

I. INTRODUCTION

Plants are the major source of food, fiber, fodder, medicines and many other useful products for mankind. Different plant parts such as roots, stem, leaves, fruits, flowers/inflorescence and seeds are utilized for day-to-day requirements of the human beings. Various insects, bacteria, viruses, fungi and other pests attack the plants at the various stages of their development. It reduces their productivity and leads to a huge loss to mankind. More than 800 million people in the developing countries do not have adequate food supplies and at least 10% of food is lost due to plant diseases^[1].

As compared to other plant parasites, fungal pathogens can infect a wide range of plant species or be restricted to one or few host species. Some of them are obligate parasites requiring the presence of the living host to grow and reproduce, but most of them are saprophytic and can survive without the presence of the living plant, in the soil, water and air^[2].

Pathogenic fungi are the main infectious agents in plants, causing alterations during developmental stages including post-harvest. In fruit and vegetables, there is a wide variety of fungal genera causing quality problems related to aspect, nutritional value, organoleptic characteristics, and limited shelf life^[3, 4], the microbiology of cereals is highly dominated by fungi, as *Aspergillus* and *Fusarium*, These genera produce most of the damage to cereals by their presence itself, but due to their capacity to produce and accumulate mycotoxins^[5]. In addition, in some cases fungi are indirectly responsible for allergic or toxic disorders among consumers because of the production of mycotoxins or allergens^[6]. A significant portion of the agricultural produce in the country and the world over become unfit for human consumption due to mycotoxins contamination of grains, especially those produced by species of *Aspergillus*^[7-9]. More than 25% of the world cereals are contaminated with well known mycotoxins and more than 300 fungal metabolites are reported to be toxic to man and animals^[10]. The main toxic effects are carcinogenicity, genotoxicity, teratogenicity, nephrotoxicity, hepatotoxicity, reproductive disorders and immunosuppression^[11, 12]. Isolates of a plant fungal species

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can be differentiated by morphological characteristics, host range, pathogenic aggressiveness (pathotypes or races) or their ability to form stable vegetative heterokaryons by fusion between genetically different strains (belonging to the same vegetative compatibility group, VCG).^[2]

Detection and accurate identification of plant pathogens is one of the most important strategies for controlling plant diseases to initiate preventive or curative measures. Special interest should be taken in the early detection of pathogens in seeds, mother plants and propagative plant material to avoid the introduction and further spreading of new pathogens in a growing area where it is not present yet. For that reason, the availability of fast, sensitive and accurate methods for detection and identification of fungal pathogens is increasingly necessary to improve disease control decision making. Traditionally, the most prevalent techniques used to identify plant pathogens relied upon culture-based morphological approaches. These methods, however, are often time-consuming, laborious, and require extensive knowledge of classical taxonomy. Other limitations include the difficulty of some species to be cultured in vitro, and the inability to accurately quantify the pathogen^[2].

The most important method of protecting the plants against the fungal attack is the use of synthetic fungicides, but their excessive use complemented with high costs, residues in plants and development of resistance, has left a negative effect on human health and the environment^[13, 14]. The increased usage of different chemical pesticides in agriculture resulted in various problems to environmental ecology including effect of chemicals residual on the quality of agriculture products, increased the resistance of chemicals to target pathogens and causes environmental pollution. Due to this problem, medicinal plants have been chosen as one of the sources of antimicrobial agents as organic pesticide to control the specific of plant diseases^[15].

Organic fungicide is one of other alternative compounds as biocontrol of plant diseases because of negative public perceptions using chemical pesticide. Organic

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fungicide products especially from plant extracts act as disease control agents have been studied, since they tend to have low mammalian toxicity, less environmental effects and wide public acceptance ^[16]. Environmentally friendly (natural) plant extracts agents have shown to be great potential as an alternative to synthetic fungicides ^[17]. That plant extracts are cheap, locally available, non-toxic and easily biodegradable

Plants could be described as a wonderful kitchen or chemical cabinets filled with attractive things. The ancient Egyptians were familiar with many medicinal herbs and were aware of their usefulness in the treatment of various diseases ^[18]. Throughout the history of mankind, medicinal plants have continuously been used for the treatment of multiple infections ^[19, 20]. Herbal medicines have made large contributions to human healthiness ^[21].

Plants, considered the most useful sources of medicinal compounds or biologically active secondary products that have continued to play a dominant role in the maintenance of human health since ancient times ^[22]. Plant extracts or their active constituents are used as folk medicine in traditional therapies of about 80% of the world's population and Over 50% of all modern clinical drugs are of natural product origin ^[23, 24]. According to World Health Organization ^[25] medicinal plants is the best source to obtain a variety of drugs ^[26].

Phytochemicals are those chemical compounds that occur naturally in plants and responsible for color and organoleptic properties, such as the deep purple of blueberries and smell of garlic ^[27]. Phytochemicals are non-nutritive plant chemicals that have protective or disease preventive properties. The qualitative and quantitative estimation of the phytochemical constituents of a medicinal plant is considered to be an important step in medicinal plant research. Plants are a rich source of secondary products which are potential sources of natural antioxidants ^[28]. Numerous crude extracts and pure natural compounds from leaves have been reported to have antioxidant and free radical scavenging activities. Among antioxidant compounds, flavonoids and phenolics, which are widely distributed in nature, have attracted attention ^[29]. Flavonoids are highly

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effective antioxidants and their protective effects in biological systems are attributed to their capacity to scavenge free radicals, chelate metal catalysts, activate antioxidant enzymes, reduce alpha-tocopherol radicals and inhibit oxidases ^[30]. Furthermore, phenolic compounds have phenolic hydroxyl groups which can dissociate to negatively charged phenolates. Dissociated phenolates can form hydrogen and ionic bonds with various proteins, which lead to disturbance of their structures and in consequence to change their bioactivity ^[31].

Phytochemical screening yielded secondary products present in the medicinal plants like alkaloids, flavonoids, cardiac glycosids, phenol, resins, steroids, Saponins, terpenoid, anthraquinone, and volatile oil have always been of great interest to scientists working in this field. In recent years this interest to evaluate plants possessing antibacterial activity for various diseases is growing ^[32, 33]. For instance, in developed countries 25% of the medical drugs are based on plants and their derivatives ^[34]. Scientists estimate that there may be as many as 10,000 different bioactive Phytochemicals having the potential to affect diseases such as cancer, stroke or metabolic syndrome. These bioactive Phytochemicals are abundant in fruits, vegetables and herbs ^[27]. More than 50,000 structures of bioactive secondary metabolites have been identified in plants via NMR, MS, X-ray and GC-MS spectrophotometric analysis. However, as only less than 20% of all plants have been studied, it is very likely that the actual numbers of secondary products or bioactive products in the plant kingdom would exceed 100,000 structures ^[35]. Secondary products are produced in specific pathways and sites of synthesis can differ between types of compounds and between plant species. Furthermore, some compounds can be produced by all tissues, whereas others are produced in a tissue or even cell-specific fashion.

Wild plants may contain a large amount of phenolic compounds as effective secondary metabolites which had antifungal activity. Among of these plants, *Asparagus stipularis* (Asparagaceae), *Cyperus capitatus* (Cyperaceae) and *Stipagrostis lanata* (Poaceae). These plants which are monocot geophytes (have subterranean organs) occur

in harsh environments (saline and/or non-saline sand formations) in the Deltaic Mediterranean coast of Egypt ^[36]. The underground and aerial parts of *A. stipularis* and *C. capitatus* as well as the aerial parts of *S. lanata* contained high amounts of biologically active compounds such as phenolics, tannins, flavonoids, alkaloids, saponin and cyanogenic glycosides ^[37, 38].

The essential oils also known as ethereal oils, are defined as, the oils obtained by the steam distillation of plants. From the view point of practical applications, these materials may be defined as odiferous bodies of an oily nature, obtained almost exclusively from vegetable organs: flowers, leaves, barks, woods, roots, rhizomes, fruits, and seeds ^[39-41]. An essential is generally identified with the name of the source plant. Volatile oils are generally liquid, aromatic and possess pleasant odour and essence. The term “essential oil” is often used in cosmetics and perfume industries as synonymous with perfume oil, base or, “compound”.

Arabs were the first who developed the techniques for obtaining essential oil from the naturally occurring organic materials ^[42]. Arab physician, Avicenna, designed the protocol to extract the essential oil from the flowers by distillation in the tenth ^[43, 44]. He isolated the perfume in the form of oil or attar from the rose flowers and produced rose water. Therefore, the first description of rose water had been reported by an Arab historian.

Essential oils are isolated from different aromatic plants generally distributed in Mediterranean and tropical countries across the world where they are esteemed as an imperative component of the native medicine systems. These essential oils can be produced in almost all plant organs such as flowers, buds, stems, leaves, fruits, seeds and roots etc. These are accumulated in secretory cells, cavities, channels, and epidermic cells ^[39, 45-47]. Almost all odoriferous plants contain essential oils. The raw material from which essential oils are manufactured may be fresh, partially dehydrated or dried ^[46, 48, 49].

The specific function of many phytochemicals is still unclear; however, a considerable number of studies have shown that they are involved in the interaction of

plants/pests/diseases. Antimicrobial screening of plant extracts and phytochemicals, then, represents a starting point for antimicrobial drug discovery. Phytochemical studies have attracted the attention of plant scientists due to the development of new and sophisticated techniques. These techniques played a significant role in the search for additional resources of raw material for pharmaceutical industry ^[50].

Due to the fact that plant extracts usually occur as a combination of various type of bioactive products or phytochemicals with different polarities, their separation still remains a big challenge for the process of identification and characterization of bioactive compounds. It is a common practice in isolation of these bioactive compounds that a number of different separation techniques such as TLC, column chromatography, flash chromatography, Sephadex chromatography and HPLC, should be used to obtain pure compounds. The pure compounds are then used for the elucidation of structure and biological activity. Besides that, non-chromatographic techniques such as immunoassay, which use monoclonal antibodies (MAbs), phytochemical screening assay, Fourier-transform infrared spectroscopy (FTIR), can also be used to obtain and facilitate the identification of the bioactive natural products.

However, medicinal plants have a wide use in pharmaceutical and food industry as antimicrobial agents, but their use as antifungal agents against phytopathogenic fungi has not been fully screened and evaluated. The antifungal activities of fifteen Egyptian herbal & medicinal plants extracts and oils were investigated and the chemical composition of their essential oils was described using gas chromatography-mass spectroscopy (GC-MS)