

Secrets of *Pueraria mirifica* Revealed

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April 11, 2001

Introduction

In Thai traditional medicine, *Pueraria mirifica* (Kwao Krua) has long been a valuable Thai herb, used for rejuvenation and good health. The tuberous roots are indicated to be the beneficial part. Confusion arose when Thai people generalized two different species of *Pueraria*, by using a similar word, Kwao Khrua.

Pueraria candollei Grah. ex. Beth. and *Pueraria mirifica* A. Shaw & Suvat (1) are different species of *Pueraria*, yet categorized in the same Leguminosae family. Most do not realize the distinction between these two species and assume that they are the same plant. *Pueraria candollei* is more widespread and very easy to find, while *Pueraria mirifica* is less extensive and exists only in very specific locations.

Confusion increased exponentially as there are more than 10 other species of *Pueraria mirifica* found in Thailand. Some of them share similarities with *Pueraria mirifica* such as the flowers, pods, and the leaves. Superficial observation can not distinguish the differences and it is very difficult for locals to realize the difference. It is very common not to realize the secret of *Pueraria mirifica*, collecting other species of *Pueraria* and assuming that it is *Pueraria mirifica*, claiming *Pueraria mirifica*'s properties. This is very dangerous because the other species of *Pueraria* do not possess the same biological characteristics and desired qualities of *Pueraria mirifica*. It may even be toxic.

The complexities of *Pueraria* may be a blessing in disguise for Thailand since it also protects *Pueraria mirifica* from foreigners who's intent to unfairly reap benefits of this plant.

This article aims to show the complexity of *Pueraria mirifica* and reveal information, which has never been in the public domain. Truthful and accurate information of this plant, for the benefit of Thailand is herein provided. Further, to prevent harmful consequences from misunderstanding and / or misuse of this plant.

In the past, there has been debate over the botanical characteristics of *Pueraria mirifica* which has Miroestrol, an active ingredient and many taxonomists still can not give a clear answer. *Pueraria candollei* Grah. ex. Beth.

and *Pueraria mirifica* A. shaw & Suvat (1) have many physical differences as indicated in the Table.

Pueraria candollei Grah. ex. Beth. and *Pueraria mirifica* A. shaw & Suvat.(1) are usually misidentified as *Pueraria candollei* Grah. ex. Beth. as *Pueraria mirifica* A. shaw & Suvat.

From the table, it is clear that *Pueraria candollei* has larger flowers, leaves and longer inflorescence (30-80 cm.) than that of *Pueraria mirifica* (maximum 30 cm.). The pod of *Pueraria mirifica* has hair and is shorter (3 cm.) than that of *Pueraria Candollie* (8 cm.). The differences between them can only be observed during March and April of each year because pod and flowers of *Pueraria* only show up during that period. For the other 10 months, it would be difficult to distinguish the differences, since only the leaves can be used for plant identification.

There are 13 species of *Pueraria* in Thailand as the following:

1. *Pueraria alopecuroides* Craib
2. *Pueraria candollei* Graph. Ex. Benth
3. *Pueraria imbricata* van der Maesen sp. nov.
4. *Pueraria mirifica* A Shaw. & Suvat.
5. *Pueraria lobata*
6. *Pueraria lobata* Var. *montana*
7. *Pueraria lobata* Var *thomsoni*
8. *Pueraria* Var. *phaseoloides*
9. *Pueraria* Var. *Javanica*
10. *Pueraria* Var. *subspicata*
11. *Pueraria wallichii*
12. *Pueraria rigens*
13. *Pueraria stricta*

Most *Pueraria* have similar outer appearances. In Thailand, there is more *Pueraria candollie*, than *Pueraria mirifica* and it is much easier to locate. Therefore, most entrepreneurs will use *Pueraria candollei* as a raw material in product production, assuming it is *Pueraria mirifica*. Local names of *Pueraria mirifica* are different, according to the geography. For example, in the north it is called "Jan Krua", in the Northeast it is "Tan Krua", in the South, "Tan Chom Thong". It would be interesting to study what kind of *Pueraria*, among 13 species mentioned, fits in the local name of *Pueraria* in each region.

It is recorded that in Kanjanaburi province, there are 4 different species of *Pueraria* having similar flowers, pods, leaves, and tuberous roots. 3 of them were found in the same area. Most local *Pueraria mirifica* suppliers do not recognize botanical differences and supply crude *Pueraria* in an unimaginable combination, labeled as *Pueraria mirifica*. Customers of these suppliers would

find it impossible to notice the differences when the crude is dried and ground, ready for shipment. for the next process of manufacture.

To develop safe and effective applications of Pueraria, the most important step is to identify the correct species of Pueraria, which, in this case, is Pueraria mirifica. The primary resource person in this field is a taxonomist, from the Forest Department, Ministry of Agriculture.

History of Study and Research on Pueraria mirifica

Although Pueraria mirifica has been used in Thailand for more than one hundred years, scientific study of this plant began only 70 years ago. In 1931, Luang Anusan Sunthorn mentioned Pueraria mirifica as a source of rejuvenation. The development follows:

- 1931 Luang Anusan Sunthorn mentioned Pueraria mirifica as a source of rejuvenation and good health
- 1932 Phaya Vinij reported that Pueraria mirifica prolongs life and enhances vitality.
- 1938 Dr. Dhara Sukhawachana reported that Pueraria mirifica has estrogenic effects.

These reports prove that Thai people have known that Pueraria mirifica has estrogenic properties for more than 60 years.

Before 1952, Pueraria mirifica was misidentified as Butea Superba, which is known as "Kwaaao Khrua Dang" in Thailand.

- 1952 A new species of Pueraria was found and was subsequently named as "Pueraria mirifica A. Shaw et Suvatabhandu.
- 1960 Cain JC. discovered an important chemical constituent in Pueraria, Miroestrol.
- 1963 The story of Pueraria mirifica which has Miroestrol as an active ingredient spread.

Significance of Miroestrol found in Pueraria mirifica. Further research was to study whether other species of Pueraria contained Miroestrol, as in Pueraria mirifica.

- 1981 Records of more than 20 year of studies of the effect of Pueraria in animal by Dr. Yuttana Smitasiri were revealed.

- 2000 Additional significant chemical constituents in *Pueraria mirifica* were discovered by Dr. Chiyo (Deoxymiroestrol) and Dr. Sunee (Puemircarpene) (7)

Popularity of *Pueraria mirifica* in Thailand dissipated during from the 1970's to 1990's when a report of Dr. Ouy Katesing in testing for the toxicity of *Pueraria*, indicated that *Pueraria* has "Butanin" which is toxic. However, there is currently no evidence that the toxin found in the study of Dr. Ouy is from *Pueraria mirifica*, owing to lack of species identification at that time. Further study to determine what species of *Pueraria*, was used in the study containing Butanin is necessary.

Benefits of *Pueraria mirifica*

Pueraria mirifica has long been used for many purposes, as follows:

- Dietary supplements for rejuvenation and good health in elderly males and females, not recommended for teenagers.
- Skin care products and anti-wrinkle agents
- Breast enhancers
- Hair tonic
- Cataract
- Dietary supplement for good memory
- Dietary supplement for strength and vitality
- Enrichment of blood
- Inducement in appetite
- Dietary supplement for sleep

In the traditional recipe of *Pueraria mirifica* of Luang Anusan Sunthorn states that:

- People stricken by exhaustion, lack of appetite and energy and insomnia, after taking *Pueraria mirifica* for 20-30 days, will get better and have a good sleep.
- Elderly females taking *Pueraria mirifica*, will have good health, vitality, and probably return to menstruation again.
- Males taking *Pueraria mirifica* will have immeasurable energy and have development of muscles in the body.
- Taking *Pueraria mirifica* with cow's milk will bring about good memory and a bright brain.
- Taking *Pueraria mirifica* with Myrobalan will help clear vision.
- Applying *Pueraria mirifica*, mixed with buffalo's milk, is a good hair tonic and hair darkening lotion.

Traditional applications, the recommended dosage is 1 pepper seed per day (equivalent to 50 mg.); however, at present, there are many manufacturers and retailers of *Pueraria mirifica* who do not know, or do not believe in the appropriate dosage and give incorrect instructions to consumers. This not only destroys the benefits of *Pueraria mirifica*, but also creates adverse effects from the usage of this plant. The benefits of *Pueraria* are based on taking an optimum dosage.

Utilities of *Pueraria mirifica* described in the previous section are from Thai folkloric knowledge of herbal medicine. It is fortunate that this knowledge is now being confirmed by scientific studies for efficacy and safety. Smith Naturals is very active in this field. It has funded various studies related to *Pueraria mirifica* such as a chronic toxicity study, a clinical study in humans, a contraception and growth promotion study in animals and a study of the effects of *Pueraria mirifica* on estrogen receptor (E, R.) positive and E. R. negative breast cancer cell lines and normal breast cells. These studies may be published in the near future.

According to its various benefits, *Pueraria mirifica* is a miracle herb of Thailand that should be promoted by the government and Thai people. It has a great potential to become a commercial crop.

Possible negative effects from using *Pueraria mirifica*

Negative effects of *Pueraria mirifica* can possibly be derived from three factors:

1. Misidentification of *Pueraria mirifica* from the crude supplier, from mixing other species of *Pueraria* in to the mixture.
2. Non-standardized manufacturing processes of the manufacturer, such as unqualified standardization process, high microbiology count in the finished product above acceptable levels, established by WHO.
3. Inappropriate application, such as overdosing.

Important chemical constituents in *Pueraria mirifica*

Chemical constituents in *Pueraria mirifica* can be categorized in to five groups as the following:

1. Coumarins : Coumestrol, Mirificoumestan, Miricoumestrol glycol, Miricoumestan hydrate,
2. Flavonoids : Daidzein, Daidzin, Genistin, Genistein, Kwakhurin, Kwakhurin hydrate, Mirificin, Puerarin, Puerarin-6 monoacetate
3. Chromene : Miroestrol
4. Steroids : Beta-sitosterol, *Pueraria mirifica* sterol
5. Others : *Pueraria mirifica* glyceride, Sucrose

There may be other important chemical substances in *Pueraria mirifica* that have not yet been identified. Miroestrol is the most outstanding substance exhibiting estrogenic effect right now, followed by Coumestrol and Genistein, and Daidzein respectively.

Pueraria from different sources have its own uniqueness in character. It contains different chemical constituents in different quantities. Therefore, similar research studies using *Pueraria* from different sources, may lead to different results.

Accurate botanical identification and standardization are the only mechanisms to control quality of *Pueraria mirifica*. To achieve consistent product quality, the manufacturer has to use only one species of *Pueraria*, from one location, and then conduct toxicity testing and efficacy studies of that *Pueraria*. Assuming the location of the plant has no relationship with the quality of the product, is fallacious and unacceptable by international standards.

Determining factor of quantity of active ingredients in *Pueraria mirifica*

1. Species
2. Source and location
3. Atmospheric conditions
4. Age of the plant
5. Harvesting period
6. Drying process and storage
7. Production process

HPLC examination on *Pueraria mirifica*

HPLC examination on *Pueraria* in the past two years shows that:

- *Pueraria* of the same species, location* and harvesting period have the same fingerprint, but different peak heights. It suggests that *Pueraria* possesses the same chemical constituents and in the same ratios, but in different quantities.
- *Pueraria* of the same species, location*, but different harvesting period, have greater differences in the quantity of actives, than the first group.
- *Pueraria* of the same species, from different locations*, but the same harvesting period, are slightly different in the fingerprint and in peak heights. It suggests that there are small differences in chemical constituents and ratios. The quantity of the active ingredients is different (up to 4 times). They may have non-significant differences in efficacy and toxicity.
- *Pueraria* of the same species, but different location*, and different harvesting period, may have differences in the level of the active ingredient, up to 20 times.

- *Pueraria mirifica* of different species, different location, and different harvesting period such as *Pueraria mirifica* and *Pueraria candollei*, have different fingerprints, and peak heights. It suggests that level of active constituents and the ratio are different. We can say that *Pueraria* in this group have different active ingredient levels.

*Location refers to the same geographical proximities such as district, amphor, village or mountain, depending on natural proliferation of *Pueraria* in each location

From this information, it is possible that *Pueraria* from one supplier may be more effective, or less effective than *Pueraria* from another supplier by 20 times. Therefore, it is not surprising to find many petitions to the government from consumers of *Pueraria*, that these products are not effective (due to low active ingredients) or create side effects (when too potent). For example, a consumer launched a complaint to (Thailand) FDA that after taking a *Pueraria* product from one company at 900 mg / day (according to the company's instructions), she experienced a migraine headache and vomiting.

To prevent such incidents in the future, manufacturers and retailers of *Pueraria* have to know more about the plant and share product information. *Pueraria mirifica* may be Thailand's miracle herb, but without knowledge and standards of manufacturing, it will only be another mediocre herbal product from Thailand, in the international market.

Future development of *Pueraria mirifica*

From what has been stated, problems in using *Pueraria mirifica* as a dietary supplement and in cosmetics, derived from inaccurate plant identification and inadequate mechanisms to control product quality, the following measures are suggested to develop *Pueraria* products, to a world standard.

1. Accurate botanical identification of *Pueraria mirifica*
2. Full characterization of *Pueraria mirifica*
4. Full efficacy and toxicity study of identified and characterized *Pueraria mirifica*
5. Clinical studies in humans
6. Dissemination of information of *Pueraria mirifica* to the public, protecting *Pueraria* in forests from overuse, while promoting plantations in local villages.

Fortunately, the Department of Medical Science, Ministry of Public Health understands the importance of such measures and has organized a group of experts on *Pueraria*, to tackle the problems and to promote this plant to the world market.

Standardized product

Smith Naturals Co., Ltd. uses genuine *Pueraria mirifica* certified by Forest Department, Ministry of Agriculture (matched with the herbarium specimen at BKF No. 085652) in its products. Moreover, Smith Naturals is the only company in Thailand to achieve standardizing *Pueraria mirifica* extract, by controlling the quantity of Miroestrol in both powdered and liquid extracts.

The study comparing the estrogenic-like effect of Smith Naturals' standardized powder extract to Progynova, a hormone replacement medication available in local markets, suggests that 50 mg. the powder extract, exhibits estrogenic-like effect equivalent to 200-300 microgram of Progynova.

Shering Co., Ltd. the manufacturer of Progynova indicates that for hormone replacement therapy, one needs 1000-2000 micrograms of Progynova per day, which is equivalent to 200-400mg. of Smith Naturals', standardized extract. Therefore, 50 mg. per day* of *Pueraria mirifica* extract, is 4-8 eight times lower than the dosage used in hormone replacement therapy and is safe and effective, used as a dietary supplement and in cosmetics.

Special appreciation to

Dr. Tawatchai Wongprasert, taxonomist of the Forest Department for botanicals knowledge.

Dr. Surapote Wong-yai, Professor at the Faculty of Pharmacy, Rangsit University, for knowledge in Chemistry and HPLC.

Dr. Yuthana Smitasiri, Professor at Mae-Fah Luang University, for additional information and making this to be a complete writing piece.

*50 mg. per day of *Pueraria mirifica* is also the recommended dosage of the Department of Medical Science for menopause females.

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