

A Review on Anti-Stress Activity of Piper Methysticum

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ABSTRACT

On the basis of study conducted on the plant *Piper methysticum* G. (Forst), Piperaceae, it was found that Kava has storage of active constituents present in its roots and rhizomes. Traditionally its root part is used to relax body and mind and promote restful sleep, therefore it is necessary to explore its importance as excellent nervine herb. Literature survey revealed that kavalactones are responsible for biological activity which include local anaesthetic, antispasmodic, Musculo-relaxant, antimycotic, sedative, anticonvulsive, analgesic, antianxiety and neuroprotective effects etc. which proves it has potent psychoactive ability but, the claim of therapeutic efficacy of the plant as an anti-stress or adaptogen yet has not been scientifically scrutinized. However, synthetic drugs are widely prescribed to reduce stress and stress induced symptoms but their soporific effect, risk of dependence and withdrawal effects limits their long-term use. Based on clinical studies Kava shows its efficacy within one week at moderate dose. Evidently, the herbal formulations claimed to enhance physical endurance; mental functions and non-specific resistance to withstand stress without altering the physiological functions of the body hence, it is essential to study its safety and efficacy for its therapeutic use.

Keywords: Anti-Stress, Piperaceae, Traditional, Kava

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INTRODUCTION

Nature always stands as a golden mark to exemplify the outstanding phenomena of symbiosis. Today about 80% of people in developing countries still relays on traditional medicine based largely on species of plants and animals for their primary health care (Chopra et al., 1956). Ancient pharmacopoeias from different regions of the world have recorded numerous herbal medicines purported to have psychotropic potential (Weigant et al., 2009). Indeed, nearly 25% of today's conventional drugs originated directly or indirectly from plants many valuable psychoactive drugs, such as yohimbine, ephedrine, tubocurarine, and galanthamine, were discovered through the study of indigenous remedies (Provino., 2010; Robinson et al., 2009; Thompson et al., 2004). Ayurvedic medicine aims to integrate and balance the body, mind, and

spirit, thus, some view it as "holistic." Ayurvedic medicine also treats specific physical and mental health problems with the aim cleanse the body of substances that can cause disease, thus helping to re-establish harmony and balance (Chopra and Doiphode, 2002). According to Ayurveda Vata, the main dosha (life force), characteristics of body constitutions (prakriti), is susceptible to stress and neurological conditions, rheumatoid arthritis, heart and skin disease, which is aggravated by, fear, grief, staying up late at night, eating dry fruit, or eating habits (Mishra et al., 2001). In Ayurveda, stress and gastrointestinal disturbances are considered to be causative or excitant of a variety of disease (Singh et al., 1991). According to the report of WHO, approximately 450 million people suffer from mental or behavioural disorders like stress responsible for 12.3% of the global burden of disease, and predicted to rise up to 15% by 2020 (Bimlesh Kumar et al., 2011).

PLANT PROFILE

Taxonomical Classification

A significant data on the taxonomy of *Piper methysticum* (Kava)Figure: 1 *Piper methysticum* F.

Kingdom	Plantae – Plants
Subkingdom	Tracheobionta – Vascular plants
Super division	Spermatophyta – Seed plants
Division	Magnoliophyta – Flowering plants
Class	Magnoliopsida – Dicotyledons
Subclass	Magnoliidae
Order	Piperales
Family	Piperaceae – Pepper family
Genus	Piper L. – pepper
Species	<i>Piper methysticum</i> G. Forst. – kava



Figure: 2 Kava Rhizome



Figure: 3 Kava Roots

Morphological Description

Table 1: List of microscopical characterisation of Kava (*Piper methysticum*. F) plant.

Parts	Characteristics	Appearance	Reference
Plant	Dioecious, occasionally monoecious, massive base (crown or short rootstock) from which several shoots arises.	2-4 m tall, woody perennial shrub, rosette appearance	(Orwa et al., 2009; Singh and Blumenthal, 1997).
Stem	Lenticle bearing, swollen nodes and prominent scars left by abscission of leaves and branches	1-3 cm (diameter), erect, green or red brown or dark purple.	(Nelson, 2000; Glover, 2007).
Leaves	Prominent and blades have 11–13 alternate veins originating at the base and 2.5 cm (1 in) long petioles (2–7 cm), margin entire and wavy, apex acute, globous to finely pubescent	Deciduous, heart shaped, 10–30 cm x 8–23 cm, stipules large	(Lebot et al., 1984; Singh, 1992).
Roots	It may eventually become a heavy knotted 8–25 cm wide mass,	60 cm in length and 8 cm in diameter	(Muller and Komorek, 1999; Douglas, 2007).
Internodes	Uniform, mottled, speckled, striated and speckled.	short and thick, long and thin, long and thick	(Nelson, 2000; Johnston and Rogers, 2006).
Rhizomes	Massive, 2–10 kg, branched and juicy with many roots.	Blackish grey outside, whitish inside.	(PDR for Herbal Medicines, 2000; Broderick et al., 2005).
Flowers	Borne on narrow spike, inflorescence type, axillary or opposite but smaller the leaves, small asexual flower.	Sepals or petals (absent) Pendicle (1.5 cm long)	(Davis and Brown., 1999; Lebot et al., 1999).
Spike	Male- numerous flowers with 2 short stamen Female- Flower with single basal ovule in an unilocular ovary topped by a stigma	3–9 cm long	(Orwa et al., 2009; Yarnell., 2007)
Fruit	A berry containing one seed.	-	(Orwa et al., 2009; Lebot et al., 1984)
Organoleptic property	Taste-pungent and numbing Odour-reminiscent of lilac Fracture-mealy and splintery	-	(PDR for Herbal Medicines., 2000)

1.2 Microscopy:

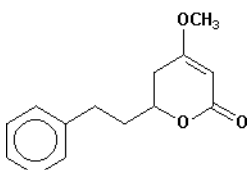
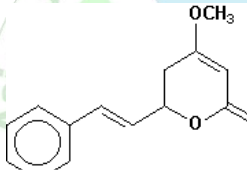
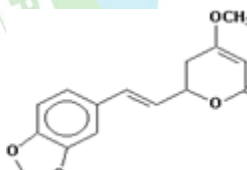
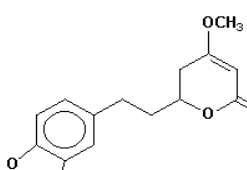
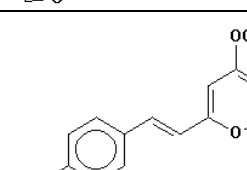
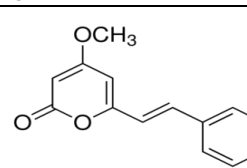
- T.S xylem- small channels with vascular bundles.
- Cross section (xylem)- narrow vessels located around the pith and alternate with large pith rays (Lebot et al., 1999; Orwa et al., 2009). Additional vessels across the pith; xylem has tracheid-like elements. Secretory canals contain a fine, brown resinous mass (Glover, 2007).
- Unpeeled rhizome has a narrow cork-layer (Singh, 1992).

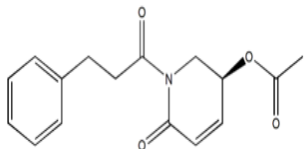
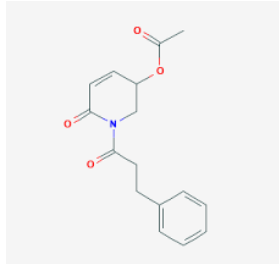
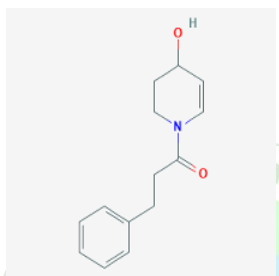
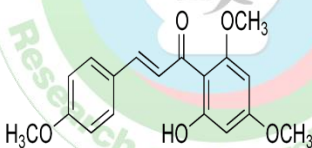
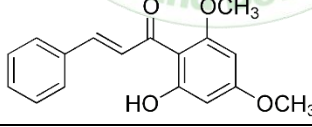
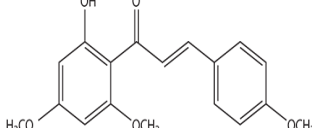
- Primary bark contains rays of collenchyma, tissues, numerous resin and storage cells around the phloem (Lebot, Merlin and Linstorm, 1989).

1.3 Chemical Constituents

Fresh kava root contains on average 80% water. Dried root contains approx. 43% starch, 20% fibres, 15% kava lactones, 12% water, 3.2% sugars, 3.6% proteins, and 3.2% minerals (**Khorassani** et al., 1999).

Table- 2: List of distribution and analysis of chemical profile of Kava plants.

Constituents	Structure	Spectroscopy
A. Resins: Kavalactones (arylethylene-alpha-pyrone-skeleton) (Roots and rhizomes)		
Dihydrokawain		HPLC-8.4 mg; GCMS32.107 m/z
Kawain		HPLC-21.6 mg; GCMS-237.0937 m/z
Methysticin		GCMS-274.0832 m/z
Dihydromethysticin		HPLC-6.3 mg; GC/QTOFMS276.0986 m/z
Yangonin		UV-355-360; HPLC-9.3 mg; GC/QTOFMS258.0884
Desmethoxyangonin		HPLC-11.6 mg

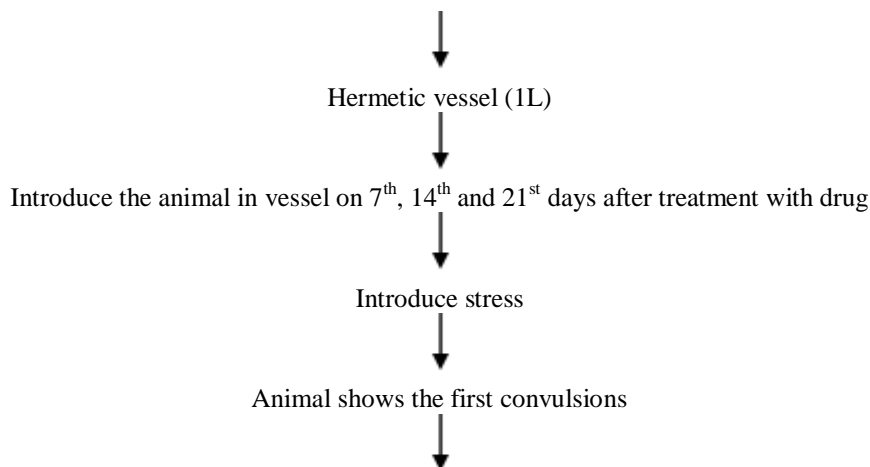
B. Alkaloids: Piperidine(leaves and stem peelings)		
Pipermethystine		NMR: ^1H - δ 52.4 ^{13}C - δ 53.4
3 α ,4 α -Epoxy-5 β -pipermethystine		: ^{13}C 169.2; MS: HRE IMS- m/z 303.1117, EIMS- m/z -303[M] ⁺
Awaine		NMR: ^1H - 6.83, d, 8.2. ^{13}C -127.3 MS:HREIMS- m/z 31.1294(m/z 231.1259).
C. Chalcone: Flavokawain (roots)		
Flavokavain A		HPLC-14.2 mg
Flavokavain B		HPLC-8.2 mg
Flavokavain C		HPLC-DAD-ESI-MS: [M-H] ⁻ at m/z 299

1.4 Mechanism involved:

- Blockade of voltage-gated sodium channels (Piscopo, 2007).
- Enhanced interactions between ligand and corresponding receptors (e.g., amino butyric acid type A receptor) (Davies et al., 1992)
- Inhibition of enzyme activity (e.g., cyclooxygenase-2) (Anke and Ramzan, 2004).
- Decrease in cytokine release (e.g. TNF- α) (Pollastri et al., 2009).

2. ANTISTRESS ACTIVITY

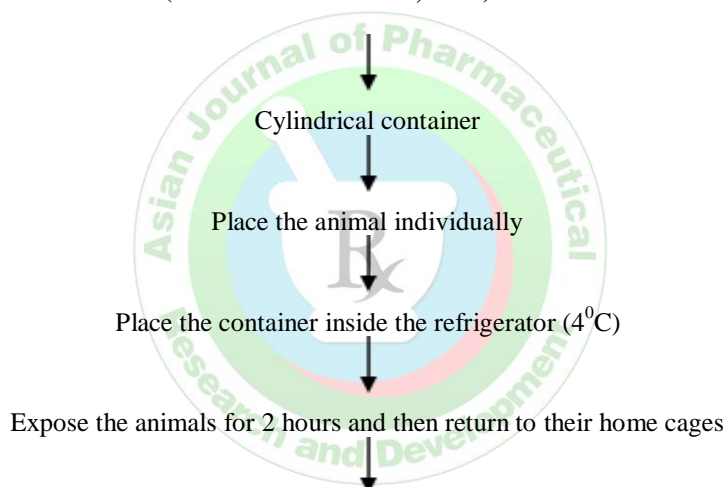
2.1 Anoxia stress tolerance test (Pawar and Hugar., 2012)



Immediately remove from the vessel and resuscitate (if needed). Delay in removal of animal may lead to death.

Record the time duration of entry of animal into the vessel and appearance of the first convulsion – Anoxia tolerance time.

2.1.2 Chronic cold restrained stress test (Bimlesh Kumar et al., 2010)



Continue the procedure for 10 days after introducing the drug on 11th day; collect the blood sample through retro orbital puncturing under light ether anaesthesia and biochemical parameters.

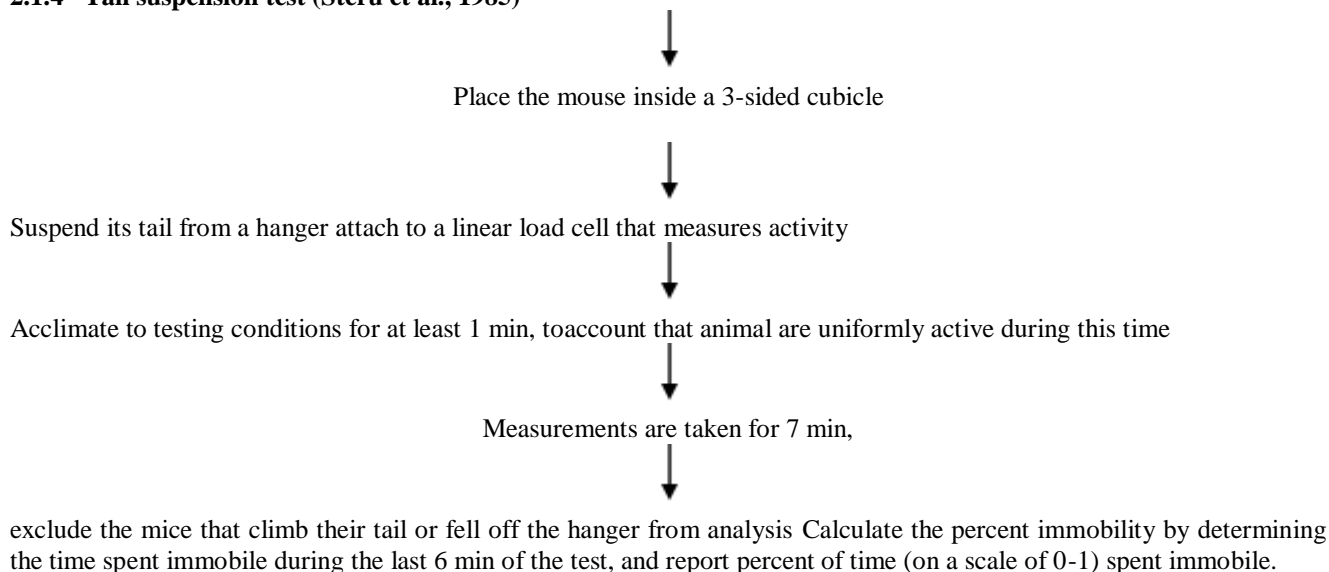
2.1.3 Forced swim test (Zomkowski et al., 2006)

A polypropylene open cylindrical container (diameter 10 cm,height 25 cm), containing 15 cm of water at 25 ± 1 °C.

on the 8th day of dosing allow rats to swim till complete exhaustion take the end point when animal ceases struggling and remained floating motionless in the water, making only those movements necessary to keep its head above water.

Animal said to be immobilized, the total duration of immobility during the 6-min test was scored. The duration of immobility was recorded and decrease in the duration of immobility during the FST was taken.

2.1.4 Tail suspension test (Steru et al., 1985)



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