Botanical Studies in the Genus *Oryza*

IV. Flowering Order in a Panicle

Tadao C. KATAYAMA

(*Laboratory of Crop Science*)

Flowering of *Gramineae* species is a complex physiological phenomenon. It is determined by a number of internal and external factors, such as temperature, water content, relative humidity, light intensity and others.

Flowering order was reported in *Oryza sativa* (1), in the genus *Triticum* (2), *Triticum aestivum* L., *Secale cereale* L., *Avena sativa* L., *Panicum miliaceum* L. (4) and other species. They reported on the flowering order in the panicle and the influence of several environmental factors upon it.

Informations on the flowering order are useful for botanical studies and plant breeding. Especially in *Oryza*, the ovule has the potency to fertilize during 24 hours of the flowering day, but pollen is viable only for a few minutes. It is important to detect the number and position of available spikelet for crossing in the respective day for breeding. The present paper is the studies on the flowering order in a panicle and flowering interval of *Oryza* species, done in the hope of obtaining a useful information on the taxonomical, morphological, phylogenetical studies of the genus.

Materials and Method

Seventy-six strains belonging to 24 species of the genus *Oryza*, including 2 cultivated and 22 wild species, were used in the present investigation. Most of them were collected by the members of the National Institute of Genetics and some were obtained from foreign workers.

Enumerations of species, their distribution and chromosome numbers were given in Table 1 of the previous paper (3). Materials were grown in the green-house. When lemma and palea of each spikelet got separated from each other, the spikelet was considered to have flowered in this experiment. One to six strains of each species collected from different localities, were used. The observations were made every day during from September 5 to December 9 in 1965 and 1966. As no obvious intraspecific variation has been found, except in *O. officinalis*, one strain was selected as the representative of a species. Several strains of *O. officinalis* showed a great variation in the flowering behaviour. Therefore, two strains were used in the present study. As *O. subulata* showed peculiar flowering behaviour, two strains were used. In this

species, flowering occurred in the first panicle at first and followed by 1/P1 and 1/P2 (according to the standard formula showing plastochrone age), the flowering system was very different from that of other species. In this paper, the first panicle was called *O. subulata*-II, and all of the panicles was called *O. subulata*-I.

Results and Discussion

Flowering behaviour of each species is shown in Tables 1 to 28. In these tables, relation between code number of first rachis and days after flowering start of the respective panicle was enumerated. Flowering processes of ten species are illustrated in Figs. 1 to 3, in which accumulative percentage of spikelets flowered in successive days is shown. The accumulative percentage of spikelets flowered on the respective first rachis of 14 strains belonging 13 species is shown in Figs. 4 and 5. Correlation coefficients and linear regressions of first rachis on the flowering day are shown in Table 29. Flowering processes in each rachis and rachilla of all species used are schematically shown in Figs. 6 to 33. A numeral in Figs. 6 to 33 shows date after flowering start, corresponding dates shown in Tables 1 to 28.

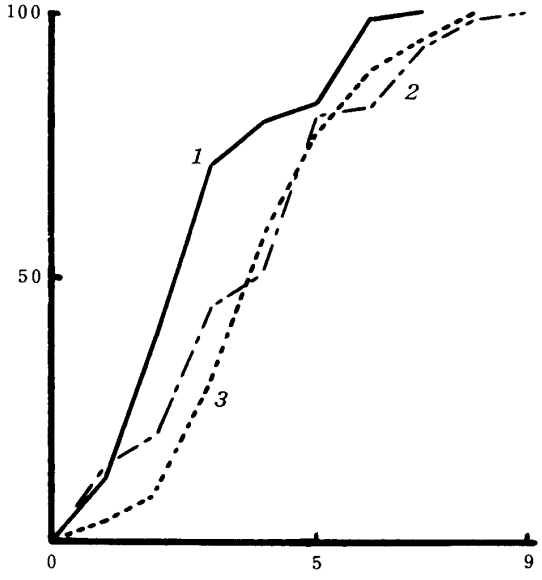


Fig. 1.

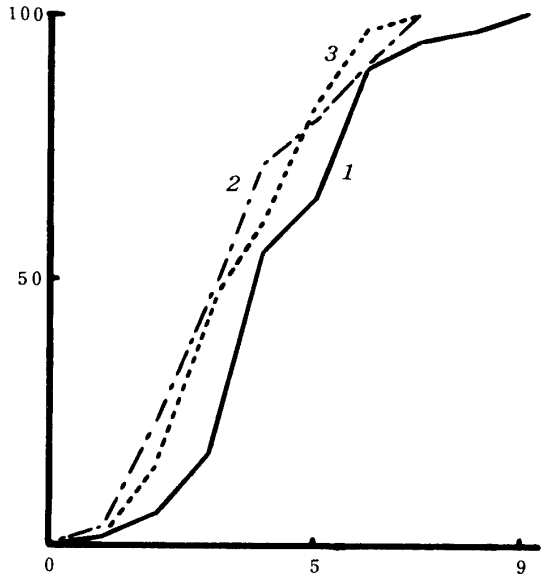


Fig. 2.

Fig. 1. Flowering processes in *O. sativa (1), O. sativa* var. *spontanea (2), O. perennis (3).* Vertical axis; accumulative flowering percentage to the total spikelets. Abscissa; days after flowering start.

Fig. 2. Flowering processes in *O. glaberrima (1), O. stapfii (2), O. breviligulata (3).* Vertical axis; accumulative flowering percentage to the total spikelets. Abscissa; days after flowering start.

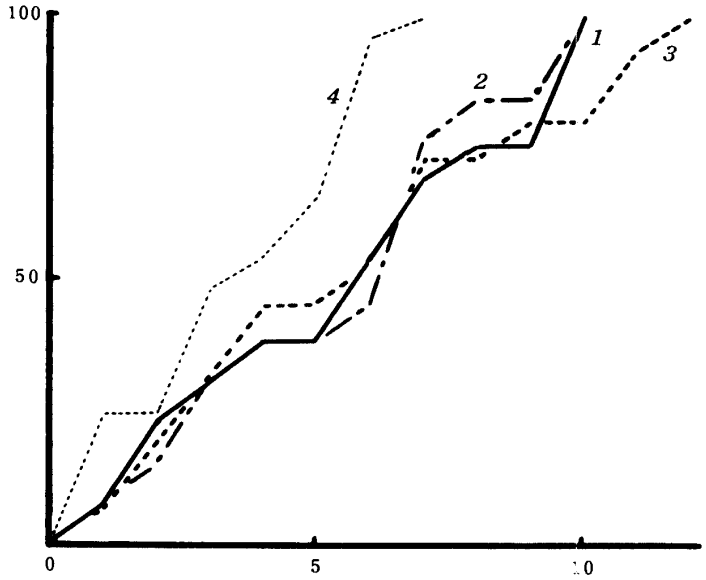


Fig. 3. Flowering processes in *O. meyeriana* subsp. *granulata* (*1*), *O. meyeriana* subsp. *meyeriana* (*2*), *O. meyeriana* subsp. *abromeitiana* (*3*), *O. subulata*-II (*4*). Vertical axis; accumulative flowering percentage to the total spikelets. Abscissa; days after flowering start.

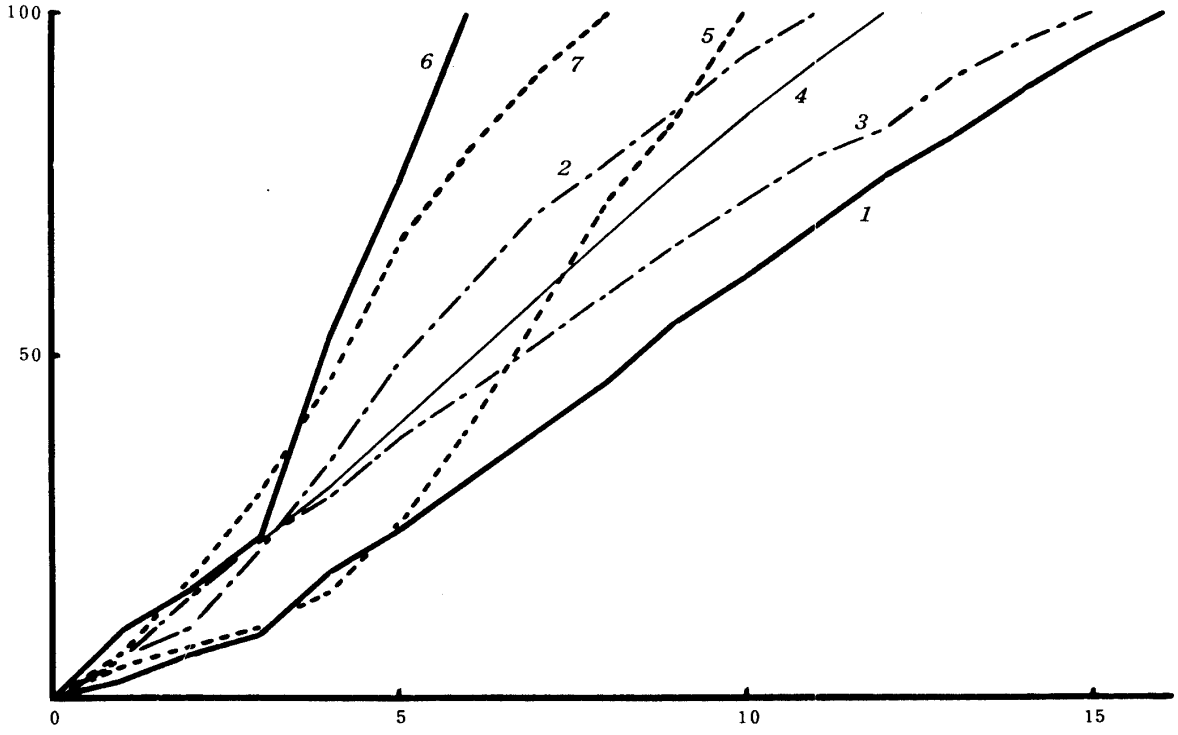


Fig. 4. Relation between accumulative number of spikelets and corresponding first rachis. Abscissa; code number of first rachis from the top. Vertical axis; accumulative percentage. *1*; *O. sativa*, *2*; *O. sativa* var. *spontanea*, *3*; *O. glaberrima*, *4*; *O. stapfii*, *5*; *O. officinalis*-I, *6*; *O. officinalis*-II, *7*; *O. malampuzhaensis*.

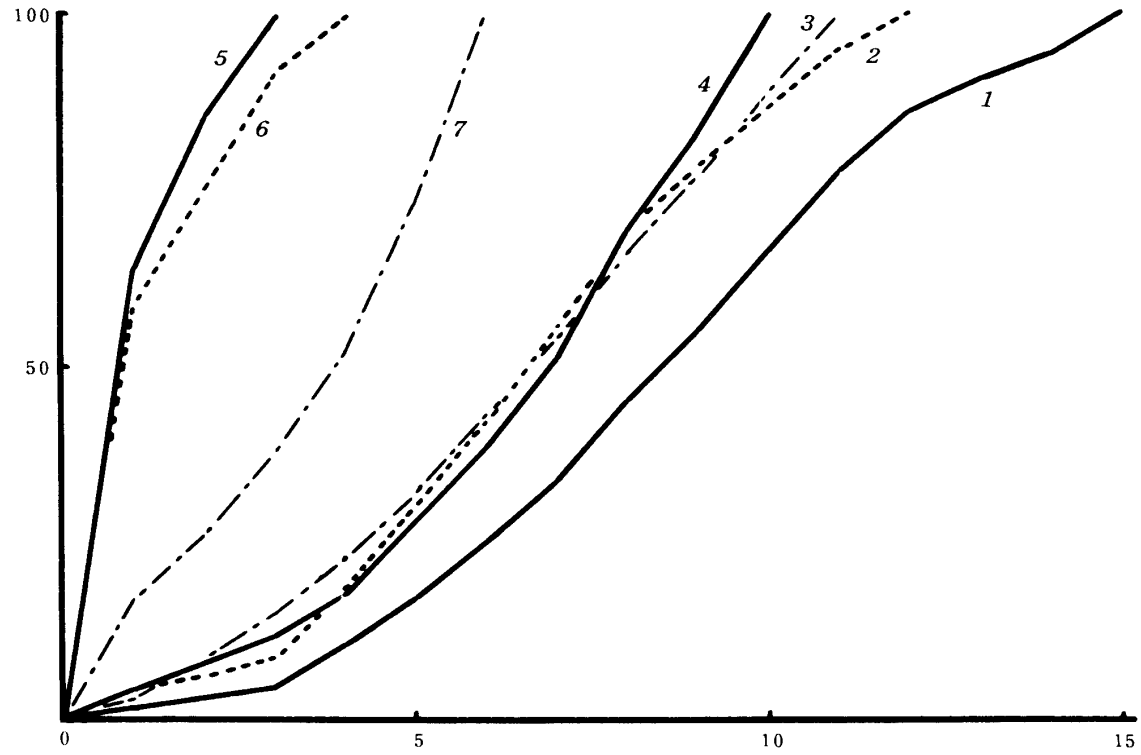
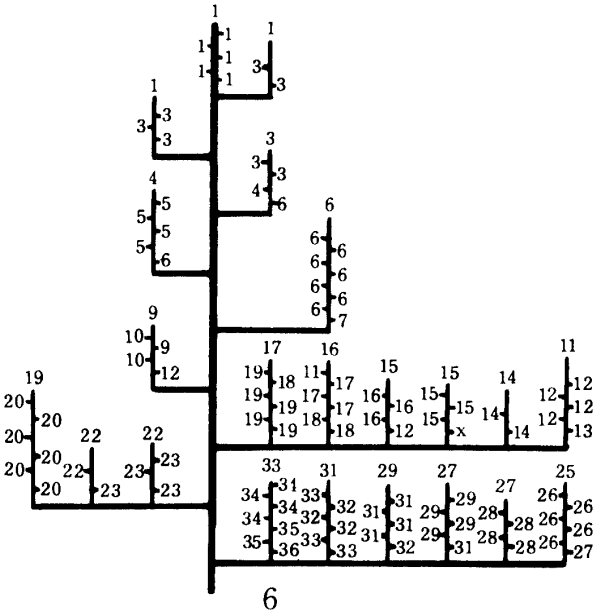


Fig. 5. Relation between accumulative number of spikelets and corresponding first rachis. Abscissa; code number of first rachis from the top. Vertical axis; accumulative percentage. *1*; *O. eichingeri*, *2*; *O. punctata*, *3*; *O. latifolia*, *4*; *O. australiensis*, *5*; *O. coarctata*, *6*; *O. brachyantha*, *7*; *O. subulata*-II.

1) Flowering order in each panicle

The flowering of spikelets in a panicle takes place in a regular sequence, that is, it is influenced very little by environmental conditions such as temperature, relative humidity and light intensity. AKEMINE (1) reported that flowering of rice starts at two to four rachises at first and proceeds to the lower rachises. However, in this experiment, in rachis level, flowering starts from the uppermost rachis of a panicle and proceeds to the lowest rachis in succession in all the species used. Correlation coefficient and linear regression of rachis position on the flowering day of individual species are shown in the Table 29. In the whole of species, correlation coefficients calculated are statistically significant at 0.1% level except two species, *i.e.*, *O. brachyantha* at 1% level and *O. coarctata* at 5% level. In linear regression, for example, flowering of rachis in *O. sativa* becomes 1.116 days later when the rachis becomes shifted by one order downward

In rachilla level, some differences in the flowering order of spikelets on a rachis position are found among several species. In 16 species, *i.e.*, *O. sativa*, *O. sativa* var. *spontanea*, *O. perennis*, *O. officinalis*, *O. minuta*, *O. malabarensis*, *O. malampuzhaensis*, *O. eichingeri*, *O. punctata*, *O. latifolia*, *O. alta*, *O. grandiglumis*, *O. australiensis*, *O. meyeriana* subsp. *granulata*, *O. meyeriana* subsp. *meyeriana*, *O. meyeriana* subsp. *abromeitiana*, *O. ridleyi* and *O. longiglumis*, the flowering occurred at first in the uppermost spikelet of a rachis, followed by the lowest one and then proceeded toward the upper spikelets in consecutive order. Consequently, the flowering of the second spikelet from the top was the latest in a rachis.



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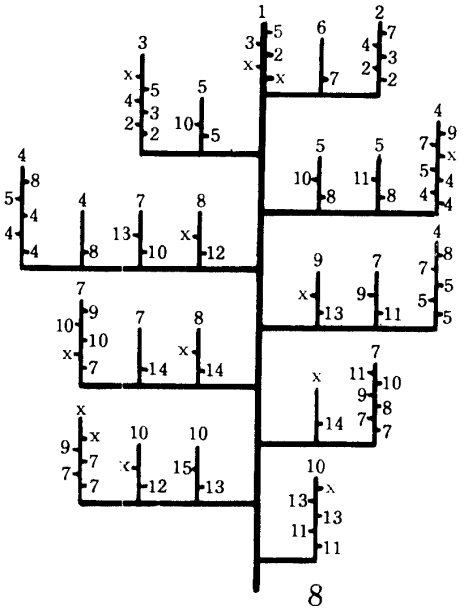

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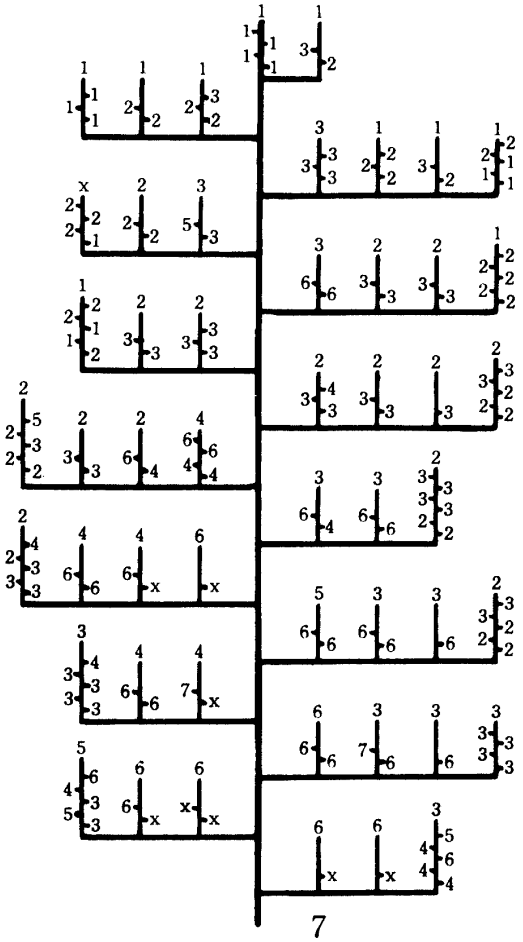

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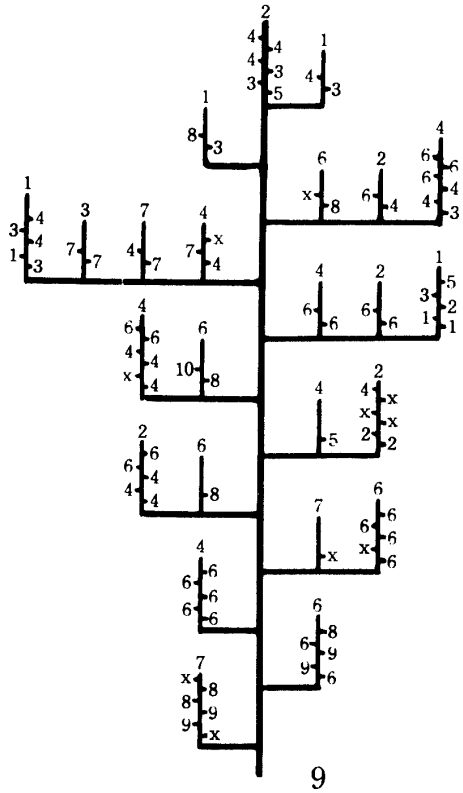

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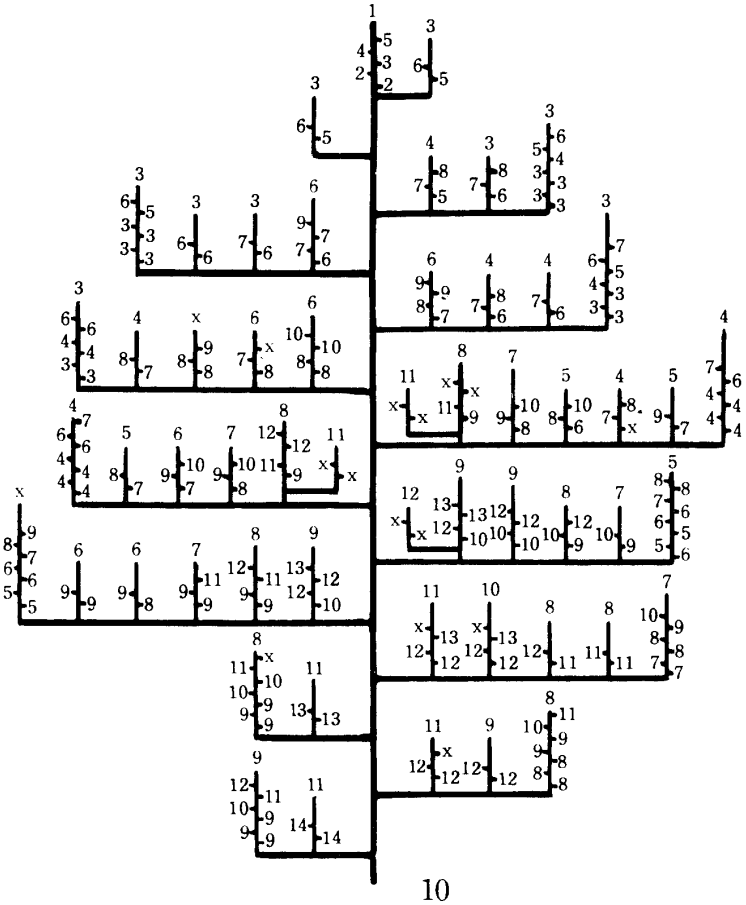

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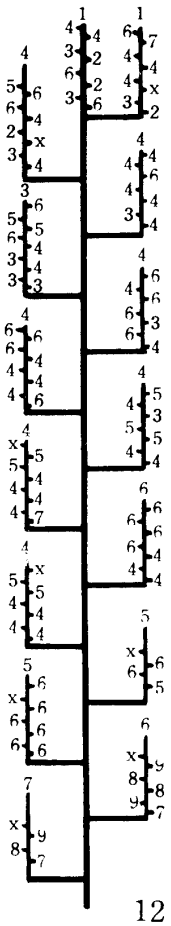

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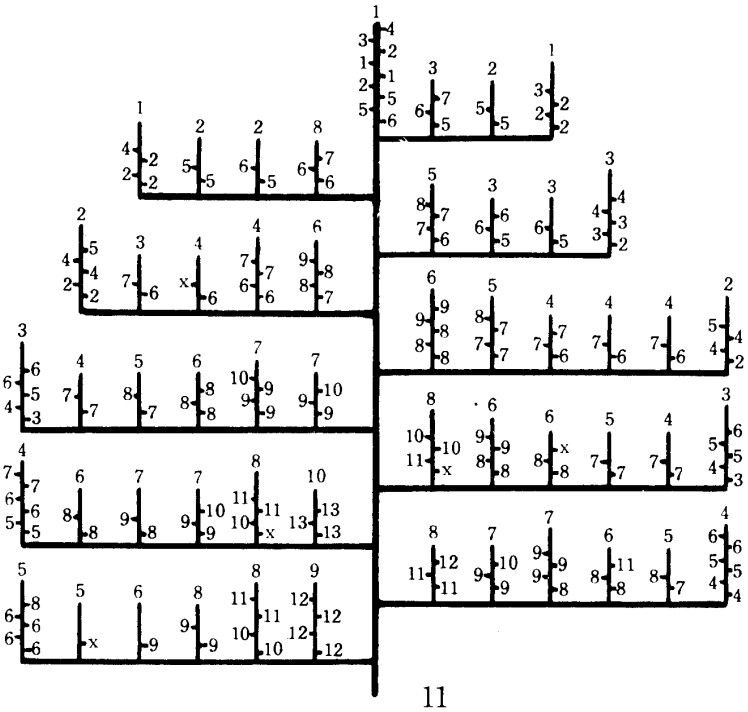

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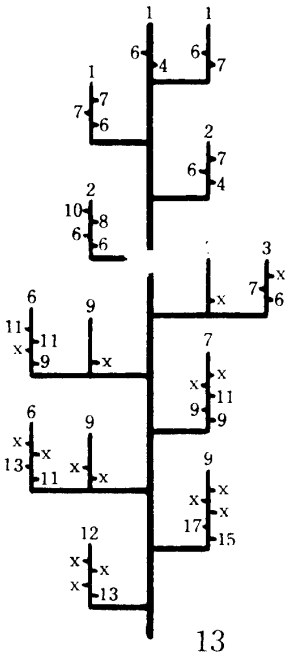

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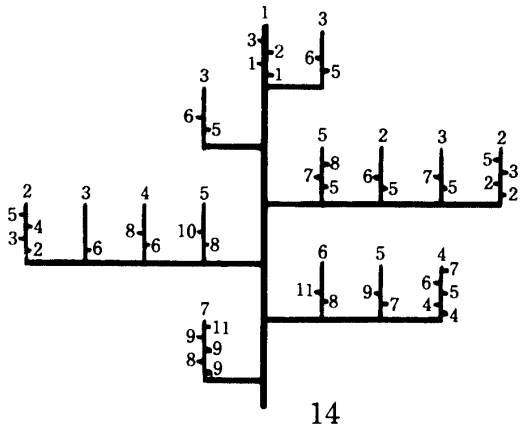

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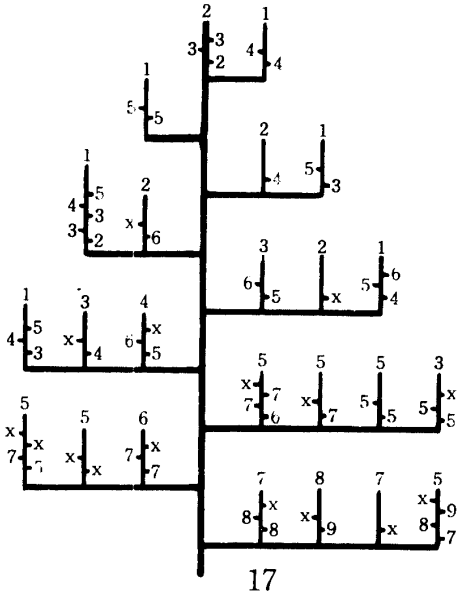

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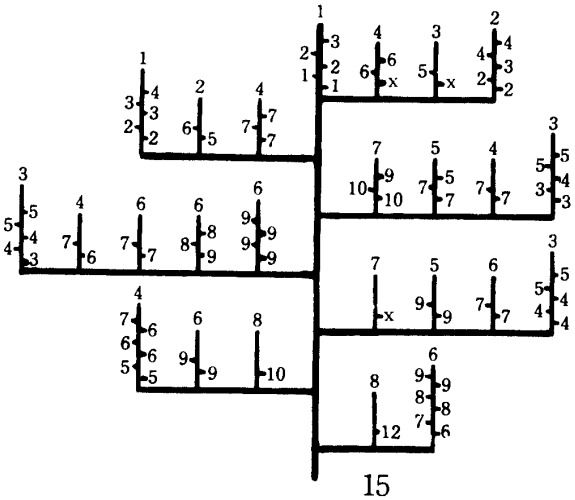

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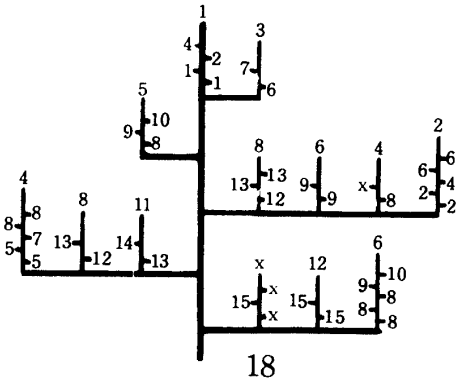

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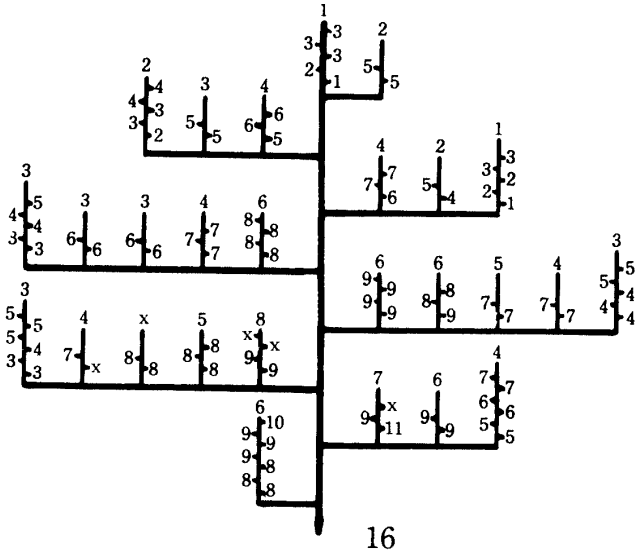

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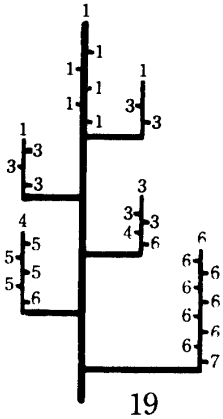

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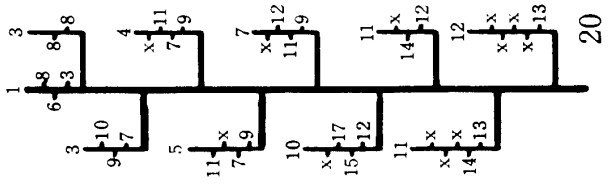
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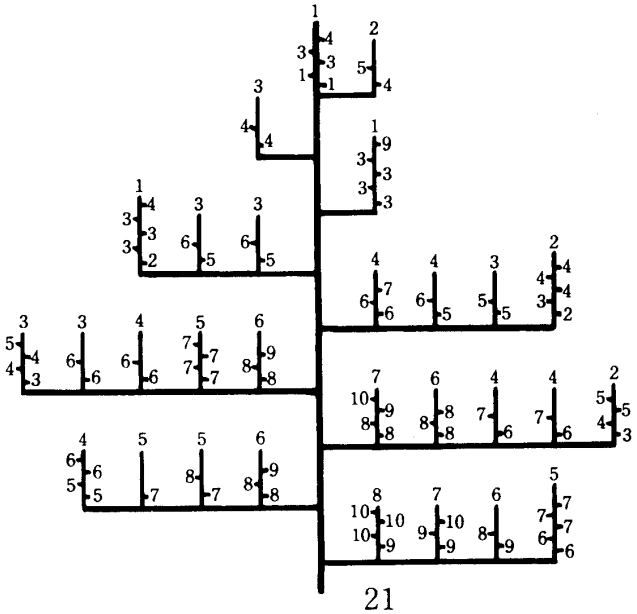
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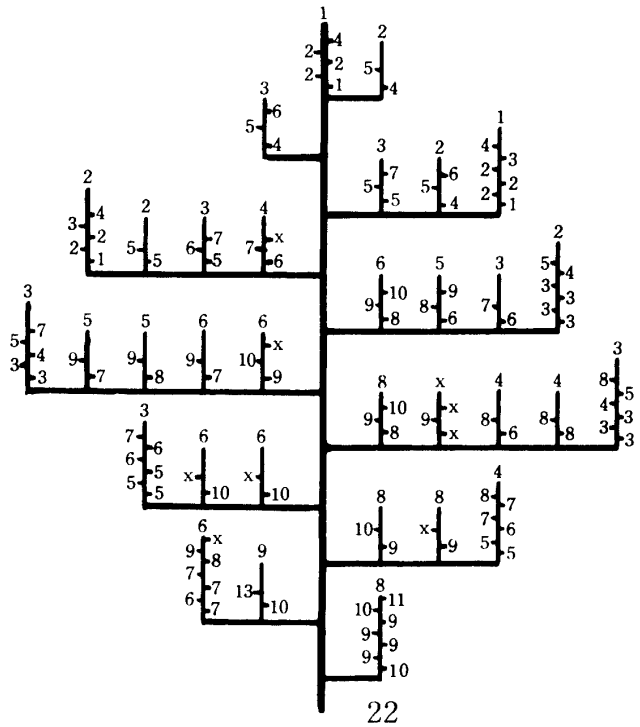
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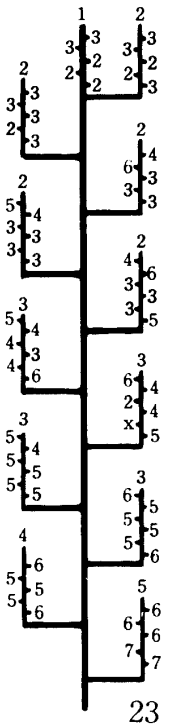
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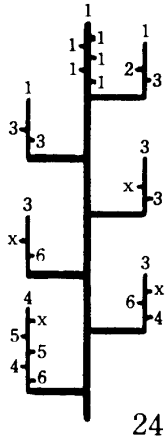
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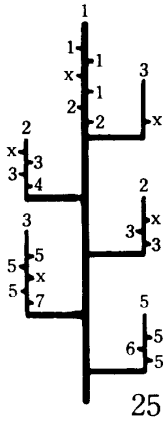
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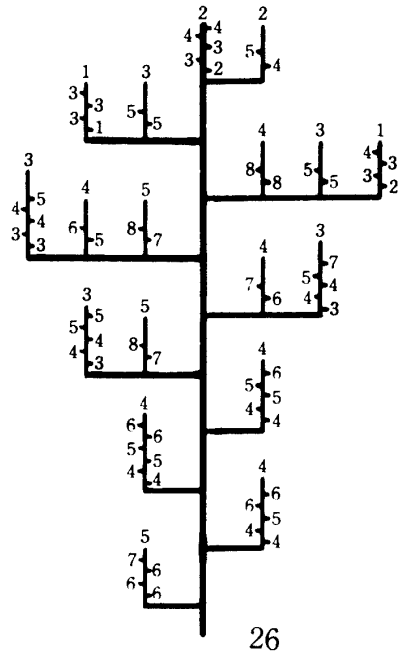
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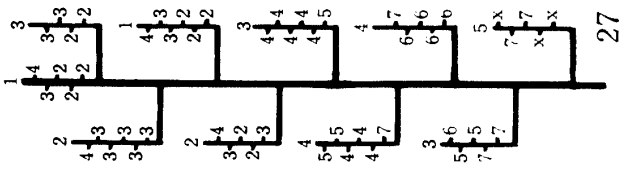
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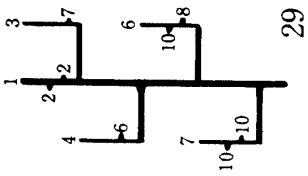
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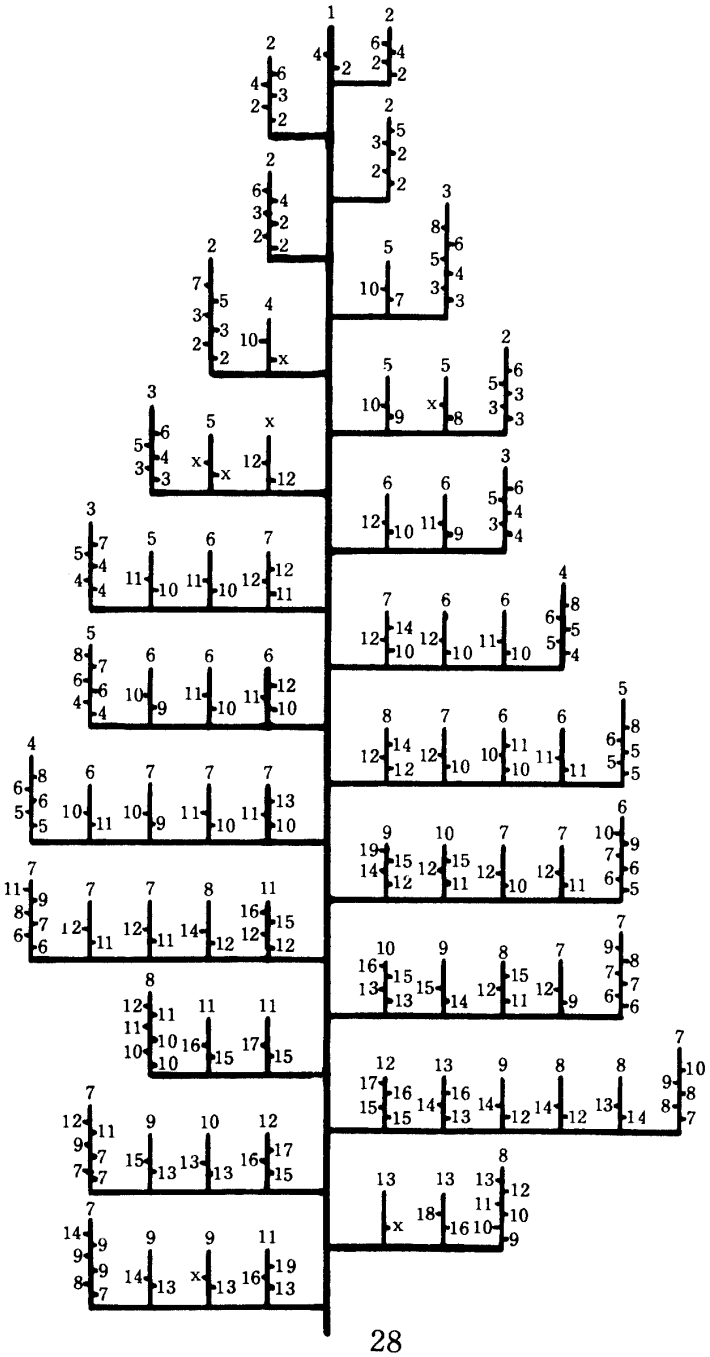
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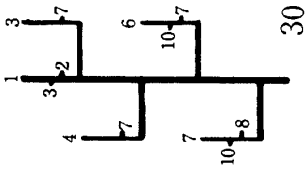
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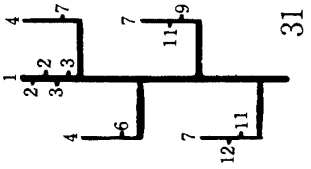
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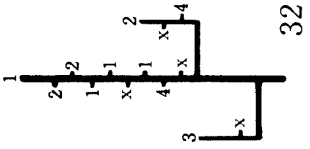
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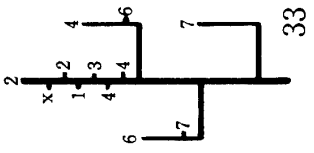
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Table 1. Flowering behaviour of *O. sativa*. The figures of the table show the number of spikelets that flowered on the respective day.

Day	Rachis number from the top																Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
1	5	1	6	6	1	1	3										23
2		1	4	6	7	7	5	7	6	3	1	4	1				52
3		1	1	5	2	5	5	7	3	6	4	4	4	7	3	1	58
4								1	4	1	3		3		1	3	16
5					1				1			1			1	2	6
6						2			3	3	4	5	2	5	4	2	30
7													1	1			2
#					1						2		1		3	2	9
Total	5	3	11	17	12	15	13	15	17	13	14	14	12	13	12	10	196

Unflowered spikelet

Table 2. Flowering behaviour of *O. sativa* var. *spontanea*. The figures of the table show the number of spikelets that flowered on the respective day.

Day	Rachis number from the top											Total
	1	2	3	4	5	6	7	8	9	10	11	
1			2	1								3
2	2	1		1								4
3	2		4	3	3	2	2					16
4	2	1	1	2	3	3	2	3	3	3		23
5		1	2	2	3	1	3	2	2	1	1	18
6					1	1		1	2	2	3	10
7					1	2	1				1	5
8				2	1		1					4
Total	6	3	9	11	12	9	9	6	7	6	5	83

In 4 species, namely, *O. glaberrima* (Fig. 12), *O. stapfii* (Fig. 23), *O. breviligulata* (Fig. 27) and *O. coarctata* (Fig. 32), the flowering occurs at first in the uppermost spikelet, followed by a spikelet slightly nearer the base than the middle of the rachis and from there proceeds both upward and downward. In other 4 species, namely, *O. brachyantha* (Fig. 33), *O. tisseranti* (Fig. 24), *O. perrieri* (Fig. 25) and *O. subulata* (Figs. 6 and 19), flowering starts at the top of a rachis, proceeding straight downward.

However, some irregularities were found. In the late-developed rachis and rachilla, in other words, in rachis or rachilla located relatively lower position, flowering order frequently deviated from the regularity mentioned above. This is due to weak development of spikelet. This irregularity was found often in panicle having relatively many spikelets.

2) Flowering interval

In the most species, in general, flowering of all spikelets occurs successively. In *O. ridleyi* (Fig. 20) and *O. longiglumis* (Fig. 13), however, an interval of several days was observed between the opening of uppermost spikelet and that of the second one in a rachis. The uppermost spikelet in each rachis and rachilla of those two species were always male sterile having degenerated anthers. This characteristic contributes to the cross-breeding tendency of those species.

In *O. subulata*-I (Fig. 6), it takes several days between the flowering of the first rachis and that of the second rachis and so on (Table 27). In general, the flowering of spikelets occurs suc-

Table 3. Flowering behaviour of *O. perennis*. The figures of the table show the number of spikelets that flowered on the respective day.

Day	Rachis number from the top													Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	
1		1	1	1	2	5		3	1					14
2	1			1	3	1								6
3	2	1	1	4	5	1	4	2	3		1			24
4	3	1				1		1						6
5	1			5		4	3		2	5	5	3		28
6										1			1	2
7				1	5		1		1			1	2	11
8			1									2	2	5
9							1							1
#				1	1			3	1	2			2	10
Total	7	3	3	13	16	12	9	9	8	8	6	6	7	107

Table 4. Flowering behaviour of *O. glaberrima*. The figures of the table show the number of spikelets that flowered on the respective day.

Day	Rachis number from the top															Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
1	1	1														2
2	2	1	2													5
3	2	1	1	1	4	1		2	1							13
4	2	3	3	6	2	3	5	3	6	3	5	2				43
5			1		2			3			2	2	1			11
6	2	1	2	1	2	4	4			5			6	1		28
7		1							1					2	2	6
8														2	1	3
9														1	1	2
#		1	1						1		1	1	1	1	1	8
Total	9	9	10	8	10	8	9	8	9	8	8	5	8	7	5	121

Table 5. Flowering behaviour of *O. stapfii*.

Day	Rachis number from the top												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
1	1												1
2	3	3	2	1	1	1							11
3	2	3	4	3	4	3	2	1	1	1			24
4				1	1	1	3	3	1		1		11
5					1	1	1	1	5	4	3	1	17
6				1		1	1	1		2	2	3	11
7												2	2
#								1					1
Total	6	6	6	6	7	7	7	7	7	7	6	6	78

Table 6. Flowering behaviour of *O. breviligulata*.

Day	Rachis number from the top										Total
	1	2	3	4	5	6	7	8	9	10	
1	1			1							2
2	3	2	1	3	3						12
3	1	3	5	2	2	1			1		15
4	1	1	1	1	1	5	4	1			15
5						1	2		2	1	6
6								4	1		5
7							1	1	2	2	6
#										3	3
Total	6	6	7	7	6	7	7	6	6	6	64

Table 7. Flowering behaviour of *O. officinalis*-I.

Day	Rachis number from the top										Total
	1	2	3	4	5	6	7	8	9	10	
1	3			1	1						5
2		1			1	2		1	1		5
3	2		1	4	5	2	3	1			18
4	1	1	2	1	1	5	3	3	1		18
5		1			2	3	2	2	4	1	15
6					2	4	5	3	3	3	20
7						1	3	3	2	4	13
8							2	5	3	2	12
9							1	1	1	4	7
10								1		4	5
Total	6	3	3	6	12	17	19	20	14	18	118

Table 8. Flowering behaviour of *O. officinalis*-II.

Day	Rachis number from the top						Total
	1	2	3	4	5	6	
1	3						3
2	1			3			4
3		1					1
4	1			2	1		4
5	1		1		2		4
6		1		3		1	5
7		1			1		2
8			1	2	3	3	9
9			1	2		1	4
10			1			1	2
11					1		1
12				1	1	1	3
13				2	2		4
14					1		1
15						3	3
#				1		3	4
Total	6	3	4	16	12	13	54

Table 9. Flowering behaviour of *O. minuta*.

Day	Rachis number from the top							Total
	1	2	3	4	5	6	7	
1	3							3
2	1			3	2			6
3	1	1	1	3	2			8
4					2	3		5
5		1	1	5	2	2		11
6		1	1	1	2	2		7
7				2		2	1	5
8				1	2	1	1	5
9						1	3	4
10					1			1
11						1	1	2
Total	5	3	3	15	13	12	6	57

Table 10. Flowering behaviour of *O. malabarensis*.

Day	Rachis number from the top									Total
	1	2	3	4	5	6	7	8	9	
1	2			2						4
2	1	1	2	3						7
3	3		3	2	5	1	3			17
4			3	2	3	4	2	1		15
5		2	3	1	1	3	4	2		16
6			2	1	4	2		3	1	13
7				2	3	4	1	3		13
8						2	6		3	11
9						5	2	3	3	13
10									1	1
11								1		1
#							4	1		5
Total	6	3	13	13	16	21	22	14	8	116

cessively in rachis, but not in rachilla. Therefore, flowering order in the rachis is clearly different from that in rachilla. Moreover, the flowering occurs successively, in general, in rachis which flowered earlier, but if anything, not successively in relatively rachis flowered later stage. Frequently, the last spikelets in each rachis flowered very late. In *O. subulata*, it is conspicuous that an interval between flowering of upper rachis and the following one was very long. According to several characters mentioned above, it is concluded that *O. subulata*-II in this paper is considered a single panicle corresponding to other species, and rachises lower than this are considered to have belonged to other panicle.

Table 11. Flowering behaviour of *O. malampuzhaensis*.

Day	Rachis number from the top								Total
	1	2	3	4	5	6	7	8	
1	3		1						4
2	2	3	3						8
3	1	2	2	3	2	1			11
4		3	2	2	3	3	1		14
5		1	1	4	2	3	2		13
6		2	1		4	1	4	2	14
7			3	5	3	3	1	1	16
8					2		1	3	6
9				1	5	2	2	2	12
10				2			1		3
11									0
12								1	1
#		2				1			3
Total	6	13	13	17	21	14	12	9	105

Table 12. Flowering behaviour of *O. eichingeri*.

Day	Rachis number from the top															Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
1	1															1
2	2															2
3	1	1	1	6	7	4	3	4								27
4	1			2		3	3	3	5							17
5	1	1	1	2	1	1		1	1	3	2					14
6		1	1	2	6	4	4	3	3	3	4					31
7				2	3	4	1	3	4	2	2	3				24
8				2		2	6	5	2	3	3	4	1	4		32
9					1	2	2	2	4	4	9	1	3	3	4	35
10							2	4	2	5	1	2	2	1	1	20
11								1	2		2	4	2	2	2	15
12										5	3	5		4	1	18
13										2	1	2	2			7
14															2	2
#							2	4	3	2	1	2	1	1		16
Total	6	3	3	16	18	20	23	30	26	29	28	23	11	15	10	261

Table 13. Flowering behaviour of *O. punctata*.

Day	Rachis number from the top												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
1	2			2	1								5
2	3	1		4	4	1							13
3			1	2	2	5	3	4	1				18
4	1	1	1	2	2	1	1	3		1			13
5		1	1	3	3	2	3	1	3	2			19
6			1	1	2	3	2	1	4	1	2		17
7				1	2	1	3		1	2	3		13
8						2	1	6		3	1	1	14
9						2	4	2		2	2	4	16
10						1	1	1	2	1	1	2	9
11												1	1
12													0
13											1		1
#					1		1	3	2	1	1		9
Total	6	3	4	15	17	18	19	21	13	13	11	8	148

Table 14. Flowering behaviour of *O. latifolia*.

Day	Rachis number from the top											Total
	1	2	3	4	5	6	7	8	9	10	11	
1	3	1	1	1								6
2	2	4	5	2	3	2						18
3	1	2	1	3	1		2	2				12
4	1		1	2	4	5	2	2	1	3		21
5	2	3	3	3	1	2	2	3	2	3	2	26
6		1	3	4	5	4	3	3	3	3	5	34
7		1	1	2	4	7	5	4	4	3	1	32
8				1	2	4	4	5	4	5	4	29
9					1	2	5	2	3	6	5	24
10							3	2	3	1	2	11
11								2	2	3	2	9
12										1	4	5
13									3			3
#					1			2	1		1	5
Total	9	12	15	18	22	26	26	27	26	28	26	235

Table 15. Flowering behaviour of *O. alta*.

Day	Rachis number from the top																							Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
1	1																							1
2	1	3	3	4	4		3	1																19
3			1	1	1	3	2	3	3	2	1													17
4	1	1	1		1	1	1		1	2	3	2	2		1									17
5				1		2	1	3	2	1	2	2	1	4	2	1								22
6		1	1		1	1		1	1	3	1	3	5	3	3	3	2	2						31
7						1	1				2	1	1	1	3	3	4	4		2	4		2	29
8						1		1				1	1	2	1		2	2	1	3		1	1	17
9								1		1			1		1	2	1	2		3	2	1	5	20
10						1	1	1	1	1	2	3	3	3	4	3		1	3	1	1	2		31
11										1	3	1	2	3	3	2	4	1	4		1	1	1	27
12									1	1	2	2	1	3		4	5	3	1	3	2	1		29
13															1			3		3	2	3	3	15
14												1		1		1	1	1		4			2	11
15																2	1	3	1	2	2			11
16																	1	1	1	2	1	1	1	8
17																			2	1	1		1	5
18																						1		1
19																1								1
#							1	1	3												1	1	1	8
Total	3	5	6	6	7	10	10	12	12	12	16	16	17	20	19	22	21	23	13	24	17	12	17	320

Table 16. Flowering behaviour of *O. grandiglumis*.

Day	Rachis number from the top										Total
	1	2	3	4	5	6	7	8	9	10	
1	1										1
2	1	3	2								6
3	1	1	2								4
4		1	1	4	5	1					12
5	1		3	3	1	3					11
6		1									1
7		2		1	1	2	3	3	3		15
8				2	3	1	1	1			8
9				1		2	1	1	1		6
10			1	1	1		2	1	2	1	9
11				1		1		1		2	5
12					1				1		2
13					1	1			1	2	5
14							2	1			3
15									1		1
#	2		1	1	1	1	2	1	3	1	13
Total	6	8	10	14	14	12	11	9	12	6	102

Table 17. Flowering behaviour of *O. australiensis*.

Day	Rachis number from the top										Total
	1	2	3	4	5	6	7	8	9	10	
1		1	1	1	1	1	1				6
2	2			1	2	1					6
3	2			1	2	1	2	1			9
4		2		1	1	1	3				8
5			2	1	1	3	2	7	3	1	20
6					1	1	1	1	1		5
7								3	3	3	9
8										4	4
9										2	2
#					1	1	2	3	5	4	16
Total	4	3	3	5	9	9	11	15	12	14	85

Table 18. Flowering behaviour of *O. meyeriana* subsp. *granulata*.

Day	Rachis number from the top					Total
	1	2	3	4	5	
1	1					1
2	2					2
3		1				1
4			1			1
5						0
6			1	1		2
7		1			1	2
8				1		1
9						0
10				1	2	3
Total	3	2	2	3	3	13

Table 19. Flowering behaviour of *O. meyeriana* subsp. *meyeriana*.

Day	Rachis number from the top					Total
	1	2	3	4	5	
1	1					1
2	1					1
3	1	1				2
4			1			1
5						0
6				1		1
7		1	1	1	1	4
8					1	1
9						0
10				1	1	2
Total	3	2	2	3	3	13

Table 20. Flowering behaviour of *O. meyeriana* subsp. *abromeitiana*.

Day	Rachis number from the top					Total
	1	2	3	4	5	
1	1					1
2	2					2
3	2					2
4		1	1			2
5						0
6			1			1
7		1		1	1	3
8						0
9				1		1
10						0
11				1	1	2
12					1	1
Total	5	2	2	3	3	15

Table 21. Flowering behaviour of *O. ridleyi*.

Day	Rachis number from the top										Total
	1	2	3	4	5	6	7	8	9	10	
1	1										1
2											0
3	1	1	1								3
4				1							1
5					1						1
6	1										1
7			1	1	1	1					4
8	1	2									3
9			1	1	1	1					4
10			1				1				2
11				1	1	1		1	1		5
12						1	1	1		1	4
13									1		1
14							1	1	1	1	4
15											0
16							1				1
#				1	1	1	1	1	3	3	11
Total	4	3	4	5	5	5	5	4	6	5	46

Table 22. Flowering behaviour of *O. longiglumis*.

Day	Rachis number from the top											Total
	1	2	3	4	5	6	7	8	9	10	11	
1	1	1	1									3
2				1	1							2
3						1						1
4	1			1								2
5												0
6	2		1	1	2	1	1		1			9
7		1	2	1		2		1				7
8					1							1
9							2	2	1	1		6
10					1							1
11							2	1	1			4
12											1	1
13									1		1	2
14												0
15										1		1
16												0
17										1		1
#						2	2	2	4	3	3	16
Total	4	2	4	4	5	6	7	6	8	6	5	57

Table 23. Flowering behaviour of *O. coarctata*.

Day	Rachis number from the top			Total
	1	2	3	
1	4			4
2	2	1		3
3			1	1
4	1	1		2
#	2	1	1	4
Total	9	3	2	14

Table 24. Flowering behaviour of *O. brachyantha*.

Day	Rachis number from the top				Total
	1	2	3	4	
1	1				1
2	2				2
3	1				1
4	2	1			3
5					0
6		1	1		2
7			1	1	2
#	1				1
Total	7	2	2	1	12

Table 25. Flowering behaviour of *O. tisseranti*.

Day	Rachis number from the top							Total
	1	2	3	4	5	6	7	
1	6	1	1					8
2		1						1
3		1	2	2	1	1		7
4						1	2	3
5							2	2
6					1	1	1	3
#				1	1	1	1	4
Total	6	3	3	3	3	4	6	28

Table 26. Flowering behaviour of *O. perrieri*.

Day	Rachis number from the top						Total
	1	2	3	4	5	6	
1	4						4
2	2		1	1			4
3		1	2	2	1		6
4			1				1
5					3	3	6
6						1	1
7					1		1
#	1	1	1	1	1		5
Total	7	2	5	4	6	4	28

Table 28. Flowering behaviour of *O. subulata*-II.

Day	Rachis number from the top						Total
	1	2	3	4	5	6	
1	6	1	1				8
2							0
3		2	3	3			8
4				1	1		2
5					4		4
6				1	1	8	10
7						1	1
#					1		1
Total	6	3	4	5	7	9	34

Table 27. Flowering behaviour of *O. subulata*-I.

Day	Rachis number from the top										Total
	1	2	3	4	5	6	7	8	9	10	
1	6	1	1								8
2											0
3		2	3	3							8
4				1	1						2
5					4						4
6				1	1	8	3				13
7						1	3				4
8							3				3
9							7				7
10							2				2
11								1			1
12							1	4			5
13								1			1
14								3			3
15								5			5
16								4			4
17											0
18											0
19									1		1
20									6		6
21											0
22									3		3
23									4		4
24											0
25										1	1
26										5	5
27										2	2
28										5	5
29										5	5
30											0
31										5	5
32										5	5
33										3	3
34										7	7
35										2	2
36										1	1
#					1						1
Total	6	3	4	5	7	9	19	18	14	41	126

Table 29. Correlation coefficient and linear regression of first rachis (y) on the flowering day (x).

Species	Correlation coefficient	d. f.	Linear regression	0 point y	0 point x
O. sativa	0.808***	185	1.116x+1.660	8	4
O. sativa var. *spontanea*	0.423***	81	0.723x−0.457	6	4
O. perennis	0.383***	95	0.617x−0.285	7	5
O. glaberrima	0.536***	111	1.370x−1.074	8	5
O. stapfii	0.795***	75	1.846x+1.005	6	4
O. breviligulata	0.788***	59	1.313x+0.482	5	4
O. officinalis-I	0.742***	116	0.830x+1.486	5	5
O. officinalis-II	0.597***	48	0.244x+1.178	3	8
O. minuta	0.611***	55	0.403x+0.848	4	6
O. malabarensis	0.762***	109	0.652x+1.235	5	6
O. malampuzhaensis	0.532***	100	0.424x+0.830	4	6
O. eichingeri	0.689***	243	0.812x+0.340	8	7
O. punctata	0.645***	137	0.665x+1.712	6	7
O. latifolia	0.722***	228	0.747x+1.545	6	7
O. alta	0.675***	310	0.881x+3.722	12	10
O. grandiglumis	0.970***	87	0.560x+2.010	5	8
O. australiensis	0.698***	67	0.877x+1.824	5	5
O. meyeriana subsp. *granulata*	0.872***	11	0.422x−0.281	3	5
O. meyeriana subsp. *meyeriana*	0.832***	11	0.442x−0.264	3	5
O. meyeriana subsp. *abromeitiana*	0.885***	13	0.394x−0.194	3	6
O. ridleyi	0.756***	33	0.554x−0.192	5	8
O. longiglumis	0.734***	39	0.580x+0.730	6	9
O. coarctata	0.743*	8	0.434x−0.643	2	2
O. brachyantha	0.859**	9	0.444x−0.263	2	4
O. tisseranti	0.861***	22	1.153x−0.119	4	3
O. perrieri	0.849***	21	0.919x+1.121	3	4
O. subulata-I	0.868***	123	0.185x+2.719	5	18
O. subulata-II	0.934***	31	0.858x+1.009	3	4

***, **, *: Significant at 0.1%, 1% and 5% level, respectively.

Summary

Seventy-six strains belonging to 24 species of the genus *Oryza* were used for investigation of flowering order in panicle.

The flowering of spikelets in a panicle takes place in a regular sequence. In rachis level, flowering starts from the uppermost rachis of a panicle and proceeds to the lowest rachis in succession in all the species used. Correlation coefficient of rachis on the flowering order is statistically highly significant in the whole species.

In rachilla level, some differences are found among several species. In 16 species, the flowering occurs at first in the uppermost spikelet of a rachilla, followed by the lowest one and then

proceeds toward the upper spikelets in the consecutive order. In 4 species, the flowering occurs at first in the uppermost spikelet of a rachilla, followed by a spikelet slightly nearer the base than the middle of the rachilla and from there proceeds both upward and downward. In other 4 species, the flowering starts at the top of a rachilla, proceeding straightly downward.

In the most species, in general, flowering of all spikelets occurs successively.

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Explanation of Figures 6 to 33

Schematical explanation of flowering order in each species. A numeral in the figure shows the day after flowering start; x in the figure shows unflowered spikelet.

Fig. 6; *O. subulata*-I, Fig. 7; *O. sativa*, Fig. 8; *O. grandiglumis*, Fig. 9; *O. perennis*, Fig. 10; *O. eichingeri*, Fig. 11; *O. latifolia*, Fig. 12; *O. glaberrima*, Fig. 13; *O. longiglumis*, Fig. 14; *O. minuta*, Fig. 15; *O. malampuzhaensis*, Fig. 16; *O. malabarensis*, Fig. 17; *O. australiensis*, Fig. 18; *O. officinalis*-II, Fig. 19; *O. subulata*-II, Fig. 20; *O. ridleyi*, Fig. 21; *O. officinalis*-I, Fig. 22; *O. punctata*, Fig. 23; *O. stapfii*, Fig. 24; *O. tisseranti*, Fig. 25; *O. perrieri*, Fig. 26; *O. sativa* var. *spontanea*, Fig. 27; *O. breviligulata*, Fig. 28; *O. alta*, Fig. 29; *O. meyeriana* subsp. *granulata*, Fig. 30; *O. meyeriana* subsp. *meyeriana*, Fig. 31; *O. meyeriana* subsp. *abromeitiana*, Fig. 32; *O. coarctata*, Fig. 33; *O. brachyantha*.