

# Piper Sarmentosum Roxb.: a mini review of ethnobotany, phytochemistry and pharmacology

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## Botanical aspects of Piper Sarmentosum

The *Piper* species are one of the well-presented genera, mostly grown as woody perennial climbers. They are rarely found as shrubs with enlarged or puffy nodes and stipules. The leaves of various *Piper* species are naturally aromatic and have a pungent smell. The flowers are very tiny, usually arranged in spikes, without perianth.<sup>1</sup> *Piper* species could also be identified by its pulpy fruit, consisting of 2 to 6 stamens, and one-celled ovary with orthotropic ovule, which means it, is growing straight so that the micropyle is at the end opposite the stalk. *Piper sarmentosum* is a wild growing herb with long creeping stems.

The leaves are alternate and heart-shaped. Young leaves usually have a waxy surface and is light green in color. It produces small, white flowers in the form of spikes, which are located at the terminal or leaf opposite the spikes.<sup>2</sup> The flower has a unisexual ovary. The fruits

are big, sweet tasting when ripe, turn black on maturity, dry, and have several rounded bulges. The plant has a pungent odor. In addition, the *P. sarmentosum* species has good ornamental value, which is popular in urban landscape gardens as ground covering shrubs with a root and sprouts at each node and can be grown in pots as bushes by pruning the creeping branches. The bushy, abundant procumbent branches are about 40-50cm in height and the fruiting season is between October and December.<sup>3</sup> In Malaysia, the plant grows wild; however, it also grows as a weed in villages and places with plenty of shade.

## Biology

*Piper sarmentosum* is easy to grow. It is propagated through vegetative cuttings where it spreads from the fragments and rhizomes that have a root and sprout at each node<sup>4</sup> and the discarded cuttings are quick to develop roots. The plant grows in a humid, warm spot in the shade, and grows well in rich and damp soil in secondary forest, near sea level at 1000m and requires good drainage.

## Distribution

It has been estimated that there are 1200 species of *Piper* distributed throughout the pantropical and Neotropical regions of the world of which more than 400 species have been recorded in the Malaysia region.<sup>5</sup> This species is widely cultivated in tropical and subtropical countries.<sup>6</sup>

## Importance

*Piper sarmentosum* is popular due to its culinary and medicinal properties. *Piper sarmentosum* has been used traditionally in different parts of the world to cure many diseases and ailments.<sup>7</sup> The plant contains constituents like alkaloids (amide, pyrones, flavonoids), as reported by Tuntiwachwutitkul et al.<sup>8</sup> It has also been reported to possess pharmacological properties like anti-cancer,<sup>9</sup> hypoglycemic,<sup>10</sup> anti-tuberculosis,<sup>11</sup> antioxidant<sup>12</sup> and antimalarial.<sup>13</sup> A result from a recent study also provided experimental evidence for the application

Sharifah Farhana Syed Ab Rahman,  
Kamaruzaman Sijam, Dzolkhifli Omar

Department of Plant Protection, University of Putra Malaysia, Malaysia

**Correspondence:** Sharifah Farhana Syed Ab Rahman, Department of Plant Protection, Faculty of Agriculture, University of Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia, Tel 60389474846, Fax 60389381014, Email shr.farhana@gmail.com

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of *P. sarmentosum* in botanical pesticides.<sup>14</sup> Due to all these properties, the plant has great potential to be commercialized as a medicinal plant in South-East Asia, particularly Malaysia.

## Ethnomedicinal uses and report on uses of P.sarmentosum in traditional medicine

Today, herbal medicine has become popular all over the world. Many people use herbal remedies in their daily life, especially in developing countries, because of the absence of harmful or unfavorable effects and their cost effectiveness.<sup>15</sup> *Piper* species are widely distributed in the tropical and subtropical regions of the world and have numerous applications in different traditional medicines. For instance, in ancient Chinese medicine, many species are used to treat inflammatory diseases.<sup>16</sup> In the southern part of Thailand, the water mixture of the whole plant of *P. sarmentosum* is used to treat patients with diabetic disease<sup>10</sup> and the crude extract is also reported to help in reducing the blood glucose level of onset diabetic patients.<sup>17</sup> *Piper sarmentosum* has also been used as a carminative and to relieve coughs and muscle pain,<sup>18</sup> while the fruits and leaves are used as an expectorant.<sup>19</sup>

*Piper sarmentosum* leaves and roots aid in relieving headaches when applied to the forehead while the decoction of the plant helps to cure muscle weakness and pain in the bones.<sup>20</sup> In Indonesia, *P. sarmentosum* is used to treat coughs and asthma by chewing the rootlets with betel nut and swallowing the juice. The rootlets are also chewed with nutmeg and ginger to treat pleurisy or with only ginger to treat toothache.<sup>20</sup> In addition, warm leaves coated with coconut oil are applied to ease painful chests and are also used by rheumatic patients to relieve the pain.<sup>21,22</sup> The plant has been shown to have antiplatelet aggregation,<sup>23</sup> antibacterial,<sup>24</sup> antiplasmodial activity against *Plasmodium falciparum* and *Plasmodium berghei*,<sup>13</sup> antioxidant and superoxide scavenger<sup>12</sup> and an antiprotozoal effect against *Entamoeba histolytica*.<sup>25</sup>

In folk medicine, the plant has been applied as a cure for headaches, asthma and joint aches, toothache and to reduce fever in influenza patients.<sup>12,20,26</sup> Based on the use in traditional medicine, this plant has demonstrated anti-inflammatory, antinociceptive and antipyretic activities. The crushed leaves of *P. sarmentosum* are mixed into water and used for bathing to treat kidney stones and difficulty in urination.<sup>27</sup>

Wei-quan et al.<sup>28</sup> discovered that essential oil from the leaves of *P. sarmentosum* demonstrated strong repellent and antifeedant effects against larvae and imagoes of the diamondback moth. Three amides, identified as 3-(3',4',5'-trimethoxyphenylpropanoyl) pyrrolidine, 3-(4'-methoxyphenylpropanoyl) pyrrole, N-(3-phenylpropanoyl) pyrrole and a sterol,  $\beta$ -sitosterol are the four compounds yielded from the phytochemical investigations of *P. sarmentosum*, all of which were found to have activity against gram-positive bacteria.<sup>29</sup>

### Chemical constituents of plants from Family Piperaceae

Investigations on the phytochemical of *Piper* species demonstrated the isolation of a number of classes of physiologically active compounds, such as amides, alkaloids, flavonoids, pyrones, dihydrochalcones, phenylpropanoids, lignans and neolignans.<sup>30</sup>

Previous studies demonstrated that various parts of this plant contain many biologically active compounds, such as guineensine, brachystamide B, brachyamide B, sesamin, 1-piperirrettyl pyrrolidine, 3',4',5'-trimethoxycinnamoyl pyrrolidine, ( $\pm$ ) asaricin and methyl piperate,<sup>26</sup> asaricin,  $\alpha$ -asarone<sup>31</sup> hydrocinnamic acid,  $\beta$ -sitosterol,<sup>32</sup> longifolene,  $\beta$ -caryophyllene, allo-aroma-dendrene, 9-epi-(E)-caryophyllene,  $\beta$ -asarone, viridiflorene and  $\beta$ -selinene, sarmentine, sarmentosine,<sup>33</sup> vitamin C, E and carotenes.<sup>34</sup>

Several compounds have been isolated from the fruits and leaves of this plant, which are the aromatic alkene, 1-allyl-2-methoxy-4,5-methylene-dioxybenzene,  $\beta$ -sitosterol, pyrrole amid, pellitorine, sesaminhirs field in, two pyrrolidine, amides and guineensine and brachystamide, all of which showed positive antibacterial activities.<sup>8</sup> In addition, Masuda et al.<sup>31</sup> reported four known phenylpropanoids isolated from the leaves of *P. sarmentosum*; namely, 1-allyl-2,6-dimethoxy-3,4-methylenedioxybenzene, 1-allyl-2,4,5-trimethoxybenzene, 1-(1-E-propenyl)-2,4,5-trimethoxybenzene and 1-allyl-2-methoxy-4,5-methylenedioxybenzene, which exhibited antimicrobial activity against *Escherichia coli* and *Bacillus subtilis*.

Twenty constituents from *Piper* species have been identified in a previous study by methods of TLC, HPLC-DAD and GC-MS. Most of the constituents found were amides with a variety of amine moieties. They were pellitorine, and four higher homologues, piperlonguminine, dihydropiperlonguminine, futoamide, and chingchengenamide; and the retrofractamides A, B and D, piperanine, piperine, piperdardine, sarmentine, pipataline and benzyl benzoate.<sup>16</sup> In a study conducted by Bokesch et al.,<sup>35</sup> a new alkaloid, langkamide, was isolated from the dichloromethane: methanol extract of *P. sarmentosum* roots and stems.

It is suggested that more investigations should be performed on the reported compounds from *P. sarmentosum* to elucidate their pharmacological and antimicrobial activities thoroughly as this will help us broaden the scope to identify and develop the candidates for new drug or bio formulations in treating human diseases as well as plant diseases, respectively.

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### Conflicts of interest

The authors declare there is no conflict of interests.

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