Chemical study of *Dodonaea viscosa* planting in Iraq

Sabah S. Hamadi

Abstract**—***Dodonaea viscosa* Linn. is distinguished therapeutic plant where the leaves are utilized as calming, hostile to ulcer, against bacterial and antifungal operators and in the treatment of breaks. In perspective of its restorative significance and compound investigation were done, these studies gave referential data to distinguishing proof of this crude medication.

Various substance constituents have been confined from *Dodonaea viscosa*, however the vast majority of these were directed to the species gathered from Iraq.

Through the analysis of phenolic acids and flavonoid in Dodonaea viscosa leaves at flowering stage found 5 important compounds which is Gallic acid, Ellagic acid, Rutin as a phenolic acids and Apigenin, Kaempferol as flavonoid, the chemical analysis appear that the rutin had the highest percentage from the other compounds where reached to 279.547.

Keywords**—**: *Dodonaea viscosa*, Chemical compound, flowering stage, medical plant.

I. Introduction

DODONAEA viscosa Linn. was a shrub from the Sapindaceae family (Rajamanickam *et al*., 2010).

The origin of *Dodonaea viscosa* from Australia, also it occurs throughout the tropics and subtropics and widely distributed in temperate regions of Australia, Africa, Mexico, New Zealand, India, Virgin Islands, Florida, Arizona, South America and elsewhere (West and Noble, 1984).

In Iraq it is imported from neighboring countries and cultivated in various gardens and orchards as plants Accessories and provides the appropriate shade of some vegetable crops grown underneath (AL-Yassiri, 2008).

Dodonaea viscosa have many medical properties and have been used by native peoples in all regions where it is found. It is a classic medicine worldwide, used as administered orally or as poultice to treat a great variety of diseases. Stem or leaf solution are used to treat sore larynx also the root solution used to treat colds. The stems and leaves are used to treat the fever, and seeds (in mixing with other plants and coated in honey) used to treat malaria (Rani *et al*., 2009), Rojas *et al.* (1996) also pointed to the importance of this plant medically where is used the Steam of stems were used to treat rheumatism and the leaves are used to relieve itching, fevers swellings, aches and can be used as a antispasmodic agent.

Sabah S. Hamadi __Department of Biology, College of education for pure sciences (Ibn- Al- haitham), Baghdad University, IRAQ.

In India, the infusions of leaves were used to treat rheumatism, gout, hemorrhoids, fractures and snake bites (Kirtikar and Basu, 1995; Nadkarni and Nadkarni, 1982).

The purpose of this work is to determinate the quantitate of essential compound in *Dodonaea viscosa* leaves that may be useful for future studies as source of bioactive molecules.

II. Material and Methods

Plants materials

Leaves of *Dodonaea viscosa* were collected at flowering periods grown in the region of Baghdad at middle of Iraq. Where collected at April 2015.

Extraction of phenolic acids and flavonoid

1.0 g of dry samples was crushed in small pieces in paste-mortar followed by suspending fine s=crushed samples into 50 ml of ethanol 0.1% TFA in water (80:20 V/V) in glass tubes.

The extraction of phenolic acids and flavonoid subjected to ultrasonication (Branson sonifier, USA) at 60% duty cycles for 25 min. at 25ºC followed by centrifugation at 7.500 rpm for 15 minet. The clear supernatant of each sample was subjected to charcoal treatment to remove pigments prior to evaporation under vacuum (Buchi Rotavapor Re Type), dried samples were resuspended in 1.0 ml HPLC grade methanol by vortexing, the mixture were passed through 2.5 µm disposable filter and stored at 4ºC for further analysis, then 20 µl of the sample injected into HPLC system according the optimum separation condition.

Analysis of phenolic acids and flavonoid in conocarpus, the main compound was separated on FLC (Fast Liquid Chromatographic) column under the optimum condition. Column: phenomenex C-18, 3µm particle size (100x 4.6 mm I.D.) column.

Mobile phase: linear gradient of solvent A 0.1% trifluoro acetic acid (TFA acid) in deionized water , solvent B was 0.1% TFA in gradient program from 0% B to 100% B for 12 minutes. Flow rate 1.2 ml/min., the detection is UV at 280 nm and the sequences of the eluted material of the standard were as follow each standard was 25 µg/ml.

Calculation

$$concentration\ of\ sample\ \mu g/l = \frac{area\ of\ sample}{areae\ of\ standard} \times conc.of\ standard \times dilution\ factor$$

The separation occurred on liquid chromatography shimadzu 10 AVLC equipped with binary delivery pump model LC-10A shimadzu, the eluted peaks were monitored by UV-Vis 10 A-SPD spectrophotometer.

Chemical analysis

All chemical used were at least analysis grade, trifluoroacetic acid, phenolic acids standards were purchased from Sigma-Aldrich (Steinheim, Germany).

III. DISCUSSION

The present chemical study affirmed that *Dodonaea viscosa* contains all the important compounds like phenols, alkaloids, flavonoids, saponins, tannins, sugar, steroids and gum adhesive.

Various substance constituents have been confined from *Dodonaea viscosa*, however the vast majority of these were directed on inside types of Iraq. The scientists have explored the concoction constituents of *Dodonaea viscosa* and discovered 23 flavones from seeds, bark, blooms and leaves of *D.viscosa* (Rani *et al*., 2009).

The analysis of phenolic acids and flavonoid in *Dodonaea viscosa* leaves at flowering stage found 5 important compounds which is Gallic acid, Ellagic acid, Rutin as a phenolic acids and Apigenin, Kaempferol as flavonoid. Critical mixes reserved from *D. viscosa* were recorded in Table 1.

Gallic acid is a trihydroxybenzoic, the chemical formula is $C_6H_2(OH)_3COOH$ (Fig.1) , a kind of phenols also consider type of natural acid, otherwise called 3,4,5-trihydroxybenzoic acid, found in gall nuts, sumac, tea leaves, oak bark, and other plants (Reynolds and Wilson, 1991). Concentration of gallic acid in this species reached to 48.672 µg/ml.

It is used as a standard for determining the phenol content of various analysis by the Folin-Ciocalteu assay results are reported in gallic acid equivalents, gallic acid can also be used as a starting material in the synthesis of the psychedelic alkaloid mescaline (Tsao, 1951).

It is a powerless carbonic anhydrase inhibitor (Satomi *et al*., 1993). In fundamental exploration, gallic corrosive separated from grape seeds has been demonstrated to restrain the development of amyloid fibrils, one of the potential reasons for Alzheimer's and Parkinson's disease (Liu *et al.,* 2013; Wang *et al*., 2009 and Liu *et al*., 2014).

One study showed that gallic corrosive has this impact on amyloid protein arrangement by altering the properties of alpha-synuclein, a protein connected with the beginning of neurodegenerative diseases (Liu *et al*., 2014).

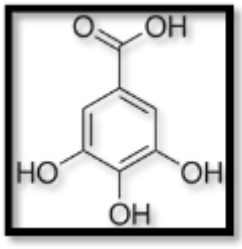

Fig 1: shape of chemical formula of Gallic acid.

Ellagic acid is a natural phenol antioxidant (Fig.2), found in numerous fruits and vegetables, the antiproliferative and antioxidant agent properties of ellagic corrosive have provoked exploration into its potential medical advantages, it has been falsely promoted as being able to anticipate and treat various human illnesses, including cancer disease, yet such claims have not been demonstrated (Food and Drug Administration, 2008). Concentration of ellagic acid in this species reached to 55.935 µg/ml.

The highest grade of ellagic acid are found in blackberries, cranberries, pecans, pomegranates, raspberries, strawberries, walnuts, wolfberries and grapes (Vattem and Shetty, 2005). It is also found in peach and other plant foods (Loreto *et al*., 2011).

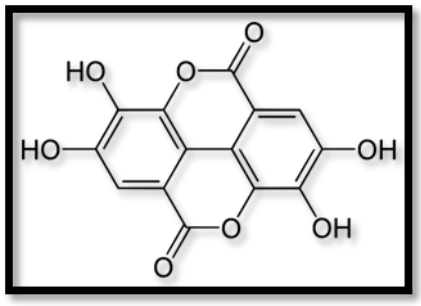

Fig. 2: shape of chemical formula of Ellagic acid.

Rutin is also one of the phenolic compounds (Fig.3), its name comes from the name of *Ruta graveolens*, a plant that also contains rutin, found in the invasive plant like as species *D. viscosa*, *Carpobrotus edulis* and contributes to the antibacterial (Watt and Johan, 2001) and antioxidant properties of the plant (Bouftira *et al*., 2012). The concentration of rutin in this species reached to 279.547 µg/ml.

This compound have many benefit to the human like as inhibits platelet aggregation (Navarro-Núñez *et al*., 2008) , as well as decreases capillary permeability, making the blood thinner and improving circulation, Recent studies show rutin could help prevent blood clots, so could be used to treat patients at risk of heart attacks andstrokes (Reporter, Daily Mail, 2012), Some evidence also shows rutin can be used to treat hemorrhoids, varicosis, and microangiopathy (Chow *et al*., 2005).

Relatively high amount of rutin increases thyroid iodide uptake in rats and decreases serum T3 and T4 level. The decreased hormone level can be explained by its inhibitory effect produced on Thyroid peroxidase enyzme (TPO) (Metodiewa *et al*., 1997) rutin is also an antioxidant compared to quercetin, acacetin, morin, hispidulin, hesperidin, and naringin, it was found to be the strongest (Bando *et al.,* 2010)

Siddiqui (1998) survey makes reference to eighteen flavonoids including glycosides of quercetin (rutin) and isorhamnetin. Mata *et al*. (1991) and colleagues segregated sakuranetin from Mexican *D. viscosa* in 1991.

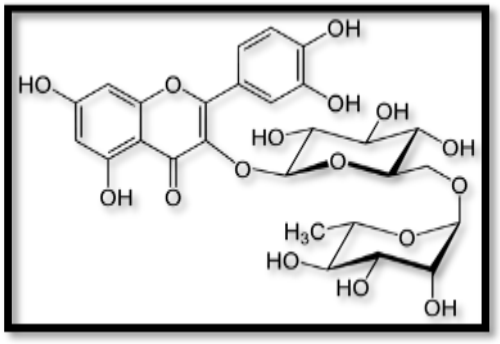

Fig 3: shape of chemical formula of Rutin

Apigenin found in many plants, is a natural product belonging to the flavone class that is the aglycone of several naturally occurring glycosides, it is a yellow crystalline solid that has been used to dye wool (Fig.4) (Mabry, 1970).

Apigenin is found in many fruits and vegetables, but parsley, celery, celeriac, and chamomile tea are the most common sources n (Taupin, 2009). Concentration of Apigenin in *D. viscosa* reached to 49.423 µg/ml.

Ruela-de-Sousa *et al*. (2010) reported that the apigenin induces autophagy (a kind of cellular waste-recycling system) in leukemia cells, which may support a possible chemopreventive role, but that induction of autophagy simultaneously induces resistance against the chemotherapy drugvincristine.

Apigenin is a potent inhibitor of CYP2C9, an enzyme responsible for the metabolism of many pharmaceutical drugs in the body (Wang *et al*., 2009).

Taupin (2009) refer that the Apigenin may also stimulate adult neurogenesis, with at least one study claiming that apigenin stimulates adult neurogenesis in vivo and in vitro, by promoting neuronal differentiation and may be useful for stimulating adult neurogenesis and for the treatment of neurological diseases, disorders and injuries, by stimulating the generation of neuronal cells in the adult brain. While potentially promising, the study used rats and its effects have yet to be demonstrated in humans.

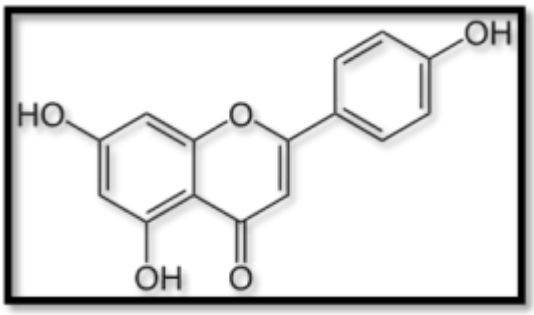

Fig 4: shape of chemical formula of Apigenin

Kaempferol is a natural flavonol, a type of flavonoid, found in a variety of plants and plant-derived foods. Kaempferol is a yellow crystalline solid with a melting point of 276–278 °C (529–532 °F) (Fig.5). It is slightly soluble in water and highly soluble in hot ethanol and ethers. Kaempferol acts as an antioxidant by reducing oxidative stress. Many studies suggest that consuming kaempferol may reduce the risk of various cancers and kaempferol is currently under consideration as a possible cancer treatment. (Liu, 2013).

Concentration of Kaempferol in *D. viscosa* reached to 11.371 µg/ml.

Numerous preclinical studies have shown kaempferol and some glycosides of kaempferol have a wide range of pharmacological activities, including antioxidant, anti-inflammatory, antimicrobial, anticancer, cardioprotective, neuroprotective, antidiabetic, antiosteoporotic, estrogenic/antiestrogenic, anxiolytic, analgesic, and antiallergic activities (Calderon-Montaño *et al*., 2011) .

Ghisalberti (1998) reported that the species *D. viscosa* used as analgesic, anti-inflammatory, antiviral, spasmolytic, laxative, antimicrobial and hypotensive agents.

Calderon-Montaño *et al.* (2011) refer that the in vitro studies along with some animal testing has demonstrated the wide range of potential anti-cancer properties of kaempferol, it has been shown in malignant cancer cells to interrupt cell growth, limit angiogenesis, induce apoptosis and to reduce their available energy and ability to metastasize.

Kaempferol has also been shown to reduce MMP-3 protein activity inferring potential ability to reduce metastasis like as Breast cancer(Calderon-Montaño *et al.*, 2011), Ovarian cancer (Chen *et al*., 2012), Leukemia (Jaganathan and Mandal, 2009) , Bladder, prostate , colorectal cancer ,Gastric cancer and Pancreatic cancer (Ute *et al*., 2007), Lung cancer (Kim and Choi, 2013)

As addition A correlation was found between increased levels of kaempferol in the diet and a reduced relative risk of type 2 diabetes in a cohort study in 2005 (Donnapee *et al*., 2014).

Cardiovascular disorders, Kaempferol has also been shown to have a protective effect on the apoptosis induced by the ischemia/reperfusion of cardiac cells. Due to this, it has a promising pharmacological role in preventing cardiovascular disease (Khalil and Sulaiman, 2010). Also use as Anti-bacterial activity, Anti-viral activity and Antioxidant effects (Veeresham *et al*., 2014).

Getie *et al*. (2000) disengaged generally huge amassings of quercetin, kaempferol and isorhamnetin in D.viscosa unrefined leaf remove.

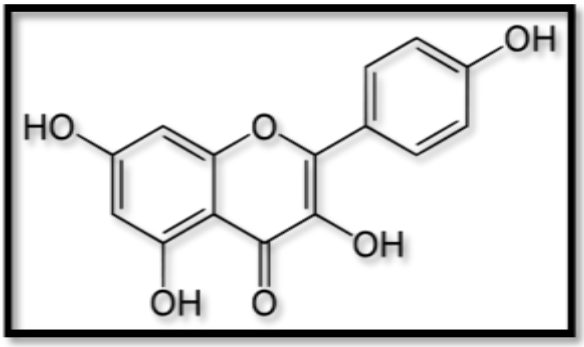

Fig 5: shape of chemical formula of Kaempferol.

Fig1: shape of the *Dodonaea viscosa* tree in flowering stage.

TABLE 1
CONCENTRATION OF SOLUTION IN THE *DODONAEA VISCOSA* LEAVES.

solution	Concentration of the solution
Gallic acid	48.672
Ellagic acid	55.935
Rutin	279.547
Apigenin	49.423
Kaempferol	11.371

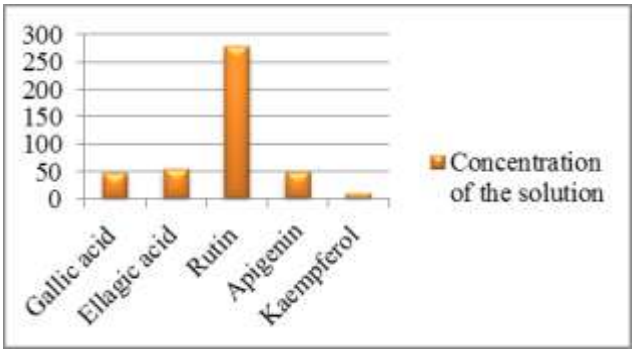

Fig 2: concentration of solution in the *Dodonaea viscosa* leaves.

IV. ACKNOWLEDGMENTS

We thank to Professor D.Fadhil M. Abid, from Biotechnology Center of the Ministry of Science and Technology in Baghdad, Iraq for helping to analyses the essential oil in the plant leaves.

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