

## Current Status and Future Prospect of Curry (*Murrayakoenigii*) Leaves in South Asia

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### ABSTRACT

Curry leaves are extremely popular in various culinary recipes in the Indian subcontinent at acts flavor and aroma to vegetables and curries. Crash curry leaves are shiny and dark green in color and have a distinctive aroma and taste to it. Curry leaves recipe involved the use of fresh curry is as well as powdered curry leaves to enhance the flavor of salads, chutneys and spices. The health benefits of curry leaves include improved functioning of the small intestine and stomach, improved quality of digestive juices during digestion, and increased salivary secretion. Most Indian dishes are devoid without the addition of curry leaves and hence any form of curry substitute in its place does not match to the real thing. In beverage shops can be prepared curry leaf congee for morning for good health. Essential oils from *Murrayakoenigiiserves* as an important part in soap making ingredients, perfume industry, lotions, massage oils, diffusers, potpourri, air fresheners, body fragrance, perfume oils, aromatherapy products, bath oils, towel scenting, spa's, incense, facial steams and hair treatments. As beverages can be produced syrups, cordials and flavored tea. There are possibility to produce biscuits, bites (murukku) and other bread products using curry leaves. Western countries prone to Ayurvedic medicines now days, so it has potential to produce balms, inhalers, oils and etc. This review considers future potential of curry leaves.

**Keywords:** Curry leaves, essential oils, sambole.

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### INTRODUCTION

*Murrayakoenigii*, belongs to the family Rutaceae, commonly known as curry-leaf tree, is a native of India, Sri Lanka and other south Asian countries eastward through Myanmar, Indonesia, Southern China and Hainan.. It is found almost everywhere in the Indian subcontinent, it shares aromatic nature, more or less deciduous shrub or tree up to 6 m in height and 15-40 cm in diameter with short trunk, thin smooth grey or brown bark and dense shady crown (Mhaskar *et al.*, 2000). Most part of plant is covered with fine down and has a strong peculiar smell. Leaves are bipinnately compound, 15-30 cm long each bearing 11-25 leaflets alternate on rachis, 2.5-3.5 cm long ovate lanceolate with an oblique base. Margins irregularly serrate, petioles 2-3 mm long, flowers are bisexual, white, funnel shaped sweetly scented, stalked, complete, ebracteate, regular with average diameter of fully opened flower being in average 1.12 cm inflorescence, terminal cymes each

bearing 60-90 flowers. Fruits are ovoid to subglobose, wrinkled or rough with glands. It is having the size of 2.5 cm long and 0.3 cm in diameter and gets purplish black when ripen ( Fig.1). Fruits are generally biseeded. Seeds generally occur in spinach green color, 11 mm long, 8 mm in diameter and weighs up to 445 mg (Prajapati, 2003).



Fig. 1: Curry leaves plant

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The leaves have a slightly pungent, bitter and feebly acidic taste, and they retain their flavor and other qualities even after drying. The leaves have been widely applied in the culinary field due to its aromatic scents and natural flavoring especially in traditional cuisines such as curries and sauces. Besides that, it was also used as medicinal purposes. In India, curry leaf are considered to be good cure against dysentery and bite of the poisonous animal. The many use of this indigenous plant also seen as a potential method to ward off insects (Deepti and Nupur, 2013). Recent studies have shown these leaves to possess anti-diabetic, antioxidant, hepatoprotective properties. They are also good for hair. Curry leaves take care of indigestion, stomach ulcers due to excessive acid secretion in stomach, diarrhea and other similar problems. In many countries, it is usual for the people to plant the tree at the back yard of their house which makes it more convenient for daily usage. It is believed that the folks in the rural areas of Malaysia use curry leaves as traditional home remedies for flies' prevention possibly due to the presence of chemical component in the curry leaf that have the similar characteristic to the repellent's active compound. This first report aims to discuss the determination of components for an essential oil of curry leaves in finding its potential as active ingredient for natural-based insect repellent (Nur et al., 2009). Present review article is going to discuss about the importance and future potential of *Murrayakoenigii* leaves in south Asia.

### Chemical Structure of *Murrayakoenigii* leaves

The leaves are reported to have rich source of carbohydrates, proteins, aminoacids and alkaloids, and are rich in minerals, vitamins A and B. They also a rich source of calcium, but due to the presence of oxalic acid in high concentration (total oxalates, 1.35%; soluble oxalates, 1.15%), its nutritional availability is affected. The leaves also contain a crystalline glucoside, koenigiin and a resin. By analysis of concentrated essence of *M. koenigii* leaf, Macleod and Pieris obtained mainly terpenes. According to them the most important constituent of *M. koenigii* are  $\beta$ -caryophyllene,  $\beta$ -gurjunene,  $\beta$ -elemene,  $\beta$ -phellendrene and  $\beta$ -thujene. The composition of the essential oil of *M. koenigii* may differ at different places. Earlier investigations on Indian curry leaf oil, hydrodistilled from fresh leaves, led to the identification of  $\beta$ -pinene,  $\beta$ -pinene,  $\beta$ -caryophyllene, isosafrole, lauric and palmitic acids. Later, Sri Lankan oil was reported to contain monoterpenes (15.9%) and sesquiterpenes (80.2%) with  $\beta$ -phellandrene,  $\beta$ -caryophyllene,  $\beta$ -gurjunene,  $\beta$ -elemene, and  $\beta$ -selinene as the main constituents. However, Chinese oil was reported to contain  $\beta$ -

and  $\beta$ -pinenes,  $\beta$ -caryophyllene and  $\beta$ -elemene as main constituents, whereas curry leaf oil from Malaysia was shown to be rich in monoterpenes and oxygenated monoterpenes (ca. 85%) with  $\beta$ -pinene, limonene,  $\beta$ -phellandrene, terpinen-4-ol and  $\beta$ -caryophyllene as the main contents. Chowdhury reported that leaves on hydrodistillation gave 0.5% essential oil on fresh weight basis, having dark yellow color, spicy odor and pungent clove-like taste (Dikui, 2009). It has following characteristics (Table 1).

**Table 1:** Characteristics of *Murrayakoenigii* leaves (Dikui, 2009).

Specific gravity (25°C)	0.9748
Refractive index (25°C)	1.5021
Optical rotation (25°C)	+ 4.8
Saponification value	5.2
Saponification value after acetylation	54.6
Moisture	66.3%
Protein	6.1%
Fat (ether extract)-	1.0%
Carbohydrate	18.7%
Fibre	6.4%
Mineral matter	4.2%
Calcium	810 mg/100 g of edible portion
Phosphorus	600 mg/100 g of edible portion
Iron	3.1 mg/100 g of edible portion
Carotene (as vitamin A)-	12 600 IU/100 g
Nicotinic acid	2.3 mg/100 g
Vitamin C	- 4 mg/100 g
Thiamine and riboflavin	absent

### Use of *Murrayakoenigii* leaves

#### 1. Health use

*M. koenigii* leaves are used in traditional medicine, for example ayurvedic and unani medicine. The plant is credited with tonic, stomachic and carminative properties. The green leaves are used to treat piles, inflammation, itching, fresh cuts, dysentery, vomiting, burses and dropsy. The green leaves are also eaten raw as a cure for diarrhea and dysentery; bruised and applied externally to cure eruptions; given as a decoction with bitters as a febrifuge; and in snake bite. Moreover its leaves have a potential role in the treatment of diabetes. Hypoglycemic action on carbohydrate metabolism was reported in rats fed with *M. koenigii*

leaves. *M. koenigii* leaf also found to exert antioxidant properties in rats fed a high fat diet. There were lower levels of hydroperoxides, conjugated dienes and free fatty acids in the liver and heart of rats supplemented with *M. koenigii* leaves compared to rats fed on the high fat diet alone. Activities of superoxide dismutase, catalase, and glutathione transferase were increased in the heart and liver of rats supplemented with *M. koenigii* leaves. Activities of glutathione reductase, glutathione peroxidase and glucose-6-phosphate dehydrogenase were also increased in the liver and the concentration of glutathione was decreased. Thus supplementing a high fat diet with 10% *M. koenigii* leaf can prevent the formation of free radicals and maintain the tissues at normal levels. The undiluted essential oil exhibited strong antibacterial and antifungal activity when tested with microorganisms. Even the crude leaf extracts of *M. koenigii* leaf plant are reported to possess antibacterial activity. *Murrayakoenigii* strengthen the functions of stomach and promotes its function. They are mainly used for digestive disorders, diabetes for reducing cholesterol, kidney disorder, premature greying of hair, eye disorders, insect bites and it is also used as a natural flavouring agent in sambar, rasam and curries. Through a few studies carried out in India has proven many varied effect of ash gourd and curry leaves the hypoglycemic and hypolipidemic effect of combination of ash gourd and curry leaves is unrevealed in diabetes and cholesterol still. It has very good potential to control and cure various health disorders (Amirthaveni and Priya, 2011; Handral et al., 2012). Leaves are used in scabies, wounds, hypertension pimples, rashes, itching,

constipation, liver disorders, and weight loss. The leaves stimulate digestive enzymes and are a good remedy for nausea and indigestion. The leaves are also good for hair growth and colour (Ramaswamy and Kanmani, 2012).

## 2. Culinary application of curry leaves

Different form of curry leaves spiced our daily lives. While there are many different kinds of curry powders and curry dishes throughout the world. However, curry leaves can come in four different forms: fresh, dried, powdered and cooked.

### Fresh

Fresh curry leaves are the preferred form for cooking. Fresh leaves may be used directly after harvesting from a curry leaf tree. They also may be placed or vacuum-packed in plastic bags and refrigerated or frozen after harvesting, which keeps them fresh from one week to two months. Fresh curry leaves are generally found in the freezer section of stores (Singha et al., 2014).

### Dried

Curry leaves may be air dried or oven dried, producing leaves that have a longer shelf life (Fig.3). According to Gernot Katzer's Spice Pages, some recipes require the baking or toasting of fresh curry leaves before the leaves are added as a flavoring. Dried leaves are also available commercially (Singha et al., 2014).

### Powdered

Powdered curry leaves are also called for in some recipes and powdered curry is also available commercially (Fig.2). After being dried, curry leaves can be pulverized, producing a concentrated powder. Powdered curry leaves, though, should not be confused with curry powder. Commercial curry powder is usually a mixture of many spices, while powdered curry leaf is a powdered version of the actual dried curry leaf. It is important to read spice labels for accuracy prior to purchase (Singha et al., 2014).

**Table 2:** Quality control parameters of *Murrayakoenigii* (Assessment of Quality of Curry Leaves (*Murrayakoenigii*)) (Saini and Reddy, 2013)

Sr. No.	Particulars	Values
1	pH	6.3 -6.4
2	Ash values	
i	Total ash	4.06 ± 0.05
ii	Water soluble ash	1.0 ± 0.05
ii	Acid insoluble ash	1.24 ± 0.11
3	<b>Extractive values</b>	
i	Petroleum ether (60-80°C)	5.60 ± 0.15
ii	Chloroform	8.07 ± 0.05
iii	Ethanol (90%)	13.05 ± 0.15
iv	Aqueous	16.05 ± 0.15
4	Loss on drying	10.06 ± 0.15
5	Crude fiber content	70.25 ± 0.15



**Fig.2 & 3:** Powdered and Dried Curry Leaves

## Cooked

Sautéed or fried curry leaves are prepared by the cook or chef prior to or during the cooking process. Some recipes require that fresh curry leaves be cooked before being added as flavouring. Such sautéed or fried curry leaves would not generally be purchased in advance. Instead, curry leaves would be purchased fresh, or perhaps dried, and then cooked in the kitchen. Sandip (2006) shows that *Murrayakoengii* is used as a spice and condiment in India and other tropical countries. Curry leaves are used in South Indian cuisine for flavouring dhal, sambhar, rasam, karietc (Prajapati *et al.*, 2003b). In the kitchen, the leaves are used for their warm, appetising aroma and subtle, spicy flavour with meat, sea food or vegetable curries, chutneys, pickles, coconut sauce, relishes, omelettes, marinades and stir fries. The curry leaf is an integral part of the South Indian cuisine and provides a typical flavour to all South Indian food. The leaf is used to temper lentil preparations, dry vegetables dishes, coconut milk based curries, meat and chicken preparations and cooling drinks made with yoghurt. Curry leaves are also made into chutneys which are delicious. A few sprigs of curry leaves can be added to buttermilk along with asafoetida (hing) and when consumed after a meal eases digestion (Prajapati *et al.*, 2003a). Most curry leaves recipes concentrate on the flavor of this magical herb. However, you can extract the curry leaves health benefits if you follow the right cooking technique. For example, some people cook curry leaves in coconut oil until they are blackened and withered. The active ingredients are now infused into the coconut oil. Fresh curry leaves can be found at specialized food stores, while most supermarkets only carry packaged curry powder. However, this product has little to do with curry leaves health benefits. Commercial curry powders are a mix of different kinds of spices, which add certain flavor to curry-based food dishes. Such powders have helped to spread East Asian flavors across the globe. A famous example is the chicken tikka masala, whose popularity has made it the national dish of Great Britain. However, in most cases, curry leaves are not even an ingredient of a packaged curry powder. It is safe to say that curry powder health benefits are not linked to the wonder plant that gives us curry leaves.

## Use curry leaves:

**Salad** was prepared by using 100gm of ash gourd and one gram of curry leaves (10 curry leaves) and five grams of skimmed milk powder (made into curd) and pepper

**Table 3:** Determination of curry leaves solubility of different extracts (Assessment of Quality of Curry Leaves (*Murrayakoengii*). (Saini and Reddy, 2013)

Solvent	Solubility		
	MPE	MAC	MME
Hexane	++	+	+
Heptane	++	+	+
Benzene	+++	++	++
Diethyl ether	++	+++	++
Petroleum ether	++	+	+
1-4 dioxan	++	+++	++
Tetrahydrofuran	-	++	+++
Ethyl acetate	++	++	++
Chloroform	+++	++	++
Acetone	++	++	++
Dimethylformamide	+	+++	+++
Dimethylsulphoxide	++	+++	+++
Dimethylsulphoxide	++	+++	+++
1-Butanol	++	++	++
1-Propanol	++	+++	+++
Acetic acid	++	++	++
Ethanol	++	+++	+++
Methanol	+	+++	+++
2-Methoxy ethanol	++	+++	+++
Triacetin	+	+	+
Toluene	-	++	+++
Distilled water	-	+	+
Tap Water	-	++	++
2-Methyl Propanol	++	++	+
Dicloromethane	+++	++	++
Amyl alcohol	++	++	+
Benzyl alcohol	++	+++	++
Benzaldehyde	+++	+++	++
Orthophosphoric acid	+	++	+++
Formic acid	++	+++	+++

(-): No presence, (+): Less presence, (++) : Moderate Presence, (+++) : High presence, MCR: Crude powder, MPE: Petroleum ether extract, MAC: Acetone extract, MME: Methanol Extract (Saini and Reddy, 2013).

and salt are added for taste. Supplementation of ash gourd and curry leaves had significant hypoglycemic and hypolipidemic effect and it had reduced the blood glucose level (both fasting and post prandial), within the period of three months (Amirthaveni and Priya, 2011).

**Karapincha Sambol (Curry Leaf Sambol):** 2 cups curry leaves, 2 table spoon shredded coconut, 2 cloves garlic

chopped, Small piece of ginger chopped, 2 green chillies finely chopped, 1/2 table spoon mustard powder, 1/2 table spoon black pepper powder, 1/2 table spoon Lime and Salt to taste. Add chopped garlic, ginger, green chillies, mustard powder, black pepper to a food processor. Squeeze 1/2 of a lime and 1 tspn water to the mixture and grind well. Now add the curry leaves and a little bit of water and grinds it further till it becomes a paste. Finally, add the shredded coconut, salt to taste and grind it until well blended. Enjoy with Rice and curry or those (dosa). Karapincha (Curry leaf) controls high blood pressure, heart disease, diabetes and high cholesterol. Therefore this is a very healthy symbol (Fig. 3).



Fig. 3: Curry Leaf Sambol

### Future prospect of curry leaves in South Asia

Essential oil composition of the leaves has been studied by various workers. The major constituent responsible for the aroma and flavor has been reported as pinene, sabinene, caryophyllene, cadinol and cadinene. There are several methods to extract essential oil from herb and spices like steam distillation, hydrodistillation, and solvent (Dikui, 2009). Essential oils from *M. koenigi* serves as an important part in soap making ingredients, perfume industry, lotions, massage oils, diffusers, potpourri, air fresheners, body fragrance, perfume oils, aromatherapy products, bath oils, towel scenting, spa's, incense, facial steams and hair treatments. In beverage shops can be prepared curry leaf congee for morning for good health. As beverages can be produced syrups, cordials and flavored tea. There are possibility to produce biscuits, bites (murukku) and other bread products using curry leaves. Western countries prone to Ayurvedic medicines now a day, so it has potential to produce balms, inhalers, oils and etc.

**Table 4:** Phytochemical Tests (Assessment of Quality of Curry Leaves (*Murrayakoenigii*). (Saini and Reddy, 2013)

Phytochemical tests	Curry leaves extracts			
	MCR	MPE	AC	MME
<b>Alkaloids</b>				
Dragendorffs test	+	+	-	-
Mayers test	++	-	-	+
Wangners test	+++	+	+++	+++
<b>Flaonoids</b>				
Shinoda test	-	-	-	-
<b>Saponins</b>				
Frothing test	+	-	+++	++
<b>Tannins</b>				
Fec13 test	+++	-	+++	+++
<b>Steroids</b>				
Liebermann-Burchard reaction	+++	+++	+++	+++
<b>Cardiac Glycosides</b>				
Keller-Kilianni test	+++	+++	+++	+++

(-): No presence, (+): Less presence, (++) : Moderate Presence, (+++): High presence, MCR: Crude powder, MPE: Petroleum ether extract, MAC: Acetone extract, MME: Methanol Extract, Common in MPE and MME. the Constituents can be further isolated and purified to find its potency for biological activities.

### CONCLUSION

Curry leaves can use to produce many economically valuable products in South Asia which are in high nourishment and healthy diet.

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