

The Lily Species behind Today's Hybrids: Part Three The "Gang of Five"

LEONARD D. MARSHALL
Casper, Wyoming

THE third group of Asiatic lily species which I wish to describe is a group of small-flowering species, including *Lilium lankongense*, *L. duchartrei*, *L. taliense*, *L. wardii*, and *L. papilliferum*, whose difficulties in hybridizing defy their apparent specific relationship. I call them the "Gang of Five." Although they are slotted as Asiatics, for breeding purposes they seem compatible only interspecifically, and that with difficulty; embryo-culturing is necessary to make progress within this group. Let us consider the species in this group.

	<i>Lilium lankongense</i>
Flower form	Tightly recurved turk's-cap. Pedicels of medium length. Flowers tiny and fragrant.
Inflorescence	Raceme
Color variation	Mauvish purple-pink (pastel)
Spotting	Sparse, very fine crimson or deep mauve-pink spotting. Spots are often "flat"—not on raised papillae—creating lovely marbled effect.
Bud count	Up to 15.
Height variation	Average to 5 feet (120 to 150 cm) under ideal conditions.
Stem strength	Strong but willowy
Foliage	Leaves average 4 inches (10 cm) long and ½ inch (1.2 cm) wide. Leaves dark green.
Soil preference	Easiest of the "Gang of Five," will grow in acid to alkaline soil if kept moist and kept sheltered from mid-day sun.
Geographic locations	Alpine areas in higher mountains of southwestern Yunnan; 10,000 feet (3,000 m) elevation. Very hardy.
Germination	Immediate epigeal
Disease resistance	Fairly virus tolerant. If given good conditions, some fusarium resistance. Very resistant to botrytis.
Interspecific compatibilities	Embryo-culturing usually needed, and hybrids show sterility problems; crosses have been made with <i>L. davidii</i> , <i>L. cernuum</i> , <i>L. leichtlinii</i> var. <i>maximowiczii</i> , and <i>L. duchartrei</i> .

Dr. Chris North and Judith McRae have produced F₁ hybrids of *L. lankongense* by using embryo-culturing. Judith's crosses of *L. lankongense* with various upright pink or white Asiatic hybrids, Columbia-Platte's Southern Belles, are the most vigorous of the *lankongense* hybrids to date, as long as they do not become infected



Lilium lankongense



'Southern Belles', *L. lankongense* × an upright pink and white Asiatic.

with virus. Some of the clones are more tolerant than others; virus symptoms include leaf mottle, reduced stature, smaller flowers, and narrow tepals. With medium-sized out- to down-facing dusty mauvish rose flowers, delicately scented, the Southern Belles are like a more robust form of the species. Some of them show odd chromosome numbers, but even the diploids show low fertility. Occasionally they will set normal seed; more seeds can be produced by embryo-culturing. In 1982 and 1983, the first of many second-generation seedlings flowered; and these have retained the grace, the delicate coloring (some in deeper intensity), and the unusual marbled spotting of *L. lankongense*. We hope that they will show greater virus tolerance. We are in the process of assaying and testing *L. lankongense* hybrids for tolerance to specific viruses, since the "Southern Belles" seem to be highly tolerant of some viruses but not of others.

Lilium lankongense is among the most botrytis-resistant of all lily species, and the hybrids do seem to inherit this. If they are overwatered, *fusarium* can be a problem. In Oregon, where there is no rain in the late summer and the field is not watered, we never see *fusarium* in this group; in overwatered areas, it can cause bulb rot.

Lilium lankongense, *L. duchartrei*, and *L. papilliferum* are very hardy, coming from high mountains. I have found that *L. taliense* and *L. wardii* in open plantings will not take the harsh winters of Wyoming. I can keep them for years near the house foundation, where the soil reaches only near-freezing temperatures. *Lilium lankongense* is hardier. If given damp, loose soil to enable its stoloniform stem-base to wander, it will endure Wyoming winters; and it seems to do well in our soil with a pH of 7.5. It also does well in Oregon's milder climate and acid soils, so this adaptability is a breeding value.

In general, embryos must be cultured to produce first- and second-generation hybrids, although occasionally there are breakthroughs. I produced an F₁ hybrid between *L. lankongense* and *L. duchartrei*, which is fertile. Although this clone rapidly became infected with virus, it grows vigorously (even with its terribly mottled leaves) and produces many flowers and an admirable number of seeds each year. (It is grown in isolation.) Henry Payne, it should be mentioned, has also attained *L. lankongense* hybrids, with seed germinating normally, in several cases.

Lilium lankongense flowers in mid-season.

Lilium duchartrei

Flower form	Tightly recurved turk's-cap. Pedicels rise to almost vertical position. Fragrant.
Inflorescence	Umbel
Color variation	Marble white. Tiny flowers.
Spotting	Fine but numerous crimson or deep mauve-purple spots; spots are not raised on papillae, and this creates a "marbling" effect.
Bud count	Usually 6 to 8; well-cultivated specimens can exceed this.
Height variation	Usually 2 to 5 feet (60–150 cm)
Stem strength	Willowy and rather weak
Foliage	Averages 3 to 4 inches (7–10 cm) long and ½ inch (1.2 cm) wide.
Soil preference	Grows in high mountain lime formations. Will deteriorate and die in acid soils.
Geographic locations	Yunnan and Szechwan in China, at elevations from 10,000 to 12,000 feet (3,000 to 4,000 m)
Germination	Immediate epigeal
Disease resistance	With good growing conditions, good resistance to botrytis and fusarium. In Wyoming has shown virus tolerance, but in Oregon it seems quite virus susceptible.
Interspecific compatibilities	Usually requires embryo culturing, but has been crossed with <i>L. davidii</i> and <i>L. lankongense</i> .

Of the "Gang of Five," *L. duchartrei* is the most difficult to grow under garden cultivation.

In Casper, Wyoming, where my home is located—close to the base of Casper Mountain, at an elevation of 6,000 feet (1,800 m) above sea level, *L. duchartrei* is rock hardy and grows like a weed. It must be mulched carefully and kept damp. The high altitude, dry air, harsh winters, and soils with a pH of 7.5 seem to be to the liking of this fairylike species. It also grows well in lower elevations, in the alkaline areas of Montana. Bert Porter has no problem with it on the cold Canadian prairie.

Coastal areas of the United States and the heavy soils of the Midwest are highly detrimental; even the most experienced fancier cannot keep *L. duchartrei* persisting under such conditions.

As discussed under the description of *L. lankongense*, we did cross *L. duchartrei* with *L. lankongense*, producing a fertile but virus-susceptible clone. We have a number of seedlings from it which should flower in 1984, in which we have crossed it with virus-tolerant Asiatics. We have also back-crossed it to *L. lankongense*, to return to the lovely racemic inflorescence (the F₁ hybrid has the umbel of *L. duchartrei*). These will give us avenues to bridge to stronger hybrids.

Lilium duchartrei is interesting to the hybridizer for two reasons. It is the only naturally white Asiatic species; although *L. cernuum* may produce white-flowered mutants, it is not naturally white. *Lilium taliense* is white but has yellow flavonoid pigments in the nectary section. Second, this species and *L. papilliferum* are the only two Asiatic species with turk's-cap flowers which also have an umbellate inflorescence.

The base roots of *L. duchartrei* are different from those of other Asiatic species. They lack contractile roots and are rather small, with a slick 'spaghetti' appearance.

To give the bulblets scattered along the wandering stoloniform stem adequate depth, the stem actually goes down about 2 inches (5 cm); it may then travel laterally for as much as 2 feet (60 cm) before emerging above the ground.

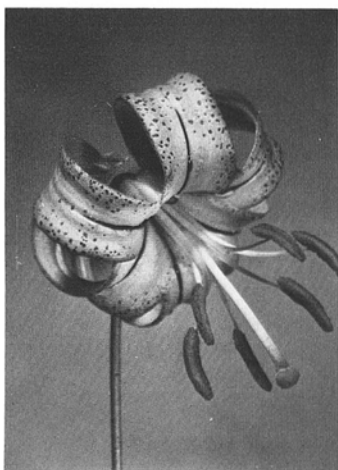
Lilium duchartrei flowers in mid-season.



Lilium duchartrei



Len Marshall's fertile hybrid
between *L. lankongense* ×
L. duchartrei



Lilium wardii



'Albipayne' × L218 hybrid — as
fragrant and early as *L. pumilum*
with truly white flowers.

Lilium wardii

Flower form	Small turk's-cap, but larger than those of the other four of the "Gang of Five"
Inflorescence	Raceme
Color variation	Light purple to mauvish rose. Close observation shows pigments to be concentrated in close-together clumps.
Spotting	Carmine in a pretty pattern on tepal borders; has a fine purple nectary stripe.
Bud count	Up to 40. Magnificent!
Height variation	5 feet (150 cm) or more
Stem strength	The purplish stem is rather weak; supported by thickets in the wild.
Foliage	Averages 3 inches (8 cm) long and ½ inch (1.2 cm) wide; dark green.
Soil preference	Will grow in alkaline or acid soils. Needs enough protection so that soil temperatures will not drop below 25 degrees F (– 7 degrees C).
Geographic locations	Tibet, in the foothills of the Himalaya at 4,000 to 5,000 feet (1,200 to 1,500 m) elevation. Not hardy in extremely cold climates.
Germination	Immediate epigeal
Disease resistance	Very susceptible to virus diseases. Good resistance to fusarium and botrytis.
Interspecific compatibilities	Very difficult to achieve any crosses. Henry Payne's cross to his mutant hybrid 'Oddball' was a breakthrough.

Although there are important physical differences, *L. wardii* and *L. taliense* are obviously closely related. They both have the pretty pencil-line nectary stripe, they are both only half-hardy, and their bulbs are similar.

There are distinctive physical differences, however. *Lilium wardii* has a wandering stoloniform stem base, whereas the stem of *L. taliense* rises perpendicularly, straight from the bulb. *Lilium taliense* has obvious flavonoid pigments in the nectary section; *L. wardii* seems to contain primarily anthocyanins. Because of the molecular similarities of these types of pigments, and their often identical biochemical precursors, it is not unlikely that both are in the epidermis (though separated) in *L. taliense* tepals.

In 1971, Henry Payne achieved a cross using *L. wardii* pollen on his badly distorted, most unusual mutant hybrid clone 'Oddball.' The progeny which resulted were the most varied and strange looking hybrid lilies I have ever seen! Some were upfacing turk's-caps; some had inner tepals yellow and outer tepals purple on the same flower. Most were distorted; all but a few were male sterile and female fertile. The seed fertility gave me a toehold, and we have continued to make use of the fertility in the next generation. Watch for the release of the *L. wardii* hybrids—you will like them! Some of the most beautiful hybrids have come from crossing these with my original *L. pumilum* × 'Rainbow' bicolor clones, giving hybrids with spectacularly long inflorescences in deep rose, unspotted cream, palest pink, and subtle buffs, as well as more vivid oranges, reds, and yellows. Many of these are pollen-free, which should add to their usefulness in flower arrangements. There are several

types of male sterility, too, so that some of the hybrids have non-opening anthers which look quite normal but are never messy; others have tiny anthers, and some have no anthers. From the brilliant red of the vigorous out-facing 'Bingo' through lovely pastels to pure unspotted white, the *L. wardii* hybrids show real promise. This is the only program involving a species in the "Gang of Five" in which fertility was achieved from the beginning.

The complex genetics of this group are made even harder to analyze by the many odd traits carried by 'Oddball.' Some *L. wardii* traits were detected in Henry Payne's F₁ cross, 'Oddball' × *L. wardii*, but the progeny did not show the uniformity you would expect from an F₁ cross between a less eccentric clone and a species. In the second generation, *L. wardii* traits were not apparent. This led to Judith McRae's raising the question of whether the progeny from Henry's original cross might have actually been produced from inadvertent open pollination on 'Oddball,' rather than from the *L. wardii* pollen. [We continue attempting to cross *L. wardii* directly with virus-tolerant Asiatic clones; if we succeed, comparisons with the 'Oddball' progeny will be interesting.] Third generation seedlings, however, do show some of the unusual traits associated with *L. wardii*, such as wandering stems. These are becoming more refined and elegant, and they represent a number of sturdy and beautiful clones meriting introduction. The wandering stems are a problem with some of the clones, but we are selecting away from this unruly habit.

A fascinating albino-flowered clone from Henry's F₁ group is still being used in breeding. We call this clone 'Albipayne,' and in spite of its floral distortion, it has given beautiful offspring.

Lilium wardii and *L. papilliferum* flower in the early part of the late season.

Lilium taliense

Flower form	Tightly reflexed turk's-cap. Has purple nectary stripe like that of <i>L. wardii</i>
Inflorescence	Raceme
Color variation	White with light yellow nectaries
Spotting	Carminc or deep mauvish purple in the same pattern as <i>L. wardii</i>
Bud count	Averages 10 to 12; well-cultivated specimens may exceed this.
Height variation	Under ideal conditions will reach 6 feet (180 cm)
Stem strength	Strongest of the "Gang of Five." Only species in this group with a non-stoloniform stem.
Foliage	Very numerous leaves; average 6 inches (15 cm) long and only ¼ inch (0.6 cm) wide. Sage green color, like <i>L. amabile</i> .
Soil preference	Will grow in both alkaline and slightly acid soils. Only half hardy.
Geographic locations	Isolated in the Tali Mountains of Yunnan. Sub-alpine species; grows at elevations of 3,000 to 5,000 feet (900 to 1,500 m).
Germination	Immediate epigeal
Disease resistance	Deteriorates rather rapidly from virus. Seems to have good resistance to fusarium and botrytis, if given ideal growing conditions and winter soil protection.

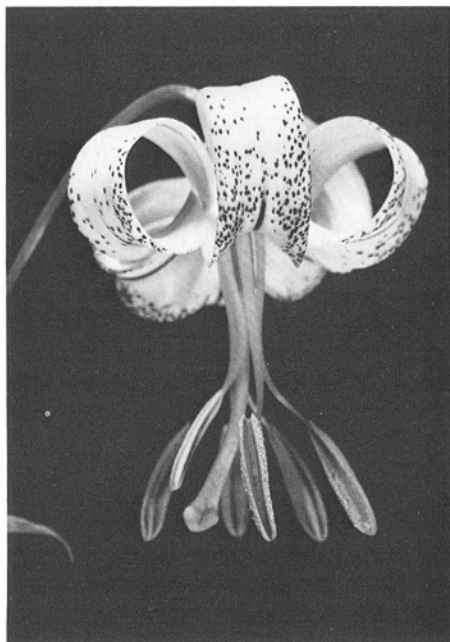
Interspecific compatibilities Dr. Chris North has crossed with *L. davidii*, using embryo culturing procedures. Henry Payne claims to have *L. taliense* hybrids, but I have not seen these.

Lilium taliense is obviously a close relative of *L. wardii*, but my efforts to cross the two have always failed.

The interesting traits this species offers to hybridizing are its non-stoloniform stem and its white flowers. Its drawbacks include its half-hardy nature and its susceptibility to virus diseases. Little has been accomplished in breeding, so the inheritance patterns among offspring cannot be described.

I have always nurtured *L. taliense* and *L. wardii* near the open northside foundation of my home. They grew and thrived for years in this planting. In 1980, I placed seeds of both *L. wardii* and *L. taliense* to grow under Gro-Lights, to produce fresh virus-free stock for breeding. On May 15th, I set them outside in a screened shelter for the balance of the season, and I harvested nice $\frac{3}{4}$ inch (2 cm) diameter bulbs in the fall. These were separated and placed in the open, under 4 inches (10 cm) of mulch in the fall, something I had done successfully with *L. papilliferum*, *L. duchartrii*, and *L. lankongense*. The result? Winterkill! *Lilium wardii* and *L. taliense* could not take the cold ground temperatures of harsh Wyoming winters. The other three species in the "Gang of Five" are very hardy.

Lilium taliense flowers in mid-season.



Lilium taliense



Lilium papilliferum

<i>Lilium papilliferum</i>	
Flower form	Downfacing, with tightly recurved inner tepals and loosely recurved outer tepals, creating a triangular shape. Green nectary stripe.
Inflorescence	Umbellate to racemic
Color variation	Very dark eggplant purple
Spotting	None. Does have a blacker elliptic blotch exactly in center of tepals.
Bud count	2 to 5
Height variation	1 to 2 feet (30 to 60 cm)
Stem strength	Small but adequate for this rather short and dainty species
Foliage	Averages 3 inches (8 cm) long and ¼ inches (0.6 cm) wide.
Soil preference	Like <i>L. duchartrei</i> , it prefers rather alkaline soil.
Geographic locations	Isolated in high mountains of northwestern Yunnan in rocky dry areas. Will live with long dry spells.
Germination	Immediate epigeal
Disease resistance	Good virus tolerance under Wyoming conditions. Excellent resistance to fusarium. Only fair botrytis resistance.
Interspecific compatibilities	Dr. Chris North has crossed with <i>L. davidii</i> , using embryo culturing. Little is known about this or other crosses.

This tiny species is of interest because of its intense coloring; its anthocyanin pigment is so dense that the flower appears to be black.

Little has been accomplished in hybridizing with it, so the field is open for challenge.

In my area, *L. papilliferum* grows well. Like *L. duchartrei*, it is capricious in most areas. Here it thrives under the same conditions suitable for *L. duchartrei*, and it is similarly very hardy.

I have tried a number of times to hybridize with *L. papilliferum*, but as yet I have not been successful. Judith McRae could not find embryos, living or dead, in the pods; there was some pod stimulation and development.

When I was growing *L. papilliferum*, the wandering stems moved straight northward. The planting moved about 15 feet (450 cm) in twelve years—always in the same direction. I wonder what attracted them. They always remained healthy.

This species flowers in the early part of the late season, at the same time as *L. wardii*. As the final species in the “Gang of Five,” *L. papilliferum* is as frustrating to the hybridizer as the other four.

I invite interested readers to search the natural mysteries in the beautiful and dainty group. If you find answers, please share them with us all!