

## Butterfly pea: A biological source of vitamins

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### ABSTRACT :

From ancient time the butterfly pea is used as an anesthetic agent and also used for treating headache, inflammation, skin disease, liver, kidney, indigestion and intestinal problems. *Clitoria ternatea* (Family: Fabaceae) or butterfly pea flower is widely used as a decorant and food colorant. Butterfly pea or *Clitoria ternatea* is one of the traditional plants used as a "shankh pushpi". Ayurvedic medicinal plants used as neurological boosters. This plant contains properties like alkaloids, flavonoids, taraxerol, taraxerone etc. as active constituents. In this article we review the uses, chemical activities and extraction methods for butterfly pea flower.

### INTRODUCTION:

*Clitoria ternatea* belongs to the kingdom Plantae, phylum Tracheophyta, class Magnoliopsida and family Fabaceae<sup>1</sup>. It is commonly used as an ornamental plant and is also used as a revegetation species while in Southeast Asia the blue flower pigment is traditionally used as a food colorant<sup>2</sup>.<sup>3</sup> The unique feature of anthocyanins present in blue pea flowers is the high abundance of

polyacylated anthocyanins known as ternatins. Ternatins are polyacylated derivatives of delphinidin 3,3',5'-triglucoside. A comparison of blue pea flower anthocyanins with two other natural blue coloring agents used in the food industry, spirulina or phycocyanin and genipin-derived pigments is also covered. Anthocyanins from blue pea flowers are promising natural blue food coloring agents.<sup>4</sup> *Clitoria ternatea* (butterfly pea) has attracted significant interest based on its agricultural and medical applications, which range from use as a fodder and nitrogen fixing crop, to applications in food coloring and cosmetics, traditional medicine and as a source of an eco-friendly insecticide. Butterfly pea flower (BP) is a rich source of bioactive components and can potentially be utilized to produce appealing, wholesome foods. Antioxidant and dietary fiber-enriched breakfast cereals were produced by extrusion cooking using blends of BP and yellow pea flour (YP). BP was added to YP at 0%, 5% and 10% levels (w/w), respectively, and extruded at two temperature profiles with die temperatures of 130 and 150 °C.



**Morphology:**

*Clitoria ternatea* is an ornamental perennial climber, twining fine stems, up to 2-3 m in height, growing wild and also in gardens, bearing conspicuous blue or white flowers resembling a conch-shell. The root system consists of a fairly stout taproot with few branches and many slender lateral roots.<sup>6</sup> The thick horizontal root, which may grow to more than 2 m long, bears one to several purplish, glaucous, wiry stems. The leaves are pinnate, petioles 2-2.5 cm long; stipules 4 mm

long, linear, acute. Leaflets 5-7, sub coriaceous, 2.5-5 by 2-3.2 cm, elliptic-oblong, obtuse or caute; stipules filiform. The flowers are solitary, deep blue to blue, mauve or sometimes white, with an orange center, very short pedicellate and 4-5 cm long. The pods are flat, linear, beaked, 6-12 cm long, 0.7-1.2 mm wide 5,6 and slightly pubescent with up to 10 seeds. The seeds are yellowish-brown or blackish in color and sub-globose or oval in shape, 4.5-7.0 mm long and 3-4 mm wide<sup>6,7,8</sup>

**Biological activities:**

*Clitoria ternatea* flower contains a significant amount of phytochemicals which exhibits great antioxidant, anti-microbial, antidiabetic, anti-inflammatory and antiproliferative/anticancer properties,<sup>9, 10, 11, 12, 13</sup>. Acute toxicity study using albino Wistar rats treated orally with aqueous ethanol extract (2000 mg/kg bodyweight) of the flower showed no signs of mortality or abnormality and there was no significant difference in the haematological values. The extract did not display acute toxicity effects and are safe for consumption<sup>14</sup>. *Clitoria ternatea* flowers can potentially be utilised as a functional food incorporated into various food products or even as a pharmaceutical supplement/ drug combined with commercial drugs to improve treatment efficacy of patients.

**Nomenclature:**

there are about 60 species of genus *clitoria* which is oriented from the tropical equatorial Asia and later was distributed in south and central America, east and west Indies, Africa and

Australia.<sup>15</sup> The vernacular name of *Clitoria ternatea* is also known as butterfly pea, blue pea, (English), aparajita (Bengali), cunha (Brazilian), lan hu die, lan hua dou (Chinese), aparajit (Hindi), kajroti (India), bunga biru, tembang telang (Indonesian), bunga biru, kacang telang (Khmer), ang san dam, bang san dam (Lao), bunga telang (Malaysian), cunhã, fula criqua (Portuguese), aparajita (Sanskrit), clitoria azul, azulejo, conchitis, bejuco de conchitas (Spanish), kakkattan, sangupushpam (Tamil), nalla ghentana (Telugu), un-chan, uang-chan, dang-chan (Thai), mavi kebek sarmaşığı (Turkish), and chidâu biéc (Vietnamese)<sup>7,8</sup>

**Traditional Uses:**

*C. ternatea* is traditionally used for anti-bacterial<sup>6,16</sup>, anti-fungal<sup>17</sup>, anti-helmintic<sup>18,19</sup>, anti-diarrheal<sup>20</sup>, antioxidant<sup>21,22</sup>, anti-hyperlipidemic<sup>23</sup>, anti-pyretic<sup>24</sup>, anti-inflammatory<sup>25</sup>, and anti-diabetic activities<sup>26,27</sup>, immunomodulatory<sup>23</sup>, wound healing property<sup>28</sup>, hepatic<sup>15</sup>, renal<sup>29</sup>, and urogenital diseases<sup>30</sup>.



### Extraction of phytochemicals:

Extraction procedure of phytochemicals from plant materials is an important step. Various extraction procedures are available and the identification/selection of optimum parameters are important to ensure the enhancement of phytochemical yield<sup>31</sup>. Conventional and non-conventional extraction methods are available having respective advantages over each other thus careful selection of method should be evaluated depending on the suitability of samples and goals needed to be achieved<sup>43</sup>.

### Conventional extraction:

Conventional extraction methods usually involve the use of different solvents with heat and/or mixing such as Soxhlet extraction, maceration and hydrodistillation which though effective can be costly and require long extraction time<sup>31,32</sup>. Conventional extraction method is a classical method which has been widely used for the extraction of *C. ternatea* flower since the 1970s. Extraction studies on *C. ternatea* flower utilizing aqueous solvent mixtures isolated and identified the structure of various phytochemicals mainly anthocyanins<sup>33,34,35</sup> while other studies<sup>36,37,38</sup> focused on the flavonol

constituents. Ultrasound assisted extraction works on the concept of acoustic waves production leading to molecular movement of solvent and sample which facilitates the leaching of organic and inorganic compounds<sup>39,44</sup> compared the effect of short extraction time with ultrasound and long extraction time with maceration for 1–7 days for extraction efficiency of phenolic and flavonoid content using aqueous ethanol. Extraction of phenolic content was more. Although conventional extraction has widely been used for the extraction of these flowers, the use of non-conventional extraction method (ultrasound assistance) has shown to be superior and beneficial for the extraction of phytochemicals. Thus exploration on the use of other non-conventional extraction methods which are considered as “green techniques” would be beneficial in determining extraction efficiency of various phytochemicals. Other studies have employed the use of ultrasound, pulsed-electric field, pressurized liquid and microwave assisted extraction which were more effective than the conventional extraction method for extraction of phenolics and anthocyanins which required shorter extraction time and were also useful in preventing oxidation of compounds<sup>40,41,42</sup>.



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