Review Article

Misai Kuching: A Glimpse of Maestro

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ABSTRACT

Orthosiphon stamineus Benth. is a medicinal herb belonging to the family Lamiaceae, grown in Southeast Asia. Leaves of this plant are used commonly in Southeast Asia and European countries for herbal tea, well known as "Java tea". Traditionally leaves of this plant have been used as diuretic, and to treat rheumatism, abdominal pain, kidney and bladder inflammation, edema and gout. Studies have shown that the *O. stamineus* leaves exhibit a range of pharmacological properties such as, anti-inflammatory, antioxidant, anti-bacterial, antiangiogenetic properties. Above all, the plant has synergistic bio-enhancing ability for tamoxifen against human breast cancer. The herb has been shown to be exceptionally safe with no toxicity in vitro and in vivo. This review emphasizes the systematic investigation in pharmacological properties of *O. stamineus*, which could be the potent source of novel herbal curative medicine for critical human diseases.

Keywords: *Orthosiphon stamineus*, lamiaceae, misai kucing etc.

INTRODUCTION

Plants used in traditional medicine are very important to humans. The practise of using medicinal plants as a source of natural medicine is as old as mankind. Most of the communities in every country do have traditional medicine also known as indigenous or folk medicine, where various herbs are extensively used to treat several primary health ailments. One of such herb is Orthosiphon *stamenius* or 'misai kucing', believed to have originated from Southeast Asia countries such as Thailand, Indonesia, the Philippines, Malaysia and Brunei. The plant can be commonly found growing in open areas for example at roadsides and wastelands either in the lowlands or highlands. This plant has been identified as one of the potential herbs to be grown on a commercial scale due to its easy planting. 'Misai kucing' began to interest researchers as early as the beginning of the 20th century when the plant was introduced to Europe and became a popular herbal tea.[1]

Morphological Features

The name 'misai kucing' was given based on the morphological features of the flowers. One of its unique features is the presence of long filaments resembling cat's whiskers. In Malaysia, two varieties have been identified based on the colour of the flowers. One variety has white flowers (MOS 1) while the other has dark purple flowers (MOS 2). The growth pattern for both varieties varies. MOS 1 has bigger canopy, taller and has more robust growth as compared to MOS2.[1] O.stamineus is a herbaceous shrub, belonging to the family Lamiaceae, which grows to a height of 1.5 m. The leaves are arranged in opposite pairs. They are simple, green, and glabrous with a lanceolate leaf blade and a serrate margin. The leaf apice is acuminate with an acute leaf base. The petiole is relatively short, about 0.3 cm in length and reddish purple in color. The stem is quadrangle, reddish in color, erect and with profuse branching. The plant is distributed throughout Southeast Asia and tropical Australia. Although it looks similar to peppermint, the plant has a dry, salty, bitter taste. The flowers are borne on verticils about 16cm in length. The terminal inflorescence is borne on a maroon pubescent. Bracts are green minute (1-2mm), caudiform in shape and two bracts normally holds a cluster of 5 flowers. The flowers are campanulate in shape, white bluish in color with long farexerted filaments, making the flowers look like cats whiskers. The flowers are hermaphrodite in nature, about 6.2m in length (including the stamens) with very irregular flower symmetry. There are two calyx lobes, which are greenish red in color, measuring about 6 mm in lengths and partially gamosepalous. One of the calyx margin is toothed and the other one entire, both covered with minute white hairs. There are two corolla lobes, which are partially gamopetalous and covered with minute hairs. The corollas are light violet in color with lobes much shorter than the corolla tube. The corollas are bilablade in shape with fringed margins. The labellum is light violet in color, hairy and pinkish on the under surface. There are 4 stamens which are inserted near the base of the corolla tube. The stamens are unequal in length, measuring from 4.7cm to 5.2cm. There is a single, central, terete style with a clavate stigma. [1, 2]

Chemical constituents

Chemically speaking, naturally the plant is bestowed with high amount of flavones, polyphenols, bioactive active

proteins, glycosides, a volatile oil, and vast quantities of potassium. Earlier studies reported bioactive pentacyclic triterpenes betulinic acid, oleanolic acid, ursolic acid and β-sitosterol from the leaves of this plant. [3] More than twenty phenolic compounds were isolated from this plant including lipophilic flavones, flavonol glycosides and caffeic acid derivatives such as rosmarinic acid and 2, 3-dicaffeoyltartaric acid, were identified and quantified by HPLC. [4] Recently we reported a rapid, quantitative and simultaneous HPLC-based determination of major phytochemicals from the extract of O. Stammineus leaves and reconfirmed its strong antioxidant potency and total phenolic content. [5]

Unlike modern pharmaceuticals, medicinal or functional plants contain numerous complex active phytochemicals (plant chemicals). Take a look at the list present in Misai Kuching. Phytochemicals, have been identified to have beneficial effects as shown in table 1. The British Pharmacopoeia and the European Pharmacopoeia have detailed analytical procedures for the testing of Java Tea (Misai Kuching) where Sinensetin is assumed as the marker i.e. the most important phytochemical.

Table 1: List of chemical constituents

Flavonoid compounds	Sinensetin, Tetramethylscutellarein, Eupatorin, Salvigenin, Cirsimaritin, Pilloin, Rhamnazin, Trimethylapigenin, Tetramethylluteolin.
Diterpene Compounds	Orthosiphonone, Orthosiphonone B, Orthosiphol A, Orthosiphol B, Orthosiphol F, Orthosiphol G, Orthosiphol H, Neoorthosiphols A, Orthosiphol B, Staminol A.
Benzochromenes	Orthochromene A, Methylripariochromene A, Acetovaillochromene
Essential oils	β-elemene, β-caryophyllene, α-humulene, β-caryophyllene oxide, Can-2-one, Palmitic acid

Botanical Names

Orthosiphon stamineus Benth, *O. aristatus* Blume

Common Names

Malaysia	Misai Kucing
English	Java tea
Indonesia	Remujung, Kumis Kucing.
Phillipines	Balbas –Pusa.
Thailand	Yaa nuat Maeo.
Family	Euphorbiaceae

Other names for *O. stamineus* include: Orthosiphon aristatus, Orthosiphon spicatus, Orthosiphon blaetter, Java tea, Misai kuching, Kumis kucing, Indischer Nierentee, Feuilles de Barbiflore, and de Java. [6]

The many health benefits that have been reported include:

1. It has properties that enables it to be used to regulate the blood sugar hence is used as an alternative treatment for diabetes.
2. This herb inhibits blood platelet from sticking together and has powerful hemolytics that can lower blood pressure thus making it an alternative treatment for high blood pressure as well as for reducing cholesterol, which is often used in traditional medicine.
3. This herb has the ability to clean toxins within the blood hence it is also used in traditional herbal medicine in the process of detoxification and in removing metabolic waste within the body. This in turn makes it a useful addition to weight loss efforts.
4. It also has diuretic properties making it beneficial in the treatment of kidney stones and for flushing the kidney and urinary tract. It helps to flush out the uric acid as well as block the production of uric acid. This in turn also helps other conditions such as gout and inflammation of joints due to high uric acid levels in the body.
5. Another health property of this herb is its ability to act as an anti-inflammatory hence its use in the herbal treatment for arthritis and rheumatism.
6. A traditional preparation for the relief of joint aches and stiffness.[7]

PHARMACO-MEDICINAL SIGNIFICANCES

Kidney stones and gout

Deposition of precipitates of calcium oxalate crystals lead to the condition commonly known as kidney stones, which can be easily diagnosed by radiological studies or ultrasound examination. This kind of crystal is difficult to be dissolved and expelled successfully out from the body with clinical therapy; however certain medications proved to be act as prophylactic agents in preventing the calcium stones if they have a propensity to recur. Kidney stones can also be caused by abnormality in uric acid metabolism. Uric acid is a common component of urinary and renal calculi (kidney stones). Diuretic action is the prerequisite quality which has to be possessed by the medicine use as a curative for kidney stones of this type. The phytochemicals **Sinensetin** and the **Tetramethoxy-flavones *"relaxes"*** the muscles of walls of the internal vessels thus facilitating easier flow of urine and even the small particles that become stones. **Methylripariochromene A** was found to affect increased urinary flow and the excretion of sodium ions .An increase in the volume of fluid flowing through the kidney will help in dissolution of the stones, assisting their flushing out from the body without further retention, and deposits. Several studies provide a scientific evidence for the traditional use of *O. stamineus* in the treatment of kidney stones and gout. *O. stamineus* appears to enhance

the activity of adenosine A receptor antagonists, and in turn stimulate the kidney for excessive flow of urine and thus sodium and other ions excretion. Similarly, another study reported that *O. stamineus* reduces levels of uric acid in rodents.[8]

Removes metabolic waste

Rheumatism and gout are the bane of many elderly in this modern age due to increased meat/protein consumption and a sedentary life. These conditions involve a build-up of acid and metabolic wastes within the muscles and joints. This leads to reduced circulation around joint which results in painful swelling in addition, in time may lead to joint destruction.

As antipyretic

A recent study reported another remarkable property of *O. stamineus*. Researchers chemically induced body temperature in experimental rodents then treated them *O. stamineus*. The extract significantly lowered the hyperthermia. The effect was observed within 4 h of the treatment. The fever-reducing efficacy of *O. stamineus* was comparable with that of standard drug acetaminophen.[9]

Anti-inflammatory and Analgesic agent

Several research studies also reported the anti-inflammation and analgesic activity of *O. stamineus*. Researchers chemically induced edema in the hind paws of rats. Then the animals were administered with the extract of *O. stamineus*. The extract significantly reduced the edema 3 and 5 h after the swelling was induced. In addition, *O. stamineus* also exhibited significant pain-killing activity. According to the study, the results of the provided supportive evidence about *O. stamineus* has as anti-inflammatory and non-narcotic analgesic agent. These findings justify the traditional medicinal uses of the plant to cure pain and inflammation.[10]

As antimicrobial and antioxidant

Recently, several researchers[11,12] reported the antimicrobial against Vibrio parahaemolyticus, Streptococcus mutans, and antioxidant activities of *O. stamineus*. Several different extracts of the *O. stamineus* were tested for antimicrobial and antioxidant activities against selected food-borne bacteria in vitro. Whole *O. stamineus* plants (powdered) were extracted using various concentrations (0%, 25%, 50%, 75%, and 100%) of methanol. *O. stamineus* extracted with 50% methanol, 75% methanol and fraction 5 of a 50% methanolic extract demonstrated inhibitory activity against Vibrio parahaemolyticus.[12]

As a hepatoprotective agent

In one of the preliminary study[13] it is reported that due to the strong anti-oxidant property of *O. stamineus* it exhibits hepatoprotective effect in rats. Latter, the bilirubin lowering potential of *O. stamineus* was evaluated in jaundiced rats. Treatment of these rats with aqueous extract of *O. stamineus* for three days reduced the bilirubin level significantly to the normal value. Whereas smaller dose (50 mg/kg body weight) resulted in the reduction in bilirubin level nearly half when compared to the control. Therefore, *O. stamineus* aqueous extract can be used to reduce bilirubin concentration to a normal level in jaundiced subjects.

As a hypoglycemic agent

The effects of *O. stamineus* on plasma glucose concentration and lipid profile in normal and streptozotocin-induced diabetic rats were investigated. In oral glucose tolerance test, the extract significantly decreased plasma glucose concentration in a dose-dependent manner in both normal and diabetic rats. The extract at 1.0 g/kg was most effective in decreasing plasma glucose concentrations and the response was closed to the result of glibenclamide (5 mg/kg). After repeated daily oral administrations of the extract for 14 days, the extract significantly reduced plasma glucose concentration in diabetic rats at days 7 and 14. By the end of the study, plasma triglyceride concentration was lower in the extract-treated diabetic rats than untreated ones. Furthermore, plasma HDL-cholesterol concentration was significantly increased in diabetic rats treated with the extract. More recently, studies have shown that **Trimethylapigenin, Eupatorin** and **Tetramethylluteolin** were the most effective phytochemicals in Misai Kuching producing this effect. In perfused rat pancreas, the extract did not increase insulin secretion in the presence of 5.5 mM glucose, but 100 g/ml extract potentiated glucose-induced insulin secretion. These findings suggested that *O. stamineus* is effective for alleviating hyperglycemia and improving lipid profile in diabetic rats.[14]

Unlike some pharmaceutical diuretics, which are thought to increase the risk of diabetes by promoting glucose intolerance, *O. stamineus* can actually maintain blood sugar levels. When the extract was given to normal and diabetic rats, it significantly decreased plasma glucose concentration in a dose-dependent manner. After repeated daily oral administrations of the extract for 14 days, the extract significantly reduced plasma glucose concentration in diabetic rats at days 7 and 14. By the end of the study, plasma triglyceride concentration was lower in the extract-treated diabetic rats than untreated ones. Furthermore, plasma HDL-cholesterol concentration was significantly increased in diabetic rats treated with the extract. “Our findings suggested that *O. stamineus* aqueous extract is effective for alleviating hyperglycemia and improving lipid profile in diabetic rats,” the researchers wrote.[15]

Antifungal and antibacterial

If you have urinary tract infections [whether due to fungal or bacterial causes], drink Misai Kucing tea to treat the condition.

Synergistic enhancer to tamoxifen

One of our lab findings reported the interesting effect of *O. stamineus* with tamoxifen towards estrogen dependent human breast cancer. It enhances the cytotoxic efficacy of tamoxifen to about 5 folds against the breast cancer cell line (MCF 7). These findings concluded that, the *O. stamineus* may probably exert the anti-estogenic effect.

Sinensetin and **Tetramethylscutellarein** have shown activity against some class of tumour cells, where sinensetin was shown to be more effective than tetramethylscutellarein. **Orthosiphols A and B** have been reported to inhibit tumour promoter 12-O-tetradecanoylphorbol–13–acetate (TPA) in experiments with laboratory mice. Extracts of Misai Kuching leaves have been reported to have activity against skin cancer. Recently **Sinensetin** has received significant attention in cancer research as it is shown to be an effective **chemosensitizer**. Chemosensitizers are materials that enhance the therapeutic effects of chemotherapy drugs, particularly with MDR (multi drug resistant) cells. [16]

An anti-angiogenic agent

Our previous study [17] demonstrated that *O. stamineus* significantly suppressed the sprouting of neovascularization of microvessels from the excised thoracic rat aorta, when cultivated in specialized 3-dimensional media in presence of the extract. Further studies revealed that, the extract has remarkable inhibitory activity on angiogenesis by blocking VEGF signaling pathway. [17]

In general health maintenance

A study [18] suggests that *O. stamineus* may be as protective to the liver as it is to the kidney. Researchers treated rats with *O. stamineus* then induced liver toxicity in the rodents. The botanical dose-dependently reduced the necrotic changes in the liver and inhibited the increase of serum ALT and AST activities. *O. stamineus* also acted as a powerful antioxidant and free radical scavenger.

Premium Misai Kuching Tea

It must be emphasized that all of the above findings show that the effects are mild (with normal dosage) as compared to the effects of modern drugs and cannot be relied on as treatment. However unlike modern drugs, Misai Kuching has no known or reported side effects. Although the extracts of Misai Kuching are used in medicinal formulations by some European companies, **Kuching Herbal Tea** is promoted, only as functional food. It is especially recommended for people with a family history of the mentioned ailments.

So there you have it – the simple, safe, natural path to good health. Drink a cup or two of Kuching Herbal Tea daily. You will surely appreciate and enjoy it. However, we would like to advise you that **not all Misai Kuching tea that is being marketed are the same**.

In balancing nitric oxide Levels

Nitric oxide (NO) is an important molecule that signals the blood vessels to relax and acts in many tissues to control a diverse range of physiological functions. When certain cells are activated by specific proinflammatory agents such as endotoxins, tumor necrosis factor (TNF), interferon-gamma (IFNg), and interleukin-1 (IL-1), NO is produced and protects the host by damaging pathogenic DNA. Balanced amounts of nitric oxide are essential to optimal health because just as normal amounts of NO promote health, the excessive production of NO that can occur during the inflammatory process can have detrimental effects on many organ systems of the body, which can lead to tissue damage. Therefore, inhibiting NO accumulation by inflammatory stimuli can result in overall benefits. *O. stamineus* has been shown to inhibit levels of nitric oxide in macrophages that were stimulated with inflammatory endotoxins, indicating that the botanical can help support healthy levels of nitric oxide and reduce one of the harmful effects of inflammation. [19]

Safety of *O. stamineus*

O. stamineus has been extensively studied in rodents with no signs of toxicity. In a 2008 study, researchers administered the botanical orally to rats for 14 days and compared it to a control group receiving distilled water. The four test groups were treated with 0.5 g/kg, 1 g/kg, 3 g/kg and 5 g/kg body weight of *O. stamineus* respectively. No lethality or adverse toxic signs were seen during the experimental period. The study concluded that *O. stamineus* within these range and treatment duration would not cause any severe toxic effects and organ damage in rats. Individuals in Malaysia, Vietnam and Japan have consumed *O. stamineus* for centuries, further supporting its safety. Furthermore, recently the herb has been shown to be exceptionally safe with no toxicity in vitro and in vivo. [20]

CONCLUSION

It is apparent that Misai Kuching is emerging as a new crop plant. However systematic agronomic study of this new emerging herb is necessary for its effective utilisation.

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