126	198	110	146	280	168	1303	4.116
16	97	127	98	150	60	130	260	140	3062	3.355
17	65	106	51	120	50	121	242	104	860	2.717
18	67	81	52	154	20	51	202	80	707	2.234
19	60	92	42	87	22	54	182	88	627	1.981
20	27	108	26	76	34	32	166	64	533	1.684
21	20	577	37	80	16	33	142	56	461	1.456
22	13	51	49	89	15	30	102	46	395	1.248
23	9	63	30	70	12	20	68	50	322	1.017
24	6	158	56	38	11	12	48	42	371	1.172
25	5	98	63	35	3	9	46	28	287	0.907
26	4	S8	132	43	—	8	38	24	337	1.065
27	S	82	27	49	—	2	22	—	190	0.600
28	2	83	15	42	—	—	14	—	156	0.493
29	—	34	31	53	—	—	—	—	118	0.373
30	—	73	19	50	—	—	—	—	142	0.449
31	—	46	57	9	—	—	—	—	112	0.354
32	—	30	56	—	—	—	—	—	86	0.272
Total	2004	3958	2855	3421	3503	3761	6582	5570	31654	100.000

sequence is from base to apex. The sessile spikelets open earlier than the pedicellate ones. The data on the distribution of anthesis (the number of spikes in anthesis on different days) in the 8 panicles are tabulated and presented in Table.

A panicle takes 25 to 32 days for completion of anthesis. In sugarcane the duration of anthesis is shorter and the time taken for the opening of all the spikelets in an arrow is 7 to 14 days (Dillewijin, 1952). In Sorghum the period is only 6 to 9 days (Stephens and Quinby, 1934). The peak period of anthesis is from 6th day the commencement of anthesis to 11th day during which period about 50% of spikes complete anthesis. About 80% of spikes complete anthesis by the 15th day. The spikelets start opening as early as 7'O Clock in the morning and the process continues to about 8.30 A.M. This is a little later than the time of anthesis in sugarcane, where the spikelets open early in the morning, usually between 5 and 6 A.M. (Dillewijin, 1952).

In a typical sessile spikelet the process of anthesis involves 4 distinct stages. It begins with the sudden separation of the glumes, glume 1 and glume 3 towards one side and glume 2 and glume 4 towards the other. This separation is brought about by the hygroscopic swelling of the 2 lodicules. The three anthers within the glumes become visible in the centre of the spikelet with the 2 stigmatic lobes crowning the top (Fig. 1). In the second stage the two dark purple stigmas emerge and spread laterally downwards. The stigmatic lobes hang down at an angle of about 60° (Fig. 2). The filaments then gradually elongate resulting in the leteral spreading of the three anthers. Th& anthers then dehisce longitudinally releasing the pollen grains which are small smooth and spherical. Soon the stamens lose their erect nature and hang down over the sides of the spikelet (Fig. 3). The last stage is the closing of the spikelet by slow but steady movements of the glumes. When the spikelet is fully closed the shrivelled stamens hang downwards while the 2 stigmatic lobes are pushed upwards (Fig. 4). The four stages occurring one after the other in quick succession in a spikelet take about 30 to 40 minutes for completion.

In a pedicellate spikelet, anthesis appears later than its appearance in the sessile spikelets of the same spike, Anthesis takes only a shorter period (20 to 30 minutes) in the pedicellate spikelets and the different stages are very similar to these of the sessile spikelets except that the second stage is totally absent.

The most characteristic feature of anthesis is the slight protogynous nature of the sessile spikelets. This is a basic adaptation for cross-pollination. The emergence of stigmas before dehiscence of anthers was reported lo be an adaptation for cross pollination in Sorghum by Rao and Rachie (1965). But the highly branched nature of the lemongrass panicle, the large number of spikelets oppening on the same day and the short period of anthesis, indicate the possibility for self pollination under field conditions, inspite of the slight protogynous nature of the sessile spikelets.

FIG. I

FIG. II

FIG. III

FIG. IV

STAGES OF ANTHESIS—

Plate XXXIII

Summary

Studies were undertaken on the mechanism of anthesis in Indian lemongrass. An inflorescence takes 25 to 32 days for completion of anthesis. The peak period of anthesis is from the 6th day from commencement of anthesis to the 11th day. About 80% of spikes complete anthesis by the 15th day. Anthesis takes place in the morning between 7 and 8.30. In the sessile spikelets anthesis appears earlier than its appearance in the pedicellate ones. There are four distinct stages in the anthesis of sessile spikelet which take place one after the other in quick succession. The most characteristic featrue of anthesis is the slight protogynous nature of the sessile spikelet. Though this is a basic adaptation for cross pollination, the large number of spikelets opening in a short span of time indicate the possibility for self pollination under field conditions.

സംഗ്രഹം

ഇഞ്ചിപ്പുല്ലിന്റെ പുല്ലനരീതി മനസ്സിലാക്കാൻ വേണ്ടിയുള്ള വിശദമായ പഠനങ്ങൾ നടത്തപ്പെട്ടു. ഒരു പൂങ്കുലയിൽ പുല്ലനം പൂർത്തിയാകാൻ 25—32 ദിവസം വേണ്ടിവരുമെന്നു് കണ്ടു. പുല്ലനത്തിന്റെ അത്യന്തദശ rai^ooffieiwrai മുതൽ 11-ാമത്തെ ദിവസം വരെയായിരിക്കും. 15 ദിവസങ്ങൾക്കുള്ളിൽ 80% സ്പൈക്കികളിലും പുല്ലനം നടന്നുകഴിഞ്ഞിരിക്കും. രാവിലെ 7—നും 8.30-നും ഇടയ്ക്കാണു് പുല്ലനം നടക്കുന്നതു്. അവൃന്തീയ സ്പൈക്കികളിൽ വൃന്തീയ സ്പൈക്കികളേക്കാൾ മുൻപേ പുല്ലനം തുടങ്ങുമെന്നു കണ്ടു. അവൃന്തീയ സ്പൈക്കികത്തിലെ പുല്ലനത്തിനു ദ്രുതഗതിയിൽ പിന്നിടുന്ന നാലു വ്യത്യസ്തദശകൾ ഉണ്ടു്. പുല്ലനത്തിലെ സവിശേഷമായ വസ്തുത അവൃന്തീയ സ്പൈക്കെത്തിന്റെ സ്ത്രീപൂർവ്വക സ്വഭാവമത്രെ. ഇതു പരപരാഗണത്തിനുള്ള ഒരു അടിസ്ഥാന 'അനുശീലനം' ആണെന്നുവരികിലും ഫീൽഡു് പരിതസ്ഥിതികളിൽ കുറഞ്ഞ കാലയളവുകൊണ്ടു് ധാരാളം സ്പൈക്കികങ്ങൾ ഒരുമിച്ചു് വിടരുന്നതിനാൽ സ്വപരാഗണത്തിനുള്ള സാധ്യതയാണു് കൂടുതൽ.

Acknowledgement

The authors acknowledge Dr. Mary K. George, Professor and Head of the Department of Agricultural Botany, for the help and encouragement during the course of this investigation.

REFERENCES

Dillewijin, C. V. 1952. Botany of Sugarcane, The Chronica Botanica Co., Waltham, Mass., U. S. A. 371.

Poehlman, J. M. and Borthakur, D, 1969. Breeding Asian field crops. Oxford and I8H publishing Co., New Delhi. 241.

Rao, D. V. M. End Rachie, K. 0. 1965. Natural Crossing in Sorghum as affected by locality and season, *Indian J. Agric. Sci,* 35, 8—13.

Stephens, J. C. and Quinby, J. R, 1934. Anthesis, pollination and fertilization in Sorghum. *J, Agric. Res.* 49. 123—136.

(M. S. Received: 22-11-1978)