Introduction

Historically, plants have provided a source of inspiration for novel drug compounds, as plant derived medicines have made large contributions to human health and well-being. According to the World Health Organization (WHO) in 2008, more than 80 % of the world's population relies on traditional medicine for their primary healthcare needs **(Pierangeli *et al.*, 2009).** Nearly, all cultures and civilizations from ancient times to the present day have depended fully or partially on herbal medicine because of their effectiveness, affordability, availability, low toxicity and acceptability **(Akharaiyi *et al.*, 2010).**

Plants are used worldwide for the treatment of diseases, and novel drugs continue to be developed through research from plants. There are more than 20,000 species of plants used in traditional medicines, and these are all potential reservoirs for new drugs **(Hamamouchi, 2002).**

Arecaceae or Palm family (Palmae), in the order Arecales is among the famous plant families which include genera that embrace phenolic-rich species, it is a monophyletic group including 183 genera and 2364 species **(Govaerts and Dransfield, 2005 and Dransfield *et al.*, 2008).**

Palms are one of the most diverse plant families, with species occurring in a wide range of environments and habitats from the wettest equatorial rainforests, to high altitude snow covered mountains to deserts. At present, most palms are

distributed in the tropics with a few species reaching subtropical areas **(Henderson *et al.*, 1995).**

The palm family (Arecaceae) has a long history of providing man with useful materials for his daily life **(Balick and Beck, 1990)**. Chemically, the family has been neglected despite of its economic importance, probably because of difficulty of collecting fresh material and getting it authenticated. Most work has been carried out on economically important plants such as *Phoenix dactylifera*, *Cocos nucifera* and other palms cultivated for their oils **(Williams *et al.*, 1973).**

Phytochemical analyses of 125 species (Arecaceae) revealed presence of flavonoids, phenolic acids and carotenoids **(Williams *et al.*, 1973; Harborne *et al.*, 1974 and Barron *et al.*, 1988).**

Hyophorbe is a genus of about five species of flowering plants in the Arecaceae family; *Hyophorbe* is a combination of two Greek words: hyo meaning "pig, hog" and phorb, meaning "feed, fodder." The name is thought to come from the use of the palm's fruit for pig fodder **(Friedman *et al.*, 2010).**

Hyophorbe verschaffeltii H.Wendl. is a member of the palm family (Arecaceae, sub-family Arecoideae). This palm is endemic to the Mascarene Islands, which are located to the east of Madagascar in the Indian Ocean **(Friedman *et al.*, 2010).**

The identified flavonoids in *Mascarena verschaffeltii* are negatively charged flavonoids, flavone C-glycoside, luteolin,

luteolin 7-rutinoside, luteolin 7-diglucoside, luteolin 7-KSo_3-3'-O-glucoside and leucocyanidin **(Williams *et al*., 1973).**

The chemical composition of the Arecaceae plants includes: diterpenes, triterpenes and their methyl esters, steroids, proanthocianidines, flavonoids, saponins and rarely alkaloids **(Piozzi *et al.*, 1981; Harborne *et al.,* 1994; Holdsworth *et al.,* 1998; El-Dib *et al.,* 2004 and Koolen *et al.,* 2012).**

A literature survey revealed that almost no recent publications are available about the phytochemical and biological investigation of *Hyophorbe verschaffeltii* H.Wendl.

It was therefore, found interesting to subject the extract of the leaves of entitled plant to an intensive biological and phytochemical investigations.

Aim of Work:

Hyophorbe verschaffeltii H.Wendl. leaves are chosen for this study with the aim of carrying out the following investigations:

- DNA Profiling of *Hyophorbe verschaffeltii* leaves.
- Preliminary phytochemical screening & phytochemical investigation of the aqueous methanolic extract to separate compounds of interesting chemical structure.
- Identification of the different compounds using spectroscopic means *viz.* ^{1}H-NMR, EI-MS and UV.

- Biological screening of the total extract of the leaves of *Hyophorbe verschaffeltii* leaves including anti-oxidant, anti-microbial, anti-inflammatory and cytotoxic activities.

The work presented in this thesis is divided into four chapters:

Chapter 1

DNA profiling of *Hyophorbe verschaffeltii* leaves.

Chapter 2

Investigation of the lipoidal matter of *Hyophorbe verschaffeltii* leaves.

Chapter 3

A Phytochemical study on the leaf extract of *Hyophorbe verschaffeltii* leaves including a preliminary phytochemical screening and phytochemical investigation of the aqueous methanolic extract was performed in an effort to fractionate and separate, hopefully, new compounds of interesting chemical structure. Physico-chemical identification of the different isolates using both chemical and spectroscopic means *viz.* ^{1}H-NMR, EI-MS and UV.

Chapter 4

Biological study of the aqueous methanolic extract of *Hyophorbe verschaffeltii* leaves including:

a- In vivo study

- Acute toxicity activity
- Anti-inflammatory activity
- Hepatoprotective-antioxidant activity

b- In vitro study

- Cytotoxic activity
- Antimicrobial activity

Review of Literature

A-Phytochemical review of Family Arecaceae:

Extensive literature review revealed that the biological activity and the phytochemistry of *Hyophorbe verschaffeltii* H.Wendl. have not been extensively investigated. All what were reported about genus *Hyophorbe* in the literature were only flavonoid pattern.

Concerning family Arecaceae (Palmae) By reviewing the available literature, It was reported its richness in many chemical compounds as phenolic compounds, triterpenoids and saponins which have biological importance.

A survey of 125 species of the Palmae reveald a complex pattern of flavonoids in the leaf. C-Glycosylflavones, leucoanthocyanins and tricin, luteolin and quercetin glycoside were common, being present. The identified flavonoids in *Mascarena verschaffeltii* are negatively charged flavonoids, flavone C-glycoside, luteolin, luteolin 7-rutinoside, luteolin 7-diglucoside, luteolin 7-KSo_3-3'-O-glucoside and leucocyanidin.

From different *Phoenix* species the following compounds were isolated: phenloics as phenolic acids (3-Caffeyl shikimic acid, Nanillic acid, Caffeic acid, Syringic acid, Ferulic acid and *p*-Coumaric acid) and Flavonoids (Luteolin, tricin and quercetin glycosides) also presence of isoorientin, orientin, isovitexin, catechin and epicatechin are also reported. Also procyanidins are

also reported in genus *Phoenix* and sterols as cholesterol, campesterol, stigmasterol and *B*-sitosterol **(Elgindi *et al*., 2015 a).**

The following tables will show different classes of isolated compounds from different genera in family Arecaceae (Palmae).

Table (1): Flavonoidal compounds identified in Family Arecaceae.

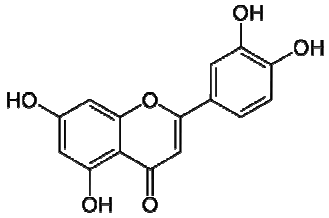
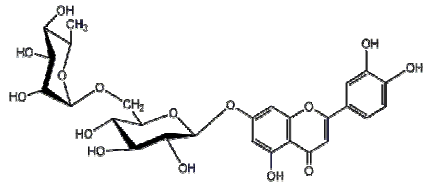
Flavonoid isolated	Present in	Reference
Luteolin 	*Mascarena verschaffeltii*	Williams *et al.*, 1973
	Aiphanes aculeata	Lee *et al.,* 2001
	Washingtonia filifera	El-Sayed and said, 2006
	Areca catechu	Zhang *et al.,* 2009
	Euterpe oleracea	Pacheco-Palencia *et al.*, 2009; Kang *et al.,* 2010; Gordon *et al.,* 2012
	Livistona australis	Kassem *et al.,* 2012
	Syagrus coronate	Belviso *et al.,* 2013
	Mauritia flexuosa	Bataglion *et al.,* 2014
	Ravenea rivularis	Elgindi *et al*., 2015 b
Luteolin 7-rutinoside 	*Mascarena verschaffeltii*	Williams *et al.,* 1973

Table (1) (Cont.)

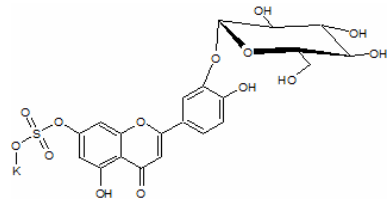
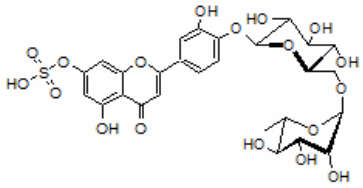
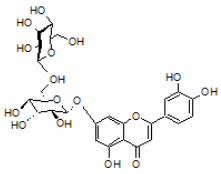
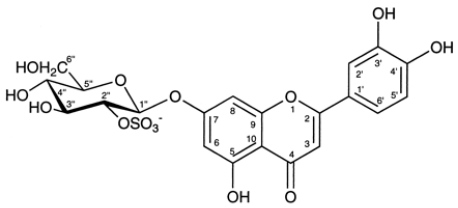
Flavonoid isolated	Present in	Reference
Luteolin 7-sulphate-3'-O-glucoside 	*Mascarena verschaffeltii*	Williams *et al.,* 1973
Luteolin 7-sulphate-3'-rutinoside 	*Mascarena verschaffeltii*	Williams *et al.,* 1973
Luteolin 7-diglucoside 	*Mascarena verschaffeltii*	Williams *et al.,* 1973
	Howea forsteriana	Williams and Harborne, 1971
luteolin 7-O-glucoside 2''-sulfate 	*Washingtonia filifera*	El-Sayed and said, 2006

Table (1) (Cont.)

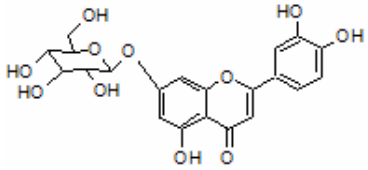
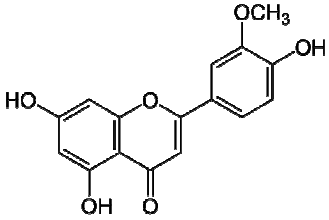
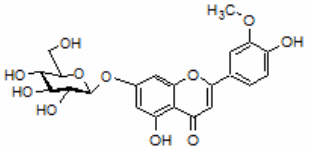
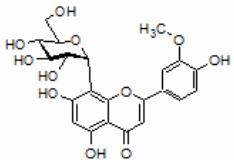
Flavonoid isolated	Present in	Reference
Luteolin-7-O-β-D-glucopyranoside 	*Howea forsteriana*	Williams and Harborne, 1971
	Butia capitata	Ammar *et al.,* 2014
	Livistona australis	Kassem *et al.,* 2012
	Euterpe oleracea	Gordon *et al.,* 2012
	Ravenea rivularis	Elgindi *et al.*, 2015 b
Chrysoeriol 	*Mascarena verschaffeltii*	Williams *et al.,* 1973
	Areca catechu	Zhang *et al.,* 2009
	Euterpe oleracea	Kang *et al.,* 2010; Gordon *et al.,* 2012
Chrysoeriol 7-O-glucoside 	*Euterpe oleracea*	Gordon *et al.,* 2012
Scoparin 	*Mauritia flexuosa*	Koolen *et al.* 2013a
	Euterpe oleracea	Schauss *et al.*, 2006

Table (1) (Cont.)

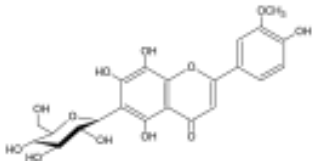
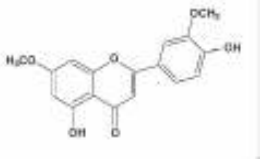
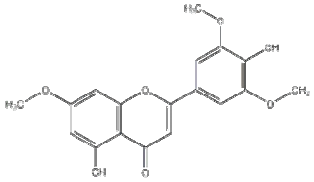
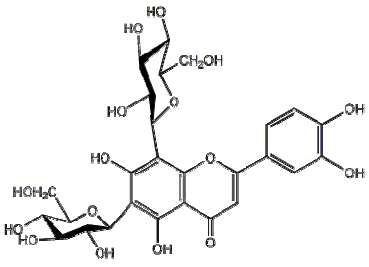
Flavonoid isolated	Present in	Reference
8-hydroxyisoscoparin 	*Washingtonia filifera*	El-Sayed and said, 2006
Velutin 	*Euterpe oleracea*	Kang *et al.,* 2011, Xie *et al.,* 2012
5,4'-dihydroxy-7,3',5'-trimethoxyflavone 	*Euterpe oleracea*	Kang *et al.,* 2011
Lucenin 2 	*Chamaerops humilis*	Benmessaoud *et al.,* 2013
	Livistona australis	Kassem *et al.,* 2014

Table (1) (Cont.)

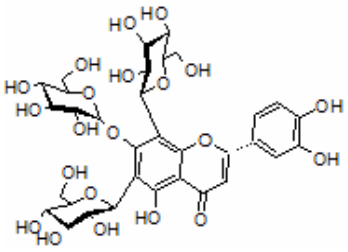
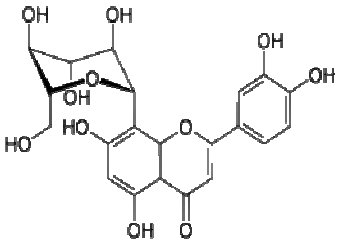
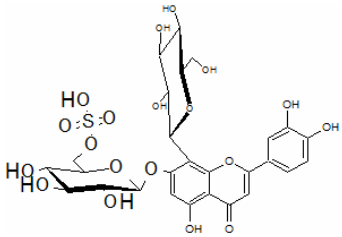
Flavonoid isolated	Present in	Reference
Lucenin2-7-glucoside 	*Arecastrum romanzoffianum*	Harborne *et al.,* 1974
Orientin 	*Arecastrum romanzoffianum*	Harborne *et al.,* 1974
	Sabal blackburniana	Harborne *et al.,* 1974
	Brahea aramata	Hussein *et al.,* 2006
	Washingtonia filifera	El-Sayed and said, 2006
	Euterpe oleracea	Gallori *et al.,* 2004; Schauss *et al.,* 2006;Pacheco-Palencia *et al.,* 2009; Kang *et al.,* 2010 Gordon *et al.,* 2012
	Livistona chinensis	Yao *et al.,* 2012
	Livistona australis	Kassem *et al.,* 2012
Orientin 7-glucoside sulphate 	*Arecastrum romanzoffianum*	Williams *et al.,* 1973

Table (1) (Cont.)

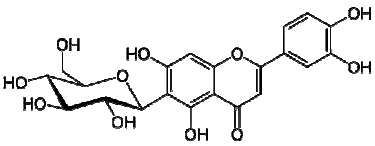
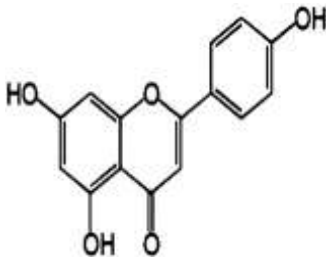
Flavonoid isolated	Present in	Reference
Isoorientin 	*Washingtonia filifera*	El-Sayed and said, 2006
	Brahea aramata	Hussein *et al.,*2006
	Livistona chinensis	Yao *et al.,* 2012
	Livistona australis	Kassem *et al.,* 2012
	Mauritia flexuosa	Oliveira *et al.,* 2013
	Euterpe oleracea	Gallori *et al.,* 2004;Kang *et al.,* 2010; Schauss *et al.,* 2006; Pacheco-Palencia *et al.,* 2009; Gordon *et al.,* 2012
Apigenin 	*Chamaedorea* sp.,	Williams and Harborne, 1971
	Howea forsteriana	Williams and Harborne, 1971
	Euterpe oleracea	Pacheco-Palencia *et al*., 2009
	Orbignya speciosa	Pinheiro *et al.,* 2012
	Livistona australis	Kassem *et al.,* 2012
	Mauritia flexuosa	Bataglion *et al.,* 2014
	Butia capitata	Ammar *et al.,* 2014
	Wodyetia bifurcate	Singab *et al.,* 2015
	Ravenea rivularis	Elgindi *et al*., 2015 b

Table (1) (Cont.)

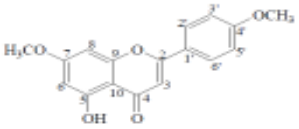
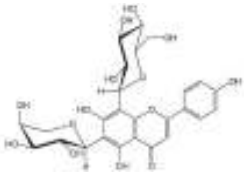
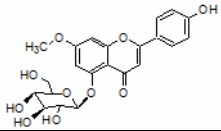
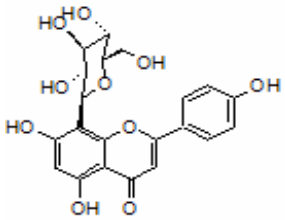
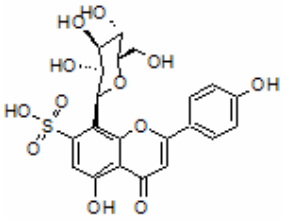
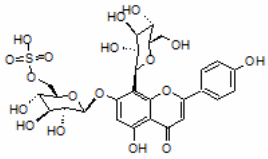
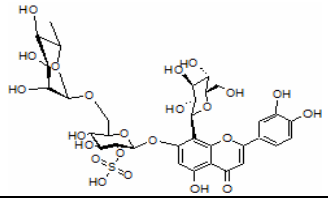
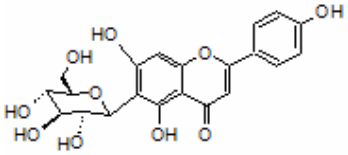
Flavonoid isolated	Present in	Reference
Apigenin 7,4'-dimethyl ether 	*Orania sylvicola*	Sukari and Said, 2013
Isoschaftoside 	*Mauritia flexuosa*	Oliveira *et al.,* 2013
Genkwanin-6-C-β-glucopyranoside 	*Livistona australis*	Kassem *et al.,* 2012
Vitexin 	*Washingtonia filifera*	El-Sayed and said, 2006
	Euterpe oleracea	Kang *et al*., 2010; Gordon *et al*., 2012
	Livistona chinensis	Yao *et al.,* 2012
	Mauritia flexuosa	Koolen *et al.,* 2013 a

Table (1) (Cont.)

Flavonoid isolated	Present in	Reference
Vitexin7-O-sulphate 	*Washingtonia robusta*	Williams *et al.,* 1973
Vitexin 7-glucosidesulphate 	*Washingtonia robusta*	Williams *et al.,* 1973
Vitexin 7-rutinoside sulphate 	*Washingtonia robusta*	Williams *et al.,* 1973
Isovitexin 	*Euterpe oleracea*	Gallori *et al.,* 2004; Schauss *et al.,* 2006;Pacheco-Palencia *et al.,* 2009; Gordon *et al.,* 2012
	Brahea aramata	Hussein *et al.,* 2006
	Euterpe oleracea	Kang *et al.,* 2011
	Livistona chinensis	Yao *et al.,* 2012
	Livistona australis	Kassem *et al.,* 2012