

**PHYTOCHEMICAL AND BIOLOGICAL STUDIES ON CERTAIN
PLANTS BELONGING TO FAMILY CRASSULACEAE**

A thesis Submitted

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LIST OF ABBREVIATIONS

μm	Micrometer
°C	Centigrade
¹³C-NMR	Carbon-13-Nuclear Magnetic Resonance
¹H-NMR	Proton Nuclear Magnetic Resonance
bp	Base pair
CC	Column Chromatography
cm	Centimeter
Conc.	Concentrated
CTAB	Hexadecyl trimethyl-ammonium bromide
DMSO-<i>d</i>₆	Dimethylsulfoxide-<i>d</i>₆
DNA	Deoxyribonucleic acid
DNTP	Deoxyribonucleotide triphosphate
DTH	Delayed-type hypersensitivity
ECG	Electrocardiogram
EDTA	Ethylene diamine tetra acetic acid
FBS	Fetal Bovine Serum
Fig.	Figure
g	Gram
GS	Genetic similarity
hr.	Hour
Hz	Hertz

IC₅₀	Inhibitory Concentration
IL	Interleukin
in.	Inch
IR	Infra-red
<i>J</i> value	coupling constant
Kg	kilogram
KMC	Kalanchosine dimalate
L	Liter
MBC	Minimum Bactericidal Concentration
mg	Milligram
MIC	Minimum Inhibitory Concentration
min.	minute
ml.	milliliter
O.D.	Optical density
PC	Paper Chromatography
PCR	Polymerase Chain Reaction
PPC	Preparative paper chromatography
ppm	Part per million
RAPD	Random Amplified Polymorphic-DNA
RNA	Ribonucleic acid
RPMI-1640	Rosewell Park Memorial Institute
SRB	Sulphorhodamine-B

SX	Selectivity Index
TCA	Trichloroacetic acid
TLC	Thin Layer Chromatography
TMS	Trimethylsilane
TPO	Thyroid peroxidase
UV	Ultraviolet
v/v	Volume per volume
w/v	Weight per volume
δ	Chemical shift
λ	Wave length

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INTRODUCTION

During the last decade, the use of traditional medicine has expanded globally and is gaining popularity. It has continued to be used not only for primary health care of the poor in the developing countries, but also in countries where conventional medicine is predominant in the national health care system. Medicinal plants have been used as sources of medicine in virtually all cultures.

The power of herbs cannot be denied as their therapeutic values have been proven and attested to by billions of people around the world. The World Health Organization estimates that 80% of the world's population relies on herbs and traditional herbal medicine for their primary health care.

Family crassulaceae is a large family, widely distributed in cosmopolitan, especially southern Africa, except Australia and West pacific. It comprises about 35 genera and 1500 species (Boulos, **1999**). Genera includes: *Aeonium*, *Crassula*, *Cotyledon*, *Esheveria*, *Sedum*, *Rosularia*, *Prometheum*, *Tylecodon* and *Kalanchoe* (Trease and Evans, **2009**).

Kalanchoe, a genus of approximately one hundred species, is native to tropical Africa but has been naturalized throughout the tropics (Chopra *et al*, **1956** and Gaind *et al*, **1981**). Other names of genus *Kalanchoe* are *Bryophyllum* and *Cotelydon* (Maurice, **1993**).

In traditional medicine the juice of *Kalanchoe* is used for the local treatment of periodontal disease, cheilitis, cracking lips in children, bruises, wounds, boils (Mourao *et al*, **1999**), insect bites (Rossi-Bergmann *et al*, **1994**), ear infection, dysentery (Akinpelu, **2000**), fever, abscesses, coughs,

skin diseases (Kuo *et al*, 2008), cholera, urinary diseases, whitlow (Siddiqui *et al*, 1989), tissue injuries (Liu *et al*, 1989), arthritis and gastric ulcers (Rossi-Bergmann *et al*, 1994). Crushed leaves are rubbed on or tied to the head to bring relief for headache (Akinpelu, 2000), rheumatism (Supratman *et al*, 2001^A), treatment of pulmonary infection, rheumatoid arthritis and gastric ulcer (Cruz *et al*, 2008).

A literature survey revealed that the different extracts of *Kalanchoe* species had been reported to possess antibacterial, antifungal (Pal & Nag Chaudhuri, 1991), analgesic (Nguelefack *et al*, 2004 and Nguelefack *et al*, 2006), anti-inflammatory (Pal & Nag Chaudhuri, 1991; Costa *et al*, 2006 and De Paiva *et al*, 2008), antiviral (Shirobokov *et al*, 1981), sedative (Wagner *et al*, 1985), antiulcer (Pal & Nag Chaudhuri, 1991), immunomodulatory (Rossi-Bergmann *et al*, 1994; Costa *et al*, 1994 and Cruz *et al*, 2008), antilishmanial (Da Silva *et al*, 1995; Muzitano *et al*, 2006^B and Muzitano *et al*, 2009), CNS depressant (Pal *et al*, 1999), thyroid peroxidase inhibitor (Ferreira *et al*, 2000), cytotoxic activity (Yamagishi *et al*, 1989; Supratman *et al*, 2001^B; Wu *et al*, 2006 and Kuo *et al*, 2008), hepatoprotective (Yadav & Dixit, 2003 and Harlalka, 2007), antimicrobial (Akinpelu, 2000; Tadege *et al*, 2005; Monthana & Lindequist, 2005; Akinsulire *et al*, 2007 and Nahar *et al*, 2008), inhibition of B cell development (De Paiva *et al*, 2008), cardiovascular effects (Nguelefack *et al*, 2008), antihyperglycemic (Kamgang *et al*, 2008), larvicidal (Trevisan *et al*, 2006) and insecticidal activities (Supratman *et al*, 2000 and Supratman *et al*, 2001^A).

Earlier studies on different *Kalanchoe* species reported the isolation of polysaccharides, flavonoids (Siddiqui *et al*, 1989 and Liu *et al*, 1989), sterols (Siddiqui *et al*, 1989 and Kalinowska *et al*, 1990), ascorbic acid,