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A review on Spilanthe sacmella

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***Abstract*---**Spilanthes acmella is a medicinal plant that is mostly found in sub-tropical and tropical regions worldwide. It is also known as toothache plant as it is known to reduce pain related to toothaches. Various studies have reported that it possesses numerous biological properties including anti-inflammatory, antimicrobial, antipyretic, local anesthetic, antioxidantand analgesic effects. It has traditional uses in health care and in cuisines as a flavor. Its flowers and leaves can be eaten and causes saliva secretion and tingling sensation in the tongue. Spilanthol is the main constituent found in the plant and is used in oral and skin care. This review will summarize the phytochemistry, pharmacology, traditional uses and present dental uses of this plant.

***Keywords*---**Spilanthesacmella, toothache plant, anti-inflammatory, antimicrobial, antipyretic, antioxidant, analgesic, tingling.

Introduction

Plants have medicinal importance as they are rich source of phytochemicals that have therapeutic benefits. There is increase in use of bioactive compounds in the medicinal aspect worldwide as the toxicity of such substances are expected to be low. Also, there has been a growth in demand for plant-based products. *Spilanthes acmella* is one such important plant that has medicinal value.It is commonly known as toothache plant and belongs to the family Asteraceae. It is found in the sub-tropical and tropical regions around the world. It is used to treat toothaches and gum infections[1,2]. It is reported to possess anti-inflammatory, anti-oxidant, anti-toothache, antipyretic, vasorelaxant, analgesic and antifungal

properties. Spilanthol is the main bioactive compound present in *Spilanthes acmella*[3]. It has found significant use in skin care preparations such as anti-wrinkle cream and oral cares. Besides its medicinal uses, this plant has also been used in traditional cuisines for a very long time.

Taxonomy of *Spilanthes acmella*

Kingdom	-	Plantae
Phylum	-	Tracheophyta
Division	-	Magnoliophyta
Class	-	Magnoliopsida
Sub Class	-	Asteridae
Order	-	Asterales
Family	-	Asteraceae
Subfamily	-	Mimosoidae
Genus	-	Spilanthes
Species	-	Acmella

Vernacular names

Hindi	-	Akarkara
Assamese	-	Pirazha
Kannada	-	Hemmugalu
Adi	-	Marsang
Manipuri	-	Lalu-kok
Tangkhul	-	Ansahan
Mizo	-	An'sa-pui

Morphology

- Plant - Anuual erect or ascending stout herbs, 20-50 cm high[4]
- Leaves - Opposite, petiolate, broadly ovate, narrowed at base, acute or obtuse at apex[4]
- Flowers - Cone-like shape[4]

Fig. 1. *Spilanthes acmella* plant

Fig. 2. Flower heads of Spilanthes acmella plant

Phytochemical Constituent

The pharmacological activity of a plant is due to the presence of bioactive compounds in the plant. These compounds may influence important physiological actions in the human body. It is important to investigate the nature of phytochemical constituents of a plant to understand the chemistry of the plant and its potential pharmacological action. The chief constituent reported in S. acmella plant is spilanthol. It is an N-alkylamide, with the molecular formula (2E, 6Z, 8E)-N-isobutyl-2,6,8-decatrienamide[5]. It is responsible for most of the biological activities. It is known to have a strong pungent taste. This bioactive compound is reported to possess insecticidal property[5]. Study has demonstrated in vitro and in vivo antimalarial activity of spilanthol[6]. The other compounds reported to be present are phenolics (vanillic acid, ferulic acid), coumarin (scopoletin) and triterpenoids like 3-acetylaleuritolic acid and stigmasterol and β-

sitostenone[3]. Presence of essential oil were also reported in the flowers of *Spilanthes acmella*. The essential oil that were isolated are found to be limonene, β-caryophyllene, (Z)-β-ocimene, γ-cadinen, thymol, germacrene D and myrcene[4].

Pharmacological Activity

There are myriad pharmological activities reported in *S. acmella.* Some of the pharmacological activity of *Spilanthes acmella* are summarized below:

Local Anesthetic Activity

The local anesthetic activity of *Spilanthes acmella* was studied in two animal models: (i) intracutaneous wheal in guinea pig for estimating duration and (ii) degree of anesthesia and plexus anesthesia in frog for determining the onset of action . The study suggested that although the onset of action was slower that that of the standard drug the plant possesses significant local anesthetic property which could be due to the presence of alkylamide[7].

Antipyretic activity

Researchers demonstrated the antipyrertic activity of Spilanthes acmella. The study exhibited antipyretic activity against yeast induced pyrexia in albino rats which could be due to the presence of flavonoids[7].

Antifungal Activity

The flower head extract of *Spilanthes acmella* inhibited some fungal species like Fusarium oxysporium, Fusarium moniliformis, Aspergillus niger and A. paraciticus at different concentrations of the test solutions. The fungal species were inhibited by all the concentrations of test solutions. The diameter of inhibition zone increased with increase in concentration[8].

Anti-Inflammatory Activity

Investigations has been carried out for the anti-inflammatory activity of *Spilanthes acmella* using carrageenan induced paw edema. The difference between two readings (paw volume at '0' and '3' hours after the carrageenan injection) was taken as the volume of edema. The aqueous extract of the plant was used in three different doses to determine the anti-inflammatory activity. It was observed that theextract produced dose-dependent inhibition of paw edema. However, the inhibition was less than the standard drug[9].

Analgesic Activity

The analgesic activity of *Spilanthes acmella* was demonstrated by researchers using acetic acid induced writhing test to evaluate peripherally acting analgesic activity and tail flick method for centrally acting analgesic. The results showed notable analgesic activity however, the analgesic activity in acetic acid-induced method was found to be more significant than the tail flick method implying peripheral analgesic activity. The presence of flavonoids was ascribed to the

analgesic activity of *Spilanthes acmella* as flavonoids target Prostaglandins which are involved in the late phase of acute inflammation[9].

Vasorelaxant/Antioxidant

The vasorelaxant and antioxidant property of *Spilanthes acmella* was investigated by researchers. The plant extract through partially endothelium induced NO and PGI_2 showed vasorelaxation in a dose dependent way. Being a potent antioxidant in diphenyl picryl hydrazine assay (DPPH assay), immediate vasorelaxation in nanogram levels was exhibited by ethyl acetate extract of the plant. The highest vasorelaxation was showed by chloroform extract with highest antioxidant concentration[10].

Immunomodulatory Activity

Spilanthes acmella was claimed to possess immunomodulatory activity. Savadi et al., (2010) demonstrated the immunomodulatory activity using various experiment models. The ethanolic leaves extract exhibited immunomodulatory activity by increasing the number of macrophage cells on the 15^{th} day of drug administration[11].

Insecticidal Activity

Study showed that S. acmella extract, spilanthol, was toxic against adults of American cockroach, Periplaneta americana. The toxic action of spilanthol was exerted on P. Americana by interference with the nervous system. However, further investigation was recommended to determine the effect of plant extract on other insect species[12].

Pancreatic Lipase Inhibition

Pancreatic lipase inhibition of ethanolic extracts of *Spilanthes acmella* was investigated by researchers. The extracts were tested at different concentrations under in vitro conditions. Lipase inhibitory action of 40% (at 2 mg/mL concentration) was observed[13].

Larvicidal Activity

Larvicidal activity was demonstrated against larvae of Culex, Anopheles and Aedes mosquitoes using spilanthol which was extracted from the flower heads of *Spilanthes acmella*. Spilanthol, the bioactive compound was found to be more effective against eggs and pupae even at low doses. It pupae, it seemed to disturb the nerve conduction observed due to abnormal movements (jerks, spinning and uncoordinated muscular activity)[14].

Traditional Uses

Practice of traditional medicine is indigenous and still relevant in different cultures around the world. To date people still rely on traditional medicine for their health care needs. S. acmella has been used as folklore remedy for very long in various regions where the plant is indigenous to the people. Traditionally, S. acmella is commonly used as a remedy for toothache[15]. The whole part of the plant is useful for remedies. In Arunachal Pradesh, it is called as 'Marsang' by a few communities and used as medicine as well as an additive in stews and soups for flavour[16]. The "Irula tribe of Hasanur hills in Erode district of Tamil Nadu", the flowers are crushed and applied at the site of toothache[17]. Root paste of the plant is used in throat problems in Chindwara and Betul district of Madhya Pradesh[18]. It gives a tingling sensation when chewed and causes saliva secretion[15]. The plant has wide use in various parts of the world. The various traditional uses of the plant is listed in table 1.

Table 1
Reported uses of *Spilanthes acmella*[19]

Name of Plant	Use	Part Used	Geographic zone
Spilanthes acmella L.	Toothache and throat complaints	Flowers and leaves	India
	Ulcer in mouth	Juice of inflorescence	Karnataka, India
	Snakebite and rheumatic fever		Entire Plant
Spilanthes acmella (L.) Murray	Get rid of unpleasant symptoms of the alcoholic hangover	Leaves	Brazil
	Anticancer agent	Entire plant	Indonesia
Spilanthes acmella	Sialagogue	Flower tincture	Sri Lanka
Spilanthes acmella Murr.	fortifier for infants	Leaves	Madagascar
	Pain which includes headache, toothache and muscle pain	Flowers and Leaves	Bangladesh
	Toothache and Dysentry	Flower	Saurashtra region, Gujarat, India
	Placed in tooth cavities to relieve pain	Pounded Flowers	Kelantan, Malaysia
	Decoction of roots and leaves is used as gargle for tooth pain	Roots and leaves	Phillipines
	Toothache	Flowers	Hasanur Hills, Erode, Tamil Nadu, India

Uses
Dental Use

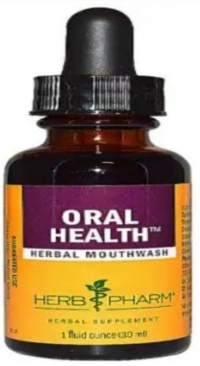
As *S.acmella* has significant dental uses. Itis used for pain relief related to toothaches. Spilanthol, the main constituent of this plant is responsible for its anti-toothache effect. Hence, spilanthol has been found to be useful in dentistry. It has been used as an ingredient in dentifrices like toothpastes and

mouthwashes as it possesses a mild anesthetic and antibacterial property. *S. acmella* is also effective in other dental problems like periodontitis (gum infection) and recurrent aphthous stomatitis[4]. Recurrent aphthous stomatitis is a disease associated with painful ulceration occurring recurrently in the oral mucosa. The flower heads and roots have been used to treat periodontitis and the leaves have been effective against recurrent aphthous stomatitis[2].

Skin Care Use

The plant extract of *Spilanthes acmella* is also used in skin care preparations. It is used for stimulating, reorganizing and strengthening the collagen network in anti-age applications, e.g. in anti-wrinkle cream formulations. The bioactive compound of the plant; spilanthol is an anti-inflammatory ingredient[20]. So, it can be beneficial in reducing swelling and redness. Studies have shown that spilanthol can block allergic inflammation in skin concerns like atopic dermatitis. Spilanthol can help calm that irritation. Spilanthol also increases the absorption of other topical substances applied on the skin such as moisturizer and facial oil[20].

Marketed Preparation

S. No.	Product	Applications
1		Health Supplement
2		Mouthwash for oral hygiene.

3		Anti-ageing Serum for skin care.
4		Anti-Wrinkle Cream
5		Serum for under-eye skin

6		Herbal Health supplement

Conclusion

S. acmella is a plant well known for its medicinal uses. The phytochemistry, pharmacology and traditional uses is highlighted emphasized in this review. Many researchers reported the plant having local anesthetic, analgesic, anti-inflammatory, antioxidant, vasorelaxant, immunomodulatory and antipyretic activity. The traditional use of this plant is associated with reducing toothache. Its various traditional uses in other parts of the world has been listed in this review. Besides, its anti-toothache effect this plant also has many dental uses from being employed in toothpaste to treating dental problems like periodontitis and recurrent aphthous stomatitis. Thus it can be concluded that *S. acmella* has significant biological activity and uses in dental problems.

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