

***Papaver x kobayashii:***  
**A New Hybrid as a Source of Opiates**

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*Riassunto*

E' stato studiato *Papaver x kobayashii*, un ibrido sperimentale tra *P. somniferum* e *P. bracteatum*. La pianta è annua e sterile, con morfologia intermedia tra i due genitori.

*P. x kobayashii* presenta tebaina e papaverina, alcaloidi presenti in ambedue i genitori, nonché morfina in quantità cinque volte superiore a *P. somniferum*.

*Papaver bracteatum* Lindl. (LINDLEY, 1821) has been widely studied because of its thebaine content. Thebaine can be converted into codeine for medical use. In an attempt to find different sources of thebaine, I tried to hybridize *P. bracteatum* with *P. rhoeas* L. but the two species proved to be incompatible. Thus I decided to hybridize *P. bracteatum* and *P. somniferum* L.

The strain of *Papaver bracteatum* utilized for hybridization is that called Arya 1, a native of the Elburz mountains in Iran, cultivated in the Naples Botanical Garden, Italy, since 1974. This strain was previously studied by me from the agronomical (SINISCALCO GIGLIANO, 1978 a) and phytochemical point of view (SINISCALCO GIGLIANO, 1978 b, and 1980).

This strain is characterized as follows:

- Perennial herb, setose. Stems erect, setose, 60-120 cm, with a rosette of pinnatisect leaves. Leaves distributed along the stem, pinnatisect, very setose. Buds erect, ovoid, 2-3 cm, with 3 sepals. Flowers conspicuously bracteate; petals 6, crenulate at the margin, purple red, with a black

spot at the base. Filaments clavate, with purple anthers. Capsule obovate-globose 0.5-3 x 1.4 cm, sessile, dehiscent, with 14-20 stigmatic rays.

*Papaver somniferum* utilized in this study is the var. *album* DC. (DE CANDOLLE, 1821) which has been cultivated in the Naples Botanical Garden for more than 50 years. It shows the following characters:

- Annual herb, glaucous. Stems erect, 100-120 cm. Lower leaves with a short petiole, the upper leaves sessile and amplexicaul all crenate-serrate, glabrous. Buds pendulous, ovoid-oblong, 2 cm, with 2 glabrous sepals. Petals 4, orbicular, white, entire at the margin, caducous, 3-5 x 6-7 cm. Filaments clavate, with pale yellow anthers. Capsule globose 5-8 x 3-5 cm, indehiscent, sharply stipitate with 10-12 stigmatic rays.

*Papaver x kobayashii*.

During the Spring of 1980 and 1981 we pollinated stigmas of each species with pollen of the other species, eliminating stamens before anthesis. After pollination pistils were covered with narrow mesh isolators and, when mature, seeds were harvested and sowed during March 1981 and 1982. All the plants obtained from these seeds were identical to each other and showed intermediate characteristics between *P. somniferum* and *P. bracteatum*, furthermore there was no difference between the plants coming from pollination of *P. somniferum* with pollen of *P. bracteatum* and viceversa.

The hybrid plants (Fig. 1) show the following characters:

- Annual herb as *P. somniferum*. Leaves pinnatisect as *P. bracteatum* but glabrous as *P. somniferum* (Fig. 2). Stems strongly setose as *P. bracteatum*. Flowers as *P. somniferum* not bracteate. Bud pendulous and with 2 sepals as *P. somniferum* but strongly setose as *P. bracteatum*. Petals 4 as *P. somniferum* but purple red as *P. bracteatum*. Flowers with petals of different width: two petals 10-12 cm; two petals 7-8 cm. Filaments clavate, with purple linear anthers all as *P. bracteatum*. Capsule (Fig. 3) oblongate 3-3.5 x 2.5-3 cm, sessile, with 10-12

stigmatic rays, dehiscent, similar to that of *P. bracteatum* except for the number of the stigmatic rays. Some specimens show stems with a rosette of pinnatisect leaves as *P. bracteatum*.

The plants revealed to be sterile. Small quantities of sterile seeds were produced.



Fig. 1. - *Papaver x kobayashii* Siniscalco Gigliano. x 2/5.

This hybrid named *Papaver x kobayashii*, is dedicated to Prof. Akira Kobayashi of the Kagoshima University, Japan, in acknowledgement of his scientific contributions to botany.

The alkaloids of *Papaver x kobayashii*.

The extraction of the thebaine, morphine and papaverine were made as described by Fairbairn and Hakim (1973). Capsules of *P. x kobayashii*, *P. somniferum* and *P. bracteatum* were collected 7 days after anthesis, dried at 105°C for 12 hr, powde-

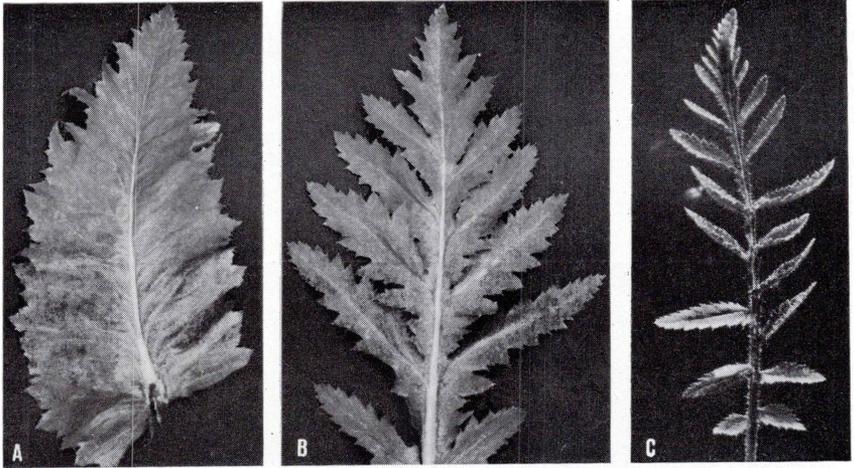


Fig. 2. - Leaves of (A) *Papaver somniferum* L., (B) *P. x kobayashii* Siniscalco Gigliano, (C) *P. bracteatum* Lindl. x 1/7.

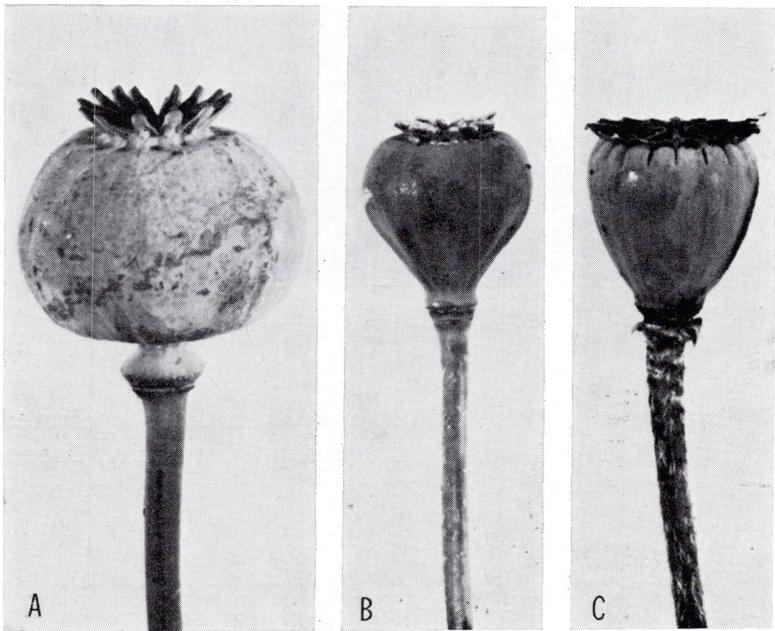


Fig. 3. - Capsules of (A) *Papaver somniferum* L., (B) *P. x kobayashii* Siniscalco Gigliano, (C) *P. bracteatum* Lindl. x 5/8.

red and extracted for 5 hr in a Soxlet apparatus using methanol-ammonia (98:2) mixture as solvent and dried *in vacuo* at 40°C. The extracts were adjusted to 4 ml by the addition of n-butanol containing cholesterol acetate (80 mg/100 ml) as an internal standard. Injections of 1-2  $\mu$ l were made directly into the gas chromatograph.

Gas chromatography was carried out isothermally at 260°C in a 1.5 m x 4 mm glass column packed with 3% OV-17 100-120 mesh. Carrier gas was N<sub>2</sub> at 40 ml/min. Injector temperature and FID detector temperature were 290°C. The morphine, thebaine and papaverine peaks have been identified utilizing pure standards.

Calibration curves of response against weight were made and the response factors determined. Peak areas were quantitated by the triangular method.

The results of the alkaloid determinations are reported in Tab. I. In the capsules of *P. x kobayashii* thebaine and papaverine are present in amounts similar to those of the parents. The morphine content of *P. x kobayashii* is, by contrast, about five times higher than of *P. somniferum*. Morphine is lacking in *P. bracteatum*. Thus at the phytochemical level *P. x kobayashii* is much more closely related to *P. somniferum* than to *P. bracteatum*.

Morphologically, however, *P. x kobayashii* shows a similar number of features both from *P. somniferum* and from *P. bracteatum*.

This new hybrid could be of interest as a source of opiates in Italy, where economic yields of morphine are currently not obtained from the cultivation of *P. somniferum*.

TAB. I. - Percentage of thebaine, morphine and papaverine in capsules of *P. somniferum*, *P. bracteatum* and *P. x kobayashii*.

<i>SPECIES</i>	Thebaine % (dry wt)*	Morphine % (dry wt)*	Papaverine % (dry wt)*
<i>Papaver somniferum</i>	0.04	0.75	0.05
<i>Papaver bracteatum</i>	1.60	—	0.05
<i>Papaver x kobayashii</i>	0.05	3.75	0.02

\* Each result is the average of three measurements.

***Papaver x kobayashii* Siniscalco Gigliano hybr. nov.**

Herba 60-150 cm alta. Folia glabra pinnatipartita; radicalia ad 50-60 cm longa, caulina minora. Pedunculus elongatus crassus, setis albis hirsutus. Flos ultra 10 cm diametro magnus. Sepala 2, setis albis hirsuta. Petala 4, 2 exteriora maiora 10-12 cm lata, 2 interiora minora 7-8 cm lata, rubra, margine undulato integro, ad unguem macula atro-violacea praediti. Staminum filamenta superne dilatata, antherae oblongae sanguineae. Capsula oblongata, 3-3.5 x 2.5-3 cm. Discus planus, stigmatibus 10-12 radiato. Semina infecunda.

Typus: Orto Botanico Univ. Napoli, 1981 (NAP.).

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SUMMARY

A new experimental hybrid of *Papaver* was obtained from *P. somniferum* and *P. bracteatum*. The name given to this new hybrid is *Papaver x kobayashii*. The plant is annual, sterile and morphologically it is intermediate between its parents.

The alkaloids thebaine, morphine and papaverine are present in *P. x kobayashii* as in its parents but the morphine content in *P. x kobayashii* is five times higher than in *P. somniferum*.

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