

Study on Interspecific Compatibility of Different Combinations Inner (Inter) Lily Hybrids

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Abstract: Cross breeding is a major method to breed a new variety of lily, different hybrid combinations will show different compatibility. Some varieties of Asiatic hybrids, Oriental hybrids, Longiflorum hybrids, Trumpet hybrids, LA hybrids, OT hybrid and several species of wild-type lily were selected as materials to hybridize using four pollination methods, which are cut-style, graft-style, conventional pollination and invert graft-style, rate of fructification and number of embryo were used to determine compatibility of different combinations inner(inter) lily hybrids. Results indicated that when combinations in the same hybrid line, LA hybrids showed poor compatibility, the rate of fructification were low or no, while Oriental hybrids showed compatibility was relevant to gene type and finally hybrid embryos for more than 60 days were obtained from 35 good combinations, Asiatic hybrids showed a certain compatibility and hybrid embryos for more than 60 days were obtained, particularly for female parent Navona best. When combinations occurred between different hybrid lines, hybrid embryos could be obtained from A×L, OT×O, OT×A and OT×L group, which showed a certain degree of compatibility, while we have obtained swollen fruit, but embryos for more than 60 days were not found among the crossing groups of A×LA and O×T their compatibility should be studied further. Alusta, Nymph, Shocking and Yelloween were fine breeding materials as female parent in OT hybrid. When wild-type lilies were male parent, combinations which had better performance were Bonsoir (LA) × *L. pumilum*, Freya (LA) × *L. davidii*, Shocking (OT) × *L. davidii*, Navona (A) × *L. pumilu*, Navona (A) × *L. concolor*, Yelloween (OT) × *L. pumilum*, Yelloween (OT) × *L. concolor* and Yelloween (OT) × *L. regale*, while *L. pumilum*, *L. concolor*, *L. daurium* and *L. davidii* performed well as male parent.

Key words: Lily · Compatibility · Rate of fructification · Number of embryo · Hybridization inner (inter)

INTRODUCTION

Lilium plant species are recorded in about 115, China has 55 kinds. Lily cross breeding is one of the main channels to get a new hybrid species, Europe and the United States carried out a great deal of work on hybrid technology and bred new varieties in the early 20th century [1-4], including Netherlands' breeding and propagation center (CPRO-DLO) had made an important contribution in the lily viewing properties and resistance breeding, companies of Flamingo International and Mart Zand introduced new varieties of lilies annual periodic, which promotes to the lily industrialization process of the Netherlands, Britain's Thompson • Morgan and Israel's Revivim Nurseies companies have outstanding achievements in potted lily breeding [5-6]. Japan bred a number of cultivars after the 60s of 20th century [7-9], since then they had rapid development of production in the commercialization.

Lily breeding work develops late in our country, until the 80's of 20th century did lily interspecific hybridization breeding begin and obtain interspecific hybrid lily by the use of distant hybridization [10]. Huang Ji-ming who was from Shanghai landscape institute started cross breeding work since 1979, he used *L. regale* and *L. amoenum*, *L. regale* and *L. davidii* var. *unicolor* Cotton, *L. longiflorum* Thunb. and *L. davidii* var. *unicolor* Cotton. to breed hybrids which with parents' good traits [11-13], Bao Weizhao reported research of colchicine induced polyploid Lily in 1985 [14]. Although Yang Liping reported seven new strains of cold resistant Lily in 90s [15] without a cut-flower varieties bred commodities, Chinese Academy of Sciences Institute of Botany and Kunming Institute of Botany, had also succeeded in breeding some hybrids between species [16]. In the last decade, just one Netherlands, its annual average output of the lily were about 100 kinds of new varieties, most of them were bred out through distant

hybridization and the stigma cutting technology and embryo rescue technique are effective means to overcome obstacles before and after pollination of the lily distant hybridization [17]. Compared with the current international cross breeding varieties mainly among the original species or varieties of hybrids, what Chinese researchers have carried out are the original hybridization between species [18-24], which is still in the initial stage of lily breeding, compared to the international breeding level there is still a long way we need to catch up. Our team systematically explored hybrid compatibility of different combinations of lily varieties according to take statistic and analysis test results of different hybrid combinations inner or inter lily hybrids, in order to make full use of these basic information to lily breeding and germplasm resources.

MATERIALS AND METHODS

Study Area: Hybrid test materials were planted in Yanqing county, Zhang sanying town of Beijing, Da dongliu Nursery and BeiNong science park of Beijing university of agriculture.

Study Materials: They were respectively belonged to six hybrids and some wild species. The six hybrids were Asiatic hybrids, Oriental hybrids, Longiflorum hybrids, Trumpet hybrids, LA hybrids and OT hybrids.

Pollination Methods: Hybridization with different groups were carried out from the year of 2007 to 2010 by using of conventional pollination method, cut-style method, graft-style method and invert graft-style method, fructification condition was observed 60-90 days after pollination.

RESULTS

Hybridization of Different Varieties in the Same Lily Hybrids

Hybridization Between Oriental Hybrids Varieties:

A total of 165 hybridization groups within Oriental hybrids between different varieties were carried out, Oriental hybrids showed compatibility was relevant to gene type, finally hybrid embryos for more than 60 days were obtained from 35 good combinations, results were showed at Table 1.

Table 1: Hybridization result in Oriental hybrids varieties

Pollination Type	Crossing groups	Number of pollinated flowers	Number of fruit	Setting percentage (%)	Number of embryo
Cut-style method	Rain Dance×Carmina	125	8	6.4	149
	Ariosto×Carmina	100	5	5.0	30
	Barletta×Carmina	125	2	1.6	56
	Giacondo×Limpopo	6	4	66.7	272
Conventional pollination	Anais×Lido	17	7	41.2	588
	Ariosto×Freetown	5	3	60.0	258
	Ariosto×Lido	15	5	33.3	265
	Ariosto×Ribera	40	13	32.5	1261
	Barletta×Rimini	16	6	37.5	696
	Cocar D'Or×Freetown	68	31	45.6	465
	Cocar D'Or×Limpopo	112	25	22.3	50
	Crystal Blanca×Tropical	23	6	26.1	690
	Freetown×Cocar D'Or	6	3	50.0	75
	Freetown×Rain Dance	38	24	63.2	2064
	Giacondo×Limpopo	7	6	85.7	1254
	Gisborn×Ascari	42	17	40.5	327
	Gisborn×Ribera	131	81	61.8	4779
	Lido×Santander	15	11	73.3	1518
	Pink impression×Crystal Blanca	64	38	59.4	998
	Pomorol×Santander	26	8	30.8	520
	Potovenere×Ascari	8	6	75.0	96
	Rain Dance×Ribera	37	17	45.9	1258
	Rain Dance×Rimini	18	11	61.1	1606
	Ribera×Crystal Blanca	37	7	18.9	847
	Ribera×Rain Dance	26	15	57.7	2685
	Rimini×Pink impression	120	80	66.7	1760
	Rimini×Santander	24	21	85.7	1953
	Santander×Lido	97	64	66.0	2880
	Santander×Rimini	29	17	58.6	1258
	Valparaiso×Ribera	126	48	38.1	288
	Siberia×Gisborn	61	48	78.7	9984
	Pink Expression×Ascari	22	16	72.7	1504
Giacometti×RainDance	21	12	57.1	132	
Caldeira×Ribera	23	8	34.8	136	
Anais×Lake Winnipeg	22	12	54.6	684	

Table 2: Hybridization result in Asiatic hybrids varieties

Pollination Type	Crossing groups	Number of pollinated flowers	Number of fruit	Setting percentage (%)	Number of embryo
Cut-style method	Navona×Gold globe	45	4	8.9	7
	Navona×Prato	21	1	4.8	0
	Navona×Gondelina	32	1	3.1	0
	Navona×Romana (frozen pollen)	6	2	33.3	10
	Navona×Cearie clarie	17	5	29.4	2
	Romana×Cearie clarie	25	6	24.0	0
	Poyaesunset×Navona	10	1	10.0	0
	Prato×Romana	11	0	0.0	0
	Poyaesunset×Roma (frozen pollen)	6	0	0.0	0
	Sun pixie×Matrix	54	8	14.8	27
	Matrix×Sun pixie	56	6	10.7	23

Table 3: Hybridization results in LA hybrids varieties

Pollination Type	Crossing groups	Number of pollinated flowers	Number of fruit
Cut-style method	Freya×Birgi	10	0
	Pirandello×Freya	15	0
	Diabolo×Bonsoir	12	0
	Diabolo×Eyeliner	21	0
	Fabgio×Boldini	37	0
	Fabgio×Freya	28	0
	Freya×Fabgio	35	0
	Freya×Kresta	19	0
	Kresta×Freya	14	0
	Serrada×Red Alert	17	0
	Termodi×Red Alert	16	0
	Diabolo×Eyeliner	17	0
	Fabgio×Boldini	11	0
	Red Alert×Serrada	13	0

while we have obtained swollen fruit, but embryos for more than 60 days were not found among 83 crossing groups and we couldn't obtain swollen fruit in 47 groups. The results showed that when using cut-style pollination and conventional pollination between different species of oriental hybrids, rate of fructification and number of embryo performed different according to different hybrid combinations, Rain Dance, Crystal Blanca, Ariosto, Barletta, Anais, Cocar D'Or Freetown, Siberia, Pink Expression, Rimini, Valparaiso and Sanrander were good as the female parent varieties, Rain Dance, Crystal Blanca, Cocar D'Or Freetown, Pink Expression, Rimini, Limpopo, Lido, Tropical, Ribera, Gisborn were good as male parent varieties in this group.

Hybridization Between Asiatic Hybrids Varieties: A total of 11 hybridization groups were carried out within Asiatic hybrids between different varieties, results were showed at Table 2. Though using the same pollination methods, different effects performed according to different hybrid combinations, Prato × Romana, Poyae sunset × Romano (frozen pollen), fruits of these two hybrid combinations

had not been enlarged. Hybrid combinations such as Navona × Prato, Navona × Gondelina, Romana × Cearie clarie, Poyae sunset × Navona accessed to the fruit, but the embryo was not peeled out, the compatibility between them should be further studied. Not only the fruit could be obtained from hybrid combinations of Navona × Gold globe, Navona × Romana (frozen pollen), Navona × Cearie clarie, Sun pixie×Matrix, Matrix×Sun pixie, but also accessed to embryos, which indicated that there were certain compatibility in these five hybridization combinations. In addition, the table reveals that there were fruit when Navona was as female parent, from which we guess Navona can be a good breeding material for female parent.

Hybridization Between LA Hybrids Varieties: A total of 14 hybridization groups were carried out within LA hybrids between different varieties, results were showed at Table 3. There were no fruit and embryo obtained from these 21 hybrid combinations by using the same cut-style pollination method, which showing poor hybridization compatibility between LA varieties.

Table 4: Hybridization results when Asiatic hybrids varieties were female parents

Pollination Type	Hybridization Type	Crossing groups	Number of pollinated flowers	Number of fruit	Setting percentage (%)	Number of embryo	
Cut-style method	A × O	Navona×Tiber	5	0	0.00	0	
		Prato×Siberia	28	0	0.00	0	
		Gold globe×Tiber	12	0	0.00	0	
		Cearie clarie×Siberia	10	0	0.00	0	
		PoP poyae sunset×Sorbonne	38	5	13.16	0	
	A × L	Gold globe×Reizah 1	12	1	8.33	1	
	A × LA	Romano×Enrostar	26	4	15.38	0	
		Umbria×Birgi	5	2	40.00	0	
		Latin Red×Boldini	15	3	20.00	0	
		Latin Red×Eyeliner	9	2	22.20	0	
		Latin Red×Trebiano Gerrit Zalm	4	1	25.00	0	
	Graft-style method	A × OT	Toro×Yelloween	10	0	0.00	0
			Poyae sunset× Yelloween	9	0	0.00	0

Table 5: Hybridization result when Oriental hybrids varieties were female parents

Hybridization Type	Pollination Type	Crossing groups	Number of pollinated flowers	Number of fruit	Setting percentage (%)	Number of embryo
O × L	Cut-style method	Corte×White heaven	10	0	0.0	0
		Solaia×White heaven	10	0	0.0	0
	Conventional pollination	Giacometti×World Trade	19	0	0.0	0
O×LA	Cut-style method	Verano×Pirandello	10	0	0.0	0
		Corte×Freya	6	0	0.0	0
	Conventional pollination	Cocar D’Or× Pergamon	36	0	0.0	0
O × T	Cut-style method	Veranda×Kresta	18	0	0.0	0
		Sorbonne×T	58	27	46.6	0
		Tiber×T	32	9	28.1	0
O×OT	Conventional pollination	Nymph×Alusta	16	0	0.0	0
		Crystal Blanca× Alusta	9	0	0.0	0
		Giacometti×Nymph	37	0	0.0	0
		Veranda×Kresta	18	0	0.0	0

Hybridization Between Different Hybrids

Hybridization When Asiatic Hybrids Varieties Were Female Parents: A total of 13 groups that Asiatic hybrids were as female parent, varieties of Oriental hybrids, LA Hybrids, OT hybrids were as male parents were carried out, results were showed at Table 4. With the exception of A ×OT groups using graft-style pollination methods, the other hybrid combinations used cut-style pollination methods. In combinations of Poyae sunset×Sorbonne, Romano×Enro, Umbria×Birgi, Latin Red×Boldini, Latin Red×Eyeliner and Latin Red×Trebiano Gerrit Zalm, enlarge fruit were available, but we did not peel out the hybrid embryos, their compatibility need be further researched. In combination of Gold globe×Reizah 1, not only a fruit is available, but we also peeled out one hybrid

embryo, this combination is expected to get more hybrids. No enlarge fruit was obtained from the rest of hybrid combinations in the appropriate manner pollination.

Hybridization When Oriental Hybrids Varieties Were Female Parents:

A total of 13 groups that Oriental hybrids were as female parent, varieties of Asiatic hybrids, Longiflorum hybrids, Trumpet hybrids, LA Hybrids and OT hybrids were as male parents were carried out, results were showed at Table 5. The only group which we can get enlarge fruit is O×T, their fructification rate is high, but we did not peel out embryos. These enlarge fruits’ formation may be caused by the existence of embryos or just an irritation or swelling, the cause should be studied further.

Table 6: Hybridization result when LA hybrids and OT hybrids were female parents

Hybridization Type	Pollination Type	Crossing groups	Number of pollinated flowers	Number of fruit	Setting percentage □%□	Number of embryo		
LA×O	Cut-style method	Birgi×Protovenere	14	0	0.0	0		
		Birgi×Timavu	11	0	0.0	0		
		Freya×Siberia	10	0	0.0	0		
	Conventional pollination	Kresta×Veranda	24	0	0.0	0		
		Pergamon×Giacondo	5	0	0.0	0		
LA×A	Cut- method	Birgi×Lemon pixie	12	0	0.0	0		
		Birgi×Matris	15	0	0.0	0		
		Pirandello×Lemon pixie	10	0	0.0	0		
LA ×L	Conventional pollination	Pavane×World Trade	4	0	0.0	0		
		Termodi×World Trade	10	0	0.0	0		
OT × O	Cut-style method	Yelloween×Sorbonne	20	4	20.0	0		
		Yelloween×Siberia	29	3	10.3	0		
		Shocking×Carmina	16	10	62.5	4		
		Shocking×Ascari	18	11	61.1	22		
		Alusta ×Latin Red	15	11	73.3	66		
		Shocking×Ascari	18	11	61.1	33		
		Conventional pollination	Alusta×Freetown	43	38	88.4	208	
	Conventional pollination	Nymph×Barletta	2	2	100.0	96		
		Nymph×Pomorol	61	47	77.5	552		
		Shocking×Ascari	6	6	100.0	210		
		Shocking×Cocar D'Or	4	4	100.0	58		
		Shocking×Freetown	5	5	100.0	124		
		OT×A	Graft-style method	Yelloween×Toro	60	0	0.0	0
				Yelloween×Poyae sunset	30	0	0.0	0
Cut-style method	Yelloween×Gondelina		30	5	16.7	4		
	Yelloween×Toro		20	2	10.0	0		
	Yelloween×Poyae sunset		20	4	20.0	8		
Conventional pollination	Nymph×Matris		15	5	33.3	10		
	Shocking×Matris		15	8	53.3	32		
Conventional pollination	Alusta×Latin Red	15	11	73.3	66			
	Nymph×Matris	15	7	46.7	21			
	Shocking×Matris	15	5	33.3	10			
OT×L	Graft-style method	Yelloween×Snow Queen	41	1	2.4	1		
	Cut-style method	Yelloween×Snow Queen	20	2	10.0	1		
	Conventional pollination	Nymph×World Trade	20	11	55.0	0		

Hybridization When LA Hybrids and OT Hybrids Were Female Parents:

A total of 35 combinations which took LA hybrids, OT hybrids as female parent respectively were carried out, results were showed at Table 6. There were fruits in 12 combinations of group OT×O and we could obtain available embryos from most of them, so the compatibility of these combinations is worth further study. In group of OT×A, enlarge fruits were available in 10 combinations which were pollinated by cut-style, hybrid embryos were also obtained in 7 combinations of them, there were no enlarge fruits available in the same combinations when used graft-style to pollinate, which indicated that graft-style method isn't one of effective pollination ways to overcome cross

sterility in this group. Yelloween × Snow Queen, which is belonged to OT×L group, there was respectively one hybrid embryo obtained both cut-style and graft-style method, it is obvious that genotype group plays an important role in cross breeding. Compared with other combinations, rate of fructification is higher in the combinations whose female parent was Alusta□Nymph□Shocking and Yelloween (belonged to OT hybrids), which indicated they were good breeding materials for female parent. In group of LA×O, LA×A and LA×L, hybrid embryos couldn't be obtained both cut-style and conventional pollination method, which indicated bad compatibility in these hybridization combinations.

Table 7: Hybridization result when wild species were male parents

Hybridization Type	Pollination Type	Crossing groups	Number of pollinated flowers	Number of fruit	Setting percentage (%)	Number of embryo		
A × W	Cut-style method	Navona× <i>L.concolor</i>	32	2	6.25	5.00		
		Navona× <i>L.regale</i>	24	6	25.00	0.00		
		Navona× <i>L.taliense</i>	16	3	18.80	0.00		
		Poyae sunset× <i>L.pumilum</i>	7	4	57.00	0.00		
		Navona× <i>L.pumilum</i>	52	34	65.40	6.00		
		Cannes× <i>L.henryi</i>	21	10	47.60	0.00		
		Latin Red× <i>L.pumilum</i>	6	4	66.70	0.00		
O × W	Cut-style method	Sorbonne× <i>L.regale</i>	13	2	14.40	0.00		
		Albion× <i>L.henryi</i>	7	3	42.90	0.00		
		Constanta× <i>L.henryi</i>	8	5	62.50	0.00		
		Barletta× <i>L.davidii</i>	5	2	40.00	0.00		
		Valparaiso× <i>L.davidii</i>	11	10	90.90	0.00		
	Conventional pollination	Ariosto× <i>L.davidii</i>	9	0	0.00	0.00		
		Giacondo× <i>L.lancifolium</i>	19	0	0.00	0.00		
L × W	Cut-style method	White lancer× <i>L.henryi</i>	20	4	20.00	0.00		
		Reizah 1× <i>L.henryi</i>	14	3	21.40	0.00		
		Snow Queen× <i>L.pumilum</i>	50	0	0.00	0.00		
		Reizah 1× <i>L.pumilum</i>	15	2	13.30	0.00		
		Freya× <i>L.pumilum</i>	34	0	0.00	0.00		
		Kingdom× <i>L.distichum</i>	6	2	33.30	0.00		
		Freya× <i>L.lancifolium</i>	66	0	0.00	0.00		
		Serrada× <i>L.tenuifolium</i>	11	11	100.00	0.00		
		Bonsoir× <i>L.tenuifolium</i>	9	6	66.70	0.00		
		Pavane× <i>L.tenuifolium</i>	6	4	66.70	0.00		
		Freya× <i>L.davidii</i>	12	9	75.00	99.00		
		Bonsoir× <i>L.pumilum</i>	9	7	77.80	95.00		
		OT × W	Cut-style method	Yelloween× <i>L.pumilum</i>	110	38	34.50	5.00
				Yelloween× <i>L.concolor</i>	110	10	9.10	2.00
				Yelloween× <i>L.regale</i>	12	6	50.00	8.00
Shocking× <i>L.davidii</i>	3			1	33.30	9.00		
shocking× <i>L.davidii</i>	22			5	22.70	4.00		
Graft-style method	Yelloween× <i>L.pumilum</i>		11	0	0.00	0.00		
	Yelloween× <i>L.concolor</i>		3	0	0.00	0.00		
	Yelloween× <i>L.regale</i>		3	0	0.00	0.00		
Invert graft-style method	Yelloween× <i>L.pumilum</i>		8	3	37.50	0.00		
	Yelloween× <i>L.concolor</i>		3	0	0.00	0.00		
		Yelloween× <i>L.regale</i>	30	14	46.60	19.00		

Interspecific Hybridization Between Different Hybrids and Wild-Type Species:

A total of 38 combinations which took Asiatic hybrids, Oriental hybrids, Longiflorum hybrids, LA hybrids, OT hybrids as female parent respectively and wild-type species as male parent were carried out, results were showed at Table 7. The statistical results indicated when using cut-style pollination method, enlarge fruits were available in most combinations, hybrid embryo could be peeled out from combinations of Bonsoir × *L. pumilum*, Freya × *L. davidii*, Shocking × *L. davidii*, shocking × *L. davidii*, Navona × *L. pumilum*, Yelloween × *L. pumilum*, Yelloween × *L. concolor* and Yelloween × *L. regale*, but when using conventional pollination,

enlarge fruits couldn't be obtained, it suggested conventional pollination shouldn't be used in this group. In addition, combinations of Yelloween × *L. pumilum*, Yelloween × *L. concolor*, Yelloween × *L. regale* used graft-style pollination, invert graft-style pollination method and cut-style pollination method, results indicated that the combination of Yelloween × *L. regale* performing high rate of fructification when using invert graft-style method and hybrid embryos could be available. The statistical results also indicated that wild-type lily *L. pumilum*, *L. concolor*, *L. regale* are good male parent materials and this results improved once again that Yelloween is a good female parent material.

DISCUSSION

Luo Jian-rang [19], Wang Danfei [22], Hao Ruijuan [27] and other researchers considered that rate of enlarge capsule (ovary), rate of embryo which with ovule, rate of fructification and rate of seed that with embryo could be direct indexes for reference and capsule expansion coefficient, time of capsule presence could be indirect indexes to determine compatibility of hybrid combinations. Ovary size and its time on receptacle are related with fertilization and development of embryo, from the aspect of physiology, most enlarge fruits are induced by growth-stimulating hormone which offered by development of seed during and after the fertilization, increasing of auxin in the pistil tissue are coincided with the order when tip of pollen tube gradually arrived different site of pistil tissue, that is, the increasing of auxin is related with length of pollen tube, which is concerned with the compatibility in some degree. According to the above reasons, we used rate of enlarge fruit and rate of embryo in this test to determine the compatibility of combinations inner (inter) hybrids of *Lilium*.

Hybrid combinations inner different hybrid lines show different compatibility. Cut-style pollination and conventional pollination was used in combinations from different varieties in the same lily hybrids, results showed that no enlarge fruit was available in LA hybrids, the probable reason was that much recognized protein disputing in the style, cut-style and conventional pollination had no effect on this hybrids, we suggest using another method may be better, the result indicated that compatibility inner this hybrids were poor in some degree. Though using the same pollination methods, Oriental hybrids showed different effects performed according to different hybrid combinations, gene type plays an important role in cross breeding. Six of hybrid combinations can obtain enlarge fruit, When cut-style pollination and conventional pollination was used in these combinations, but it didn't occur when using Graft-style method, it suggested graft-style method isn't suitable for Hybrid combinations inner Oriental. While using the same method, enlarge fruit was obtained from 9 out of 11 combinations in Asiatic hybrids, five of which Navona × Gold globe, Navona × Romana (frozen pollen), Navona × Cearie clarie, Sun pixie × Matrix, Matrix × Sun pixie had been got more than sixty days old hybrid embryo, this reflects the compatibility between varieties of Asiatic hybrids. From the combinations which got

embryo, we knew that female parent of three combinations were Navona, so we guessed Navona could be a good material for female parent. The fact that we got the most hybrid embryo from combination of Navona × Romana (frozen pollen) indicated frozen pollen might be good for formation of hybrids, though we did not obtain enlarge fruit from another combination, Poyae sunset × Romano (frozen pollen)], which was also used frozen pollen. The existence of this difference may be because their genotype were not match with each other, so frozen pollen didn't work, its influence on recognition and fertilization need further study.

Researchers from oversea have got many new varieties of LA and OA hybrids when using Asiatic lily as female parent. We got a hybrid embryo from an enlarge fruit when twelve flowers were pollinated from combination Gold globe × Reizah 1 of A×L group, if corresponding increasing the number of pollinated flowers, may be more hybrid embryo will be available. We had also got enlarge fruit from combinations of A×O (Poyae sunset × Sorbonne), A×LA (Navona × LA, Romano × Enro star), but no embryo was peeled out. There are two possibilities which induced low rate of fructification in group A×O. first, compatibility between pollen and pistil is poor, second, cut-style is not a suitable method to this group, our test result is coincided with results from Zhou Houzhao [26] and Hao Ruijuan [27]. To analysis group A×LA with the aspect of genetic, their parents have certain blood relationship, hybridization may succeed, but it need more study.

Rate of enlarge fruit is high when Oriental hybrids were female parent and Trumpet hybrids were male parent, but it abortion early, so the time to rescue embryo should be earlier. There are more and more OT varieties in the oversea market, we are also expected to get hybrid generation from group of O×T.

There were all fructification in 19 hybrid combinations of group OT×O and embryo was available, when the female parent was Alusta, Nymph and Shocking. From the perspective of genetic, these combinations have the characteristic of back cross, a certain degree of compatibility is in line with the genetic law. There are no reports about commercial varieties of OTA or OTL on market nowadays. In this experiment, we had got hybrid embryo from (OT)×Asiatic hybrids, (OT) × Longiflorum, which was an exciting news worthing more detail research, from our statistic we concluded that Yelloween, Alusta, Nymph and Shocking are good female parents.

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