

Recent Discoveries on *Acmella Oleracea*: A Review

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Abstract

The genus *Acmella Rich.* (Asteraceae) comprises 30 species and 9 additional intraspecific taxa that are mainly distributed in the tropical and subtropical regions around the world. One of the most distinct and recognizable members of the genus is *Acmella oleracea*. In particular, this species is famous as a traditional remedy for toothache and for throat, gum infections, that's why it is known in the English nickname, "toothache plant." The whole plant is used as a medicinal remedy in various parts of the world. It is suggested that the origin of *A. oleracea* is linked to the cultivation of *Acmella alba*. However, in some cases, its nativity has been attributed to Brazil, where the plant is called jambù and is grown as an ornamental or medicinal plant. Even though its origin is unclear, it is certain that it is cultivated throughout the year, and is widespread as a crop in the world.

Keywords: *Acmella Oleracea* • Toothache plant • Antiseptic agent

Introduction

The genus *Acmella Rich.* (Asteraceae) comprises 30 species and 9 additional intraspecific taxa that are mainly distributed in the tropical and subtropical regions around the world. One of the most distinct and recognizable members of the genus is *Acmella oleracea*. In particular, this species is famous as a traditional remedy for toothache and for throat, gum infections, that's why it is known in the English nickname, "toothache plant." The whole plant is used as a medicinal remedy in various parts of the world. It is suggested that the origin of *A. oleracea* is linked to the cultivation of *Acmella alba*. However, in some cases, its nativity has been attributed to Brazil, where the plant is called jambù and is grown as an ornamental or medicinal plant. Even though its origin is unclear, it is certain that it is cultivated throughout the year, and is widespread as a crop in the world.

Some other traditional applications of this herb are as follows: *Acmella oleracea* is well accepted for its intended use as spices, as an antiseptic agent, antimalarial, antibacterial, antifungal treatment, and as a remedy for toothache, flu, cough, rabies diseases, and tuberculosis [1-3]. There is some doubt in the literature over the name of the genus and species of *Acmella* plant. The monographs on *Acmella* mentioned of false synonyms for *A. oleracea* that appear on various websites. Some of them state that the "accepted scientific name" is *Spilanthes acmella* (L.) Murr., but the photos on them clearly show *A. oleracea* vice versa. Morphological, chromosomal and molecular evidence assist authentication of the genus into two genera: *Spilanthes* and *Acmella*, which can be clearly identified by at least eight morphological characters and by distinctive basic chromosome numbers.

Many studies have been carried out for chemical analysis and structural determination of various constituents of *Acmella oleracea*. It was found to contain many important bioactive compounds such as spilanthol, amyriester, stigmaterol, miricilic alcohol glycosides, sitosterol, saponins, and triterpenes

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Received: 06 February, 2023, Manuscript No. jnp-23-88805; Editor assigned: 08 February, 2023, PreQC No. P-88805; Reviewed: 16 February, 2023, QC No. Q-88805; Revised: 21 February, 2023, Manuscript No.R-88805; Published: 28 February, 2023, DOI: 10.37421/2472-0992.2023.9.245

which are responsible for therapeutic uses have been reported in *Acmella oleracea* species. These compounds have been linked to the biological health-promoting effects of the plant, including antioxidant, anesthetic and anti-inflammatory activities [4]. The major pungent constituent reported in this plant *Acmella oleracea* is "spilanthol," an olefinic N -alkylamide with an isobutyl side chain, (C₁₄H₂₃NO, 221.339 g/mol) is a bioactive compound found in many different plants used as traditional remedies. Its IUPAC name is (2E, 6Z, 8E) - N -isobutyl-2,6,8 -decatrienamamide. It is also known as affinin and is well known for its activities like insecticidal, analgesic, antinociceptive, antimutagenic, anti-inflammatory, anti-spasmodic etc [5]. The articles on 1990 onwards were reviewed and collected the complete pharmacological activities of *acmella oleracea* plant. On the basis of number of articles reviewed, pharmacological data is given as pie diagram (Figure 1). From the above data it is clear that, more number of article evidence obtained for its analgesic activity, followed by antiinflammatory and anaesthetic properties [6-10] (Table 1).

Detection of chemical composition of *A. Oleracea* using different biochemical tests

Several bioactive compounds, notably alkamides, flavonoids and other phenolic compounds have been reported in *Acmella oleracea* species. These compounds have been linked to the biological health-promoting effects of the plant. The herbal products today symbolise safety in contrast to the synthetics remedies. Medical plants play an important role in the management of diseases in many countries. Among them *Acmella oleracea* is important for their therapeutical potentials. Many researches justifies the use of *A. oleracea* in a wide range of applications in medicinal purposes (Figure 2 and Table 2).

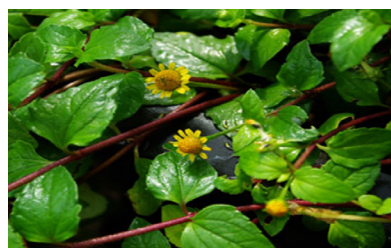
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Ethanobotanical survey, extraction, phytochemical test, charecterization and isolation, biological pharmacological activities, *invitro invivo* properties, poly herbal formulations, herbal drug standardisation, quality control studies (Figures 3 and 4).

Summary and Conclusion

This review has focused on the plant *A.oleracea*, and its journey starting from the simple anti toothache plant to highly valuable annual herb. It possesses multifunctional roles as indigenous medicine for therapeutics in health care, beauty care and cosmetics as well as health food or supplements enriched with numerous antioxidants.. It is among the most widely used medicinal and culinary plants in various traditional systems.

PLANT PROFILE

Botanical name: *Acmella oleracea*

Scientific classification

Kingdom	Plantae
Division	Angiosperm
Class	Magnoliopsid
Order	Asterales
Family	Asteraceae
Genus	<i>Acmella</i>
Species	<i>A. oleracea</i>

Figure 1. Plant profile.

Table 1. Different types of and plants.

Serial no	Author name	Title	Year	Out come
1	Nicholas Hind, et al.	<i>Acmella oleracea</i> , Compositae	2003	Discussed in detail about cultivation, propagation, distribution, habitat, common names, traditional uses etc. However, the study did not include any tests or information on the effectiveness of the plant.
2	Rajesh Yadav	Phytochemical screening of <i>Spilanthes acmella</i> plant parts	2012	The observations revealed the presence of alkaloids, carbohydrates, tannins, steroids, carotenoids, fats and fixed oils, sesquiterpenes and amino acids in different extracts of <i>Spilanthes acmella</i> plant parts
3	Veda Prachayasittikul, et al.	High therapeutic potential of <i>spilanthes acmella</i> : A review	2013	Considering data from the literature, it could be demonstrated that <i>S. acmella</i> possesses diverse bioactive properties and immense utilization in medicine, health care, cosmetics and as health supplements. As a health food, it is enriched with high therapeutic value with high potential for further development
4	E.C.O. Nomura, et al.	Antinociceptive effects of ethanolic extract from the flowers of <i>Acmella oleracea</i> (L.) R.K. Jansen in mice	2013	Ethanolic extract obtained from the flowers of <i>Acmella oleracea</i> reduced both neurogenic and inflammatory phases of the formalin- and also capsaicin- and cinnamaldehyde -induced orofacial nociception.
5	Bianca Nascimento de Alcantara, et al.	Pharmacognostic analyses and evaluation of the <i>in vitro</i> antimicrobial activity of <i>Acmella oleracea</i> (L.) RK Jansen (Jambu) floral extract and fractions	2014	This paper reports the pharmacognostic characteristics of the herbal drug (flowers) and the <i>in vitro</i> antimicrobial effect of its ethanol extract (EEFAO) and fractions on pathogenic microorganisms present both in skin and in gastrointestinal tract of domestic animals.
6	Yuan-Bin Cheng, et al.	Alkyl amides of <i>Acmella oleracea</i>	2015	Phytochemical investigation of the flowers of <i>Acmella oleracea</i> had resulted in the isolation of one new alkylamide .The structures were determined by the interpretation of spectroscopic methods, especially NMR technologies In addition, a convenient method for concentrating the alkyl amide-rich fraction and analysing fingerprint profile of <i>A. oleracea</i> was established.
7	Santana de Freitas-Blanco, et al.	Development and evaluation of a novel mucoadhesive film containing <i>Acmella oleracea</i> extract for oral mucosa topical anesthesia	2016	Mucoadhesive film containing crude extract of jambu treated with activated carbon is a potential alternative for oral, topical use, encouraging future clinical studies.
8	Alexey Arkad'evich Matyushin, et al.	<i>Acmella oleracea</i> : A comprehensive study of anatomical and diagnostic characteristics	2017	The study was conducted using dried aerial parts of the herb which were separated into flowers, leaves and stems. The authors conclude that the results of the study can be used for identification purposes and in regulatory documents development.
9	Ranjith D	Evaluation of analgesic and anti-inflammatory activity of herbal formulation used for mastitis in animals	2018	Significant analgesic and anti-inflammatory activity was noticed in the herbal formulation. The study can be concluded that the test drug possess significantly higher analgesic and anti-inflammatory activity possibly due to the presence of manifold secondary phyto constituents.
10	V.S.d. Freitas Blanco, et al.	Isolation of spilanthol from <i>Acmella oleracea</i> based on green chemistry and evaluation of its <i>in vitro</i> anti-inflammatory activity	2018	First, the aerial parts of jambu were extracted and fractionated using supercritical carbon dioxide. This new approach enabled spilanthol to be obtained at high purity, in a fairly rapid procedure, while the results of the <i>in vitro</i> anti-inflammatory activity study indicated that the compound could be a promising new therapeutic agent.
11	D.A. Neves, et al.	Chemical and nutritional characterization of raw and hydrothermal processed jambu (<i>Acmella oleracea</i> (L.) R.K. Jansen)	2019	Thus, this study has shown that raw and processed jambu may be good alternatives for conventional vegetables, even with nutrients losses during boiling
12	L.E.S. Nascimento, et al.	Phytochemical profile of different anatomical parts of jambu (<i>Acmella oleracea</i> (L.) R.K. Jansen): A comparison between hydroponic and conventional cultivation using PCA and cluster analysis	2020	The extracts were characterized by determining 45 compounds, including phenolic acids, glycosylated flavonoids, alkamides and fatty acids, by LC-MS analysis. The PCA and cluster analysis results distinguished different anatomical parts (PC1 and PC2) and cultivation systems (PC3) into well-defined groups.
13	K. Sudheer Kumar, et al.	Evaluation of analgesics and anti-inflammatory activity of poly herbal formulation containing some indigenous medicinal plants	2020	Various poly-herbal formulations are used in the ayurvedic system of medicine for the treatment of inflammation and pain associated with rheumatoid arthritis. The results indicated that the poly-herbal formulation possesses good analgesic and anti-inflammatory activities in the experimental animal model
14	Pooja S. Dhoke	Recent formulation development and evaluation of lozenges containing poly herbal extract of <i>Cinnamomum tamala</i> and <i>Spilanthes acmella</i>	2021	<i>Spilanthes acmella</i> is an annual hairy herb, up to 40-60 cm. tall with numerous stems of marigold yellow flowers. The goal of this study is to develop a modern dosage form, such as lozenges, that is related with a long-term local cure that has a favourable therapeutic impact.

15	Eleonora Spinozzi, et al.	Spilanthal-rich essential oil obtained by microwave-assisted extraction from <i>Acmella oleracea</i> (L.) R.K. Jansen and its nano emulsion: Insecticidal, cytotoxic and anti-inflammatory activities	2021	The safety use of <i>A. oleracea</i> EO, NE and spilanthal was demonstrated in assays on mammalian fibroblasts and microglia cells, showing low level of cytotoxicity coupled with protective effects against inflammation.
16	Mirosława Grymel, et al.	Extraction, purification, quantification, and stability of bioactive spilanthal from <i>Acmella oleracea</i>	2022	An effective method of spilanthal extraction, a simple, fast and economically feasible quantification protocol for spilanthal was developed. The methodology used in this paper allows for the obtaining of extracts from <i>Acmella oleracea</i> with a relatively high content of spilanthal.

Pharmacological activities of *A. Oleracea*

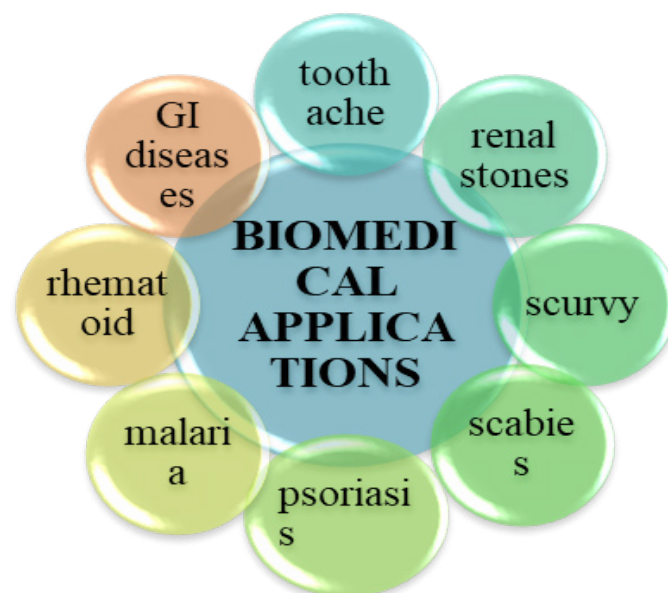
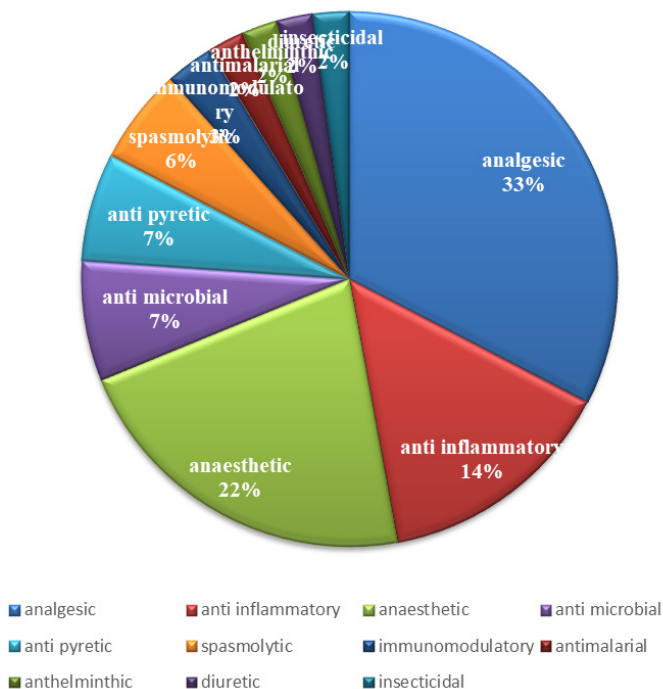


Figure 3. Biomedical applications of *A. oleracea* plant.

Figure 2. Pie diagram showing the pharmacological activities of *A. oleracea* plant.

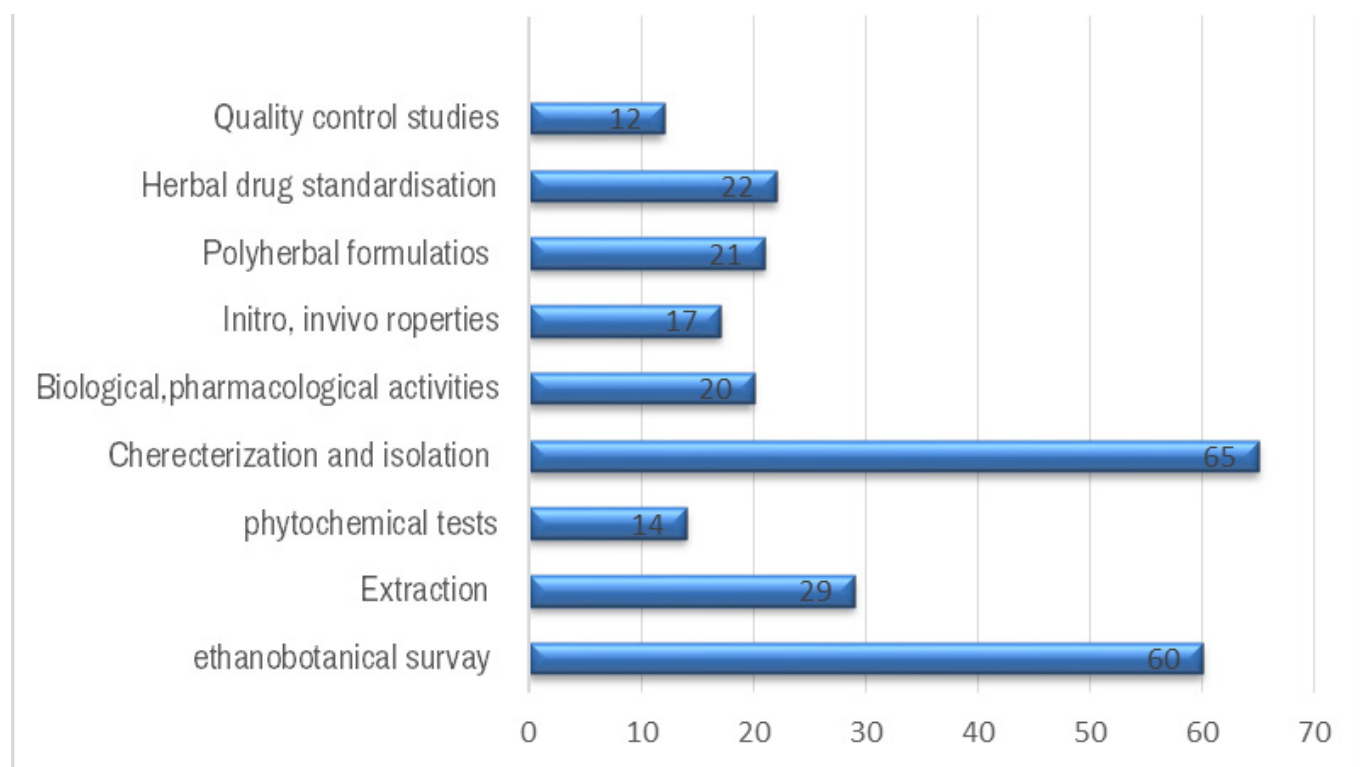


Figure 4. Bar graph showing the keywords on X-axis and the number of articles on Y-axis.

Table 2. Different types of tests are shown.

Sl. No	Phytochemicals	Name of test	Result
1	Alkaloid	Mayer's test	–
		Dragendorff's test	–
2	Carbohydrate	Molisch's test	–
		Fehling's test	+
		Barfoed's test	+
		Benedict's test	+
3	Phytosterol	Liebermann Burchard's test	+
		Salkowski reaction	+
4	Glycoside	Legal's test	–
		Keller-Killiani's test	–
5	Saponin	Foam test	–
6	Tannin	FeCl ₃ test	+
		K ₂ Cr ₂ O ₇ test	+
		Lead acetate test	+
		Fehling's test	+
7	Reducing sugar	Benedict's test	+
		Shinoda test	–
8	Flavonoid	Zn hydrochloride reduction	–

For its medicinal properties it has been extensively applied as antimicrobial, antimalarial, analgesic, anaesthetic, antiulcer, antipyretic, diuretic, and anti-inflammatory agent. Using the whole plant, crude extracts can be prepared by using Soxhlet extractor, supercritical fluid extraction, simple maceration etc and concentrated in a rotary vacuum evaporator. The most abundant isolates of the plant species were lipid alkalimides, especially, the spilanthol along with other bioactive metabolites e.g. phenolic, flavonoid, coumarin and triterpenoid compounds. In this review, articles including the various details of *A. oleracea* plant has been cited along with the details in a capsulated form by graphical and tabular representation.

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How to cite this article: Rabwa, Fathima. "Recent Discoveries on *Acmella Oleracea*: A Review." *J Pharmacogn Nat Prod* 9 (2023): 245.