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Research Article

Variations of Exhaustive Extraction Yields and Methods of Preparations for (*Arum palaestinum*) Solomon's Lily Plant in all Regions of West Bank/Palestine

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ABSTRACT

Arum palaestinum Boiss. leaves considered one of the most edible wild plant in Palestine also one of the medicinal plant utilized for treatment various diseases specially cancer. The present study sought to evaluate the exhaustive extract yields percentages for Solomon's Lily (*Arum palaestinum* Boiss.) leaves from all of the regions in the West Bank/Palestine (Nablus, Jenin, Tubas, Tulkarm, Salpheet, Qalqilya, Ramallah, Jericho, Jerusalem, Bethlehem, Hebron) to investigate the best region in Palestine that have the strongest anticancer activity which can be helpful in manufacturing foods supplements, cosmeceuticals and pharmaceuticals formulations. By using exhaustive extraction method, the yield of organic and water extraction experimental method was assessed, with steeping the plant in ethanol, water and hexane to extract all the chemical ingredients without destroying or changing their chemical constituents. It is found that the best aqueous and organic yields were in Salfeet region (4.8%, 3.24 %, respectively) while the lowest aqueous yield and organic yield was in Jericho (2.64%, 0.76%, respectively). In recommendation for pharmaceutical companies, Salfeet region was the best area for cultivation *Arum palaestinum* Boiss. plant for manufacturing evidence based standardized pharmacological active pharmaceutical forms also for further scientific researches.

Keywords: Solomon's Lily, Exhaustive extraction, *Arum palaestinum Boiss.*,Organic extraction yield, Aqueous extraction yield.

INTRODUCTION

About 31 species of plants that belong to genus Arum were identified in nature. One of the most popular ones is *Arum palaestinum* Boiss. This species is a perennial herbaceous plant belonging to the Araceae family. This family has about 1000 members distributed mainly in Mediterranean regions. *Arum palaestinum* Boiss. (Lufe in Arabic) is also known as Solomon's Lily, Black Calla, Priest's Hood and Palestinian Arum. This plant grows wildly in Palestine, Jordan, Lebanon and Syria[1]. Since the ancient time many species of Arum was and still used in food and folk medicine[2]. In fact, in Palestine, the leaves of A. *palaestinum* are considered edible after steeping them in salty water or after drying them or after roasting them. It is used by herbal practitioners and local rural healers in the treatment of several diseases such as : (i) cough, (ii) constipation, (iii) heart burn, (iv) urinary tract infections, (v) cancer, (vi) diabetes, (vii) hemorrhoids, (viii) atherosclerosis, and (ix) worms in the GIT. The use of arum in several types of food toxicity and skin diseases was also reported in Palestinian folk medicine[3,4]. Arum is considered a poisonous plant, which can eaten only after cooking with oil or roasting or after sun drying. The leaves and other plants parts can cause vomiting and swelling in the mouth and throat mucous membranes . This inconvenience can be stopped by using olive oil as reported in the Palestinian folklore[5,6].

Arum contains oxalates salts derived from the toxic oxalic acid, are founded as Calcium Oxalate crystals Fig 2. These needle-shaped crystals are held in "bundles" called Raphides, inside the leaves (predominantly) in "idioblasts". They are small specialized cells which are capable of expelling the double-pointed and sharp raphides when damaged, for example when eaten . The raphides lodge very easily and rapidly into the lining of the mouth, throat and gastro-intestinal tract mucous membranes causing strong and intense burning hot irritation, swelling, and often violent choking even in very small amounts[7,8].

Occasionally, the small raphides can pass through the stomach with a little insignificant effect. However, these calcium oxalate crystals are converted to Calcium and Oxalic Acid, which are potentially and dangerously damaging the internal organs . In larger doses, other symptoms may arise, including severe stomach upset and breathing difficulties. Suffocation may even occur if the oesophagus is blocked by swelling of the tissue around the base of the tongue and throat. Too high dose (by excessive consumption) is lethal[9,10] .

**Author for Correpondence*

Figure 1: *Arum paleastinum* Boiss leaves.

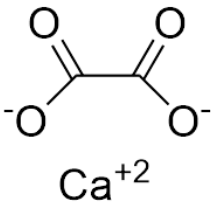

Figure 2: Calcium oxalate structure

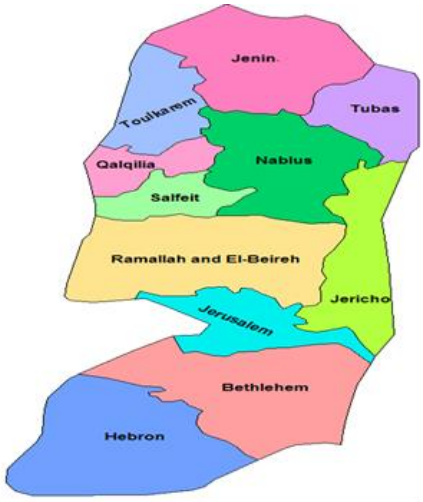

Figure 3: The regions of West Bank- Palestine

The phytochemical screening of Arum plants showed that these plants contain alkaloids, polyphenols, glycosides (flavonoids, saponin and cyanogenic groups), proanthocyanidins , 2-heptanone, indoles, p-cresol, (E)-caryophyllene, monoterpenes, and two unidentified sesquiterpenes and lectin[11,12].

Isoprenoids or terpenoids consist mainly from isoprene units and have antibacterial, antifungal, antiviral and antiprotozoal activities[13]. One of the main constituents of Arum tubers is lectin, which has insecticidal activity that tested against Lipaphis erysimi and Aphis craccivor and these two are economically important sucking pests[14].

Another study was conducted in order to analyze the ethyl acetate fraction of the plant. A new polyhydroxy alkaloid compound and other compounds such as (S)-3,4,5-trihydroxy-1H-pyrrol-2(5H)-one, and other five known compounds; caffeic acid, isoorientin, luteolin and vicenin II (5), as well as the rare compound 3,6,8-trimethoxy, 5,7,3′,4′-tetrahydroxy flavone were isolated and characterized[14].

In addition, the isolation and structural elucidation of a novel pyrrole alkaloid, was investigated and showed it

Table 1: The serial exhaustive organic extractions yields and their frequency for *Arum palaestinum* Boiss.leaves

West Bank Regions	Weight of the sample (g)	Weight of organic extraction yield (g)	Frequency of organic extract yield (%)
Salfeet	25	0.81	3.24
Qalqelyah	25	0.75	3.00
Qalqilya	25	0.61	2.44
Hebron	25	0.55	2.20
Jenin	25	0.54	2.16
Nablus	25	0.54	2.16
Tulkarem	25	0.47	1.88
Bethlehem	25	0.33	1.32
Jerusalem	25	0.26	1.04
Ramallah	25	0.22	0.88
Jericho	25	0.19	0.76

Table 2: The serial exhaustive aqueous extractions yields and their frequency for *Arum palaestinum* Boiss.leaves

West Bank Regions	Weight of the sample (g)	Weight of aqueous extraction yield (g)	Frequency of the aqueous extract yield (%)
Salfeet	25	1.2	4.80
Nablus	25	1	4.00
Qalqelyah	25	0.88	3.52
Jerusalem	25	0.84	3.36
Tulkarem	25	0.83	3.32
Bethlehem	25	0.82	3.28
Ramallah	25	0.79	3.16
Jenin	25	0.77	3.08
Qalqilya	25	0.73	2.92
Hebron	25	0.71	2.84
Jericho	25	0.66	2.64

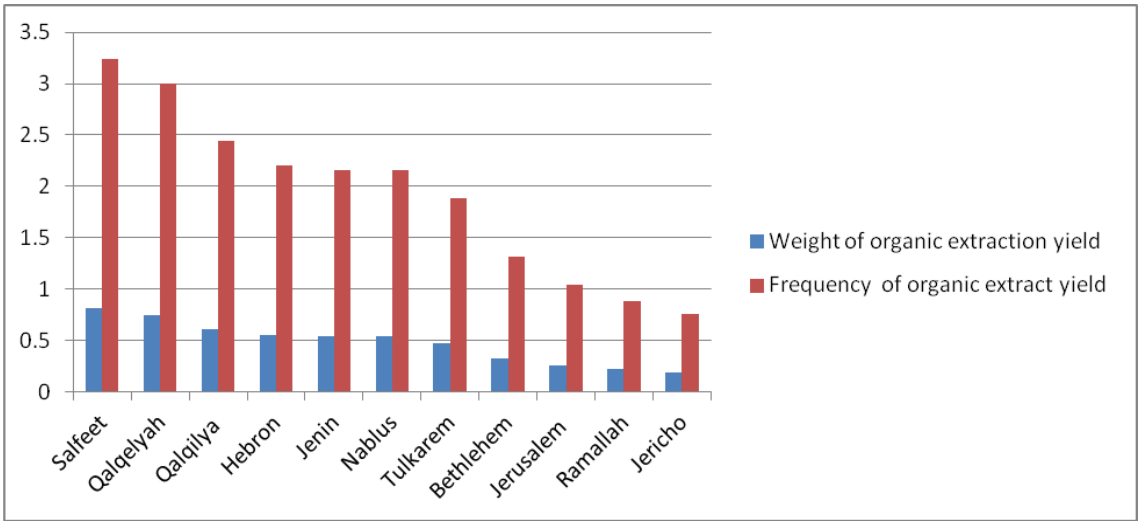

Figure 4: The weight and frequency for the yields of the serial exhaustive *Arum palaestinum* Boiss. leaves organic extraction

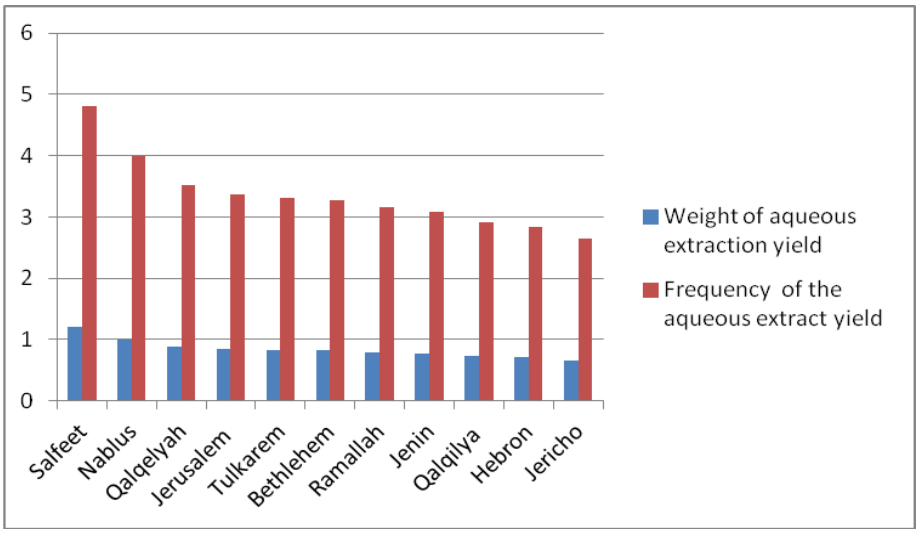

Figure 5: The weight and frequency for the yields of the serial exhaustive *Arum palaestinum* Boiss. leaves aqueous extraction.

has anticancer activity against breast carcinoma cells, hepatocarcinoma, and lymphoplastic leukemia using the 3-[4,5-dimethyl-2-thiazolyl)-2,5- diphenyl-2H-tetrazolium bromide cyto-toxicity assay. The Arum plant ethyl acetate extract of this plant has showed an antioxidant activity through evaluating its scavenging potency of DPPH free radicals .

Saponin glycosides consist of sapogenins and glycone part that is a major family of secondary metabolite plant products, Saponins sub grouped into pentacyclic or steroidal triterpenoids[15].

In fact, some biological and physiological examinations have been reported on this plant[16] as it had potential antifungal activity due the presence of saponin glycosides and monoterpenoids[17-19]. It has also reported an inhibitory effect of *A. Palaestinum* extract on the muscle contraction of rat and guinea-pig uteri[20].

Recently, the growing interests in the natural phytogenic drugs have led to an increased need for efficient extraction methods that can isolate the phytogenic compounds without damaging or changing their chemical structures or their biological activities. Among these methods, serial exhaustive extraction is the most popular one since it is considered as a non aggressive method that does not harsh the active ingredients present in the plant extract. In order to exhaustively extract all active ingredients (hydrophilic and hydrophobic constituents) available in the interested medicinal plant, polar and nonpolar solvents have been without heating[21].

MATERIALS AND METHODS

Plant material

Leaves of *Arum palaestinum* were collected and identified during the spring (May–June, 2013) from the hills and mountains of all regions of the West-bank, Palestine (Fig 3). The herbariums of plant materials were identified and further prepared for scientific work by the pharmacognosist Dr. Nidal Jaradat.

The leaves were washed twice with triple distilled water, dried for 14 days in the shade at room temperature at An-Najah National University, in the Department of Pharmacy laboratories, Faculty of Medicine and Health

Sciences then the dried parts were grounded and the powder was stored in cloth bags at 5 ˚C until their use[22].

Chemicals & Instruments

Ethanol, n-hexane, shaker device (Memmert Shaking Incubator, Germany), rotary evaporator (Heidolph OB2000 Heidolph VV2000, Germany), freeze dryer (Mill rock technology, model BT85, Danfoss, china), grinder (Moulinex model, Uno, China), balance (Rad wag, AS 220 / c/2, Poland), filter paper (Machrery –nagel, MN 617 and Whatman no.1).

Preparation of the extracts

25 gram of the dried and powdered leaves was soaked in a 3:1 mixture of ethanol (50%) & hexane in a well closed Erlenmeyer flask. Then the containers were placed in the shaking incubator for 3days under 200 rpm and the shaker was kept at 25 ˚C. After that the soaked materials were filtered using semi-permeable filter, then the organic and the aqueous phases were separated from each other using a separator funnel. The above procedure was repeated twice[23,24].

The organic phase was eliminated and the residue was weighed in order to calculate the yield. The aqueous phase was placed in a rotary evaporator for one hour at 35 ˚C in order to eliminate ethanol. The aqueous phase was freeze dried and then weighted in order to estimate the obtained yield. These procedures repeated for eleven samples that were obtained from all regions.

RESULTS AND DISCUSSION

In Palestine, the screening of wild plants flora for pharmacological active compounds and food started in the late sixties[25]. There are more than 2300 plant species found on a very small Palestinian geographical area, this large number of plants was founded due to the diversity of the soil and climatic conditions. One of these plants that is widely used to treat or prevent various diseases especially cancer is *Arum Palaestinum*[16].

Due to the high interests of Arum in research statement and popular utilizing between natives as edible and medicinal plant, this study was aimed to evaluate the best area in the West Bank of Palestine that can be considered the best area of cultivation and collection of this plant for further researches and as a good source of manufacturing standardized pharmacological active pharmaceutical forms. Exhaustive extraction method has been selected which involves successive extraction with solvents of increasing polarity from a non-polar (hexane) to a more polar solvent (50% ethanol), to be sure that a wide ranges of natural compounds could be extracted without using any boiling methods of extractions to avoid any hydrolysis of the biological active components.

The results demonstrated that the yields of exhaustive extractions (polar and nonpolar) for *Arum palaestinum* leaves was the highest in Salfeet region and the lowest yield was in Jericho regions as presented in the tables 1 &2 and explained in Fig 4 and 5. The effect on the growth of *Arum palaestinum* was due to the climate zone. Jericho has very hot climate zone while Salfeet has mild climate zone which is very suitable for the growth of this plant[26].

CONCLUSION

The *Arum palaestinum* Boiss leaves were collected from different regions of the West Bank/ Palestine, exhaustively extracted by using polar and nonpolar solvents. This research scientifically certified that this plant which cultivated and collected from Salfeet region of Palestine was the best source for further manufacturing of standardized pharmacological active and evidence based pharmaceutical forms. We also recommend researchers to use *Arum palaestinum* plant from Salfeet region for their scientific works.

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