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A comparative pharmacognostical and phytochemical analysis of *Kalanchoe pinnata* (Lam.) Pers. leaf extracts

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Abstract
Kalanchoe pinnata (Lam.) Pers. has many pharmacological properties such as anticancer, antidiabetic, insecticidal, antimicrobial, anti-urolithiatic, etc. The plant leaves are used as ethno medicine traditionally. Various methods of medicinal preparations are used but most effective, scientific and safe preparation is not known yet. In the present study, four types of extracts of *K. pinnata* leaves were prepared using different methods (Extract 1 – fresh leaf juice, Extract 2 – cold aqueous extract of fresh leaves, Extract 3 – decoction of fresh leaves and Extract 4 – decoction of dried leaf powder). The extracts were investigated for its macroscopical, microscopical, physicochemical and phytochemical properties and the comparative statistical analysis was done. All the extracts showed significant results for their phytochemical study, and Extract 1 showed highest diversity of compounds which places it as best extracts. This study provides important information for the selection of best extract as folkloric preparation.

Keywords: *Kalanchoe pinnata*, *Bryophyllum pinnatum*, pharmacognostical analysis, phytochemical analysis, leaf extracts, comparative

Introduction
Drugs from the plants are easily available, less expensive, safe and efficient and rarely have side effects [1]. According to World Health Organization (WHO), medicinal plants would be the best source to obtain variety of drugs. Large sections of the population in developing countries still rely on traditional practitioners and herbal medicines for their primary care [2]. During past years public interest has greatly increased in public interest. Medicinal plants are plants in which one or more of their organs contain substances that can be used for therapeutic purposes or which are precursors for the synthesis of useful drugs. World Health Organization consultative group that formulated this definition stated also that, such a description makes it possible to distinguish between medicinal plants whose therapeutic properties and constituents have been established scientifically and plants that are regarded as medicinal but which have not yet been subjected to a thorough scientific study [3]. Such plants should be investigated to better understand their properties, safety and efficacy.

Extensive use of plant belonging to Kalanchoe species in complementary and alternative therapy has been widely reported. It is one of the Pashanbhed (meaning 'stone breaker') plant mentioned in ancient Ayurvedic literature. *Kalanchoe pinnata* (Lam.) Pers. (Synonyms: *Bryophyllum pinnatum*, *Bryophyllum Calycinum)* belongs to family *Crassulaceae*, and is commonly known as life plant, air plant (Mexican), love plant, Canterbury bells, Cathedral bells etc. It is a perennial herb growing widely and used in folkloric medicine in tropical India, Africa, China, Australia and tropical America [4].

It is a succulent glabrous and ornamental herb, which can grow in houses and garden. It is 0.3-1.2 m high with stems obtusely four angled stem and variable, decussate leaves. The lower leaves are usually simple or occasionally compound, the upper usually 3-5 or sometimes 7 folliolate, long petioled (United by a ridge around the stem). Leaflets ovate or elliptic, crenate or serrate. Flowers pendent, in large spreading panicles with opposite stout branches; pedicels slender. Calyx 2.5-3.8 cm. long, striated red, and green at the base, pale green above; teeth triangular, Corolla swollen and octagonal at the base, constricted in the middle, reddish purple; lobes triangular. Filaments green at the base, pinkish below the anther, anthers hastate, black. Hypogynous scales subquadrate, free or slightly adherent to the carpels, Styles green. Fruit enclosed in the persistent papery calyx and corolla. Seeds small, oblong-ellipsoid, smooth, scarcely striate [5-7].

The plant contains alkaloids, phenolics, tannins, macro elements (magnesium, calcium, potassium, phosphorus, sodium), microelements, (iron, zinc), vitamins (ascorbic acid,