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Review

Importance of *Cleome droserifolia* as an endangered medicinal plant species in the Sinai Peninsula and the need for its conservation

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Abstract

This review focuses on biological activities, chemical composition, threats, and how to make a conservation plan for *Cleome droserifolia*. Cleomaceae are a small family of flowering Brassicales, with over 300 species distributed among nine genera, the largest of which is *Cleome*, with 199 species of ecological, traditional, and medical value. It contains a vast array of secondary metabolites that occur naturally in *Cleome* genus shrubs such as several terpenes, flavonoids, glucosinolates, anthocyanin alkaloids, and polyphenols. In traditional medicine, *Cleome* species are therefore well recognized for treating stomachaches, skin allergies, and open wounds as well as having anticancer and hepatoprotective qualities. Shrubs from the *Cleome* genus have also demonstrated potent anti-diabetic effects. It is widely used by the Bedouins of the southern Sinai for the treatment that makes plant species endangered. As a result, a significant effort must be made to enhance conservation planning by taking potential distribution changes and making enclosures to protect the target species.

Keywords: *C. droserifolia*, chemical composition, biological activities, threats, conservation program.

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INTRODUCTION

Medicinal plants can serve as a natural source of therapeutic drugs, nutraceutical supplements, and feed additives that can be used to improve human and animal health. The interest in exploring plants as a new source of different drugs, specifically antimicrobials, has increased in recent decades as an attempt to fight multidrug-resistant bacteria (Hashem et al., 2019; Awad et al., 2019). The Sinai Peninsula is characterized by the presence of a large number of medicinal species that are highly used in folk treatments while only a few of these received scientific and medical evaluation to know their efficacy. One such species is *Cleome droserifolia* (Cleomaceae), which is commonly used in Egyptian folk medicine to treat many diseases. In the last 50 years, natural resource management is growing and conservation strategies are being developed.

The Cleomaceae are a small family of Angiosperms (Eudicots, Rosids, Malvids, Brassicales) comprising more than 300 species belonging to nine genera of which *Cleome* is the largest genus with 199 species (POWO, 2023) of medicinal and ecological importance. The most famous species of the genus *Cleome* in Egypt is *C.droserifolia* (Forssk.) Delile Descr. (*Roridula droserifolia* Forssk) and known by the name Samwah. It is a perennial aromatic shrub with typical orbicular leaves and requires stony and sandy soil. The species is also found in Libya, Syria and Palestine. This species is well-known as an antihyperglycemic agent (Abdel-Hady, 1998; Motaal et al., 2011; Abdel-Kawy et al., 2000) and it is widely used by the Bedouins of southern Sinai for treating diabetes. It has been uprooted extensively from vast areas, especially in the Sinai and the Eastern Deserts, to the extent that it became endangered.

However, it was found thriving in the far southeastern desert (Batanouny, 1999). The other important medicinal species in the region include *Artemisia judaica*, *Balanites*

aegyptiaca, *Calotropis procera*, *Capparis spinosa*, *Cleome droserifolia*, *Citrullus colocynthis*, *Limonium axillare*, *Senna alexandrina*, *S. italica*, *Salvadora persica*, *Solenostemma argel* (Mahmoud and Gairola, 2013). These plant species may be prioritized for conservation and further ethnopharmacological studies. It is necessary to document the indigenous knowledge and protect such medicinally important species for future generations (Mahmoud and Gairola, 2013).

GEOGRAPHICAL DISTRIBUTION

The target species is a Cleomaceae perennial aromatic shrub that grows well in stony soil and is regionally dispersed in Egypt, Libya, Syria, Jordan, and Palestine. In Egypt, it can be found in South Sinai, along the Red Sea coast, in the Oasis, and along the Mediterranean coast. The geographical distribution and occurrence of the Family Cleomaceae in the wild flora of Egypt vary greatly among the species (Kamel et al, 2010). Zalat et al. (2008) recorded *C. droserifolia* in three wadies in Saint Cathrine, wadi el Tarfa, wadi Isla and wadi Hebran. Salama et al. (2014) recorded a rare occurrence of *C. droserifolia* in three out of four stations in the South of the Eastern Desert, Egypt. Their study area covered three desert types: The limestone desert (Assuit-Qena Desert), the sandstone desert (Idfu-Kom Ombo Desert), and the Red Sea coastal plain (Zahran and Willis, 2009). The *C. droserifolia* was not recorded in the Idfu marsa alam transect probably due to the sandy nature (Figure 1).

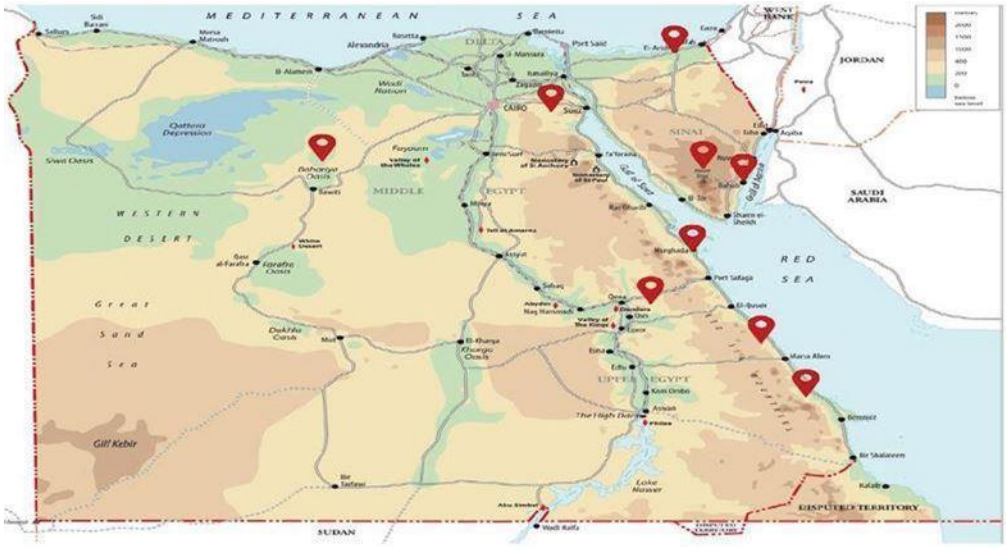

Figure 1. Map representing the geographic distribution of *Cleome droserifolia* in Egypt.

ECOLOGY

Cleome droserifolia prefers the gentle slopes with depressions, vast wadis, and low terraces of South Eastern Sinai (Moustafa and Kamel, 1995) and wet wadis and coarse-textured stony soil with stone surface as shown in Figure 2 (Dargie and El-Demerdash, 1991). Near Kattamia station Eastern desert (Hegazy, 1990) the population of *C. droserifolia* had the soil rocky calcareous with 28% carbonate content and alkalinity of 7.8 while the precipitation ranged from 25 to 55 mm/y at maximum. *C. droserifolia* dominated the community with an importance value of 67.8 out of a total of 300, followed by *Zygophyllum decumbens*, *Launaea spinosa,* and *Gymnocarpos decandrum* the seed population demonstrated that 44.2% of seeds were endogenously dormant and 8.9% exhibited exogenous dormancy and rest –seeds were non-viable. Adult plants had higher survival more than seedlings and juveniles due to the development of deeper root systems thus more water access. According to a study by Hegazy, *C. droserifolia* keeps vegetating all year round, leafing reaches a peak in April, flowering and fruiting extends from early May until early October (Hegazy and Fadl-Allah, 1995; Hegazy, 1990).

BIOLOGICAL AND MEDICINAL ACTIVITIES

To safely improve human and animal health, medicinal plants can be used as a natural source of therapeutic medications, pharmaceuticals/food supplements, and

Figure 2. *C. droserifolia* plant growing in South Sinai, Egypt.

feed additives. Samwah, Afein, or Reeh-El-Bard are other names known in Egypt for *cleome droserifolia*. Egyptian herbalists utilize it as a hypoglycemic agent, and the southern Sinai Bedouins frequently use its decoction to cure diabetes. This plant has great fame as an antihyperglycemic agent (Yang et al., 1990; Nicola et al., 1996; Abdel-Hady, 1998; Abdel-Kawy et al., 2000; Motaal et al., 2011). The considerable research efforts confirmed its utility as a hypoglycemic herb (Hashem et al., 2019; Awad et al., 2019). The *Cleome* genus is one of the largest genera among medicinal plants and is a member of the Cleomaceae family. According to Moustafa et al. (2019), this genus contains 180–200 species that are geographically dispersed over Egypt, Libya, Palestine, Syria, and other dry and semi-arid regions. Additionally, they are perennial, low fragrant, cushion-like shrubs with a length of 25 to 60 cm that have broad, oval, three-nerved leaves with inflated glandular hairs and elaborately branching stems (El-Askary et al., 2019; Moustafa et al., 2019). The shrubs which belong to this genus have medicinal and ecological importance. *Cleome* genus shrubs are well-known in folk medicine for treating stomachache, skin allergies, and open wounds, as well as for exhibiting anticancer and hepatoprotective properties (Ezzat and Motaal, 2012; Abdel-Kader et al., 2009; Maksoud et al., 2020). In addition, *Cleome* genus shrubs have demonstrated remarkable antidiabetic characteristics. Shrubs in the genus *Cleome* have antibacterial, antiparasitic, and antioxidant properties (Maksoud et al., 2020). These biological effects are connected to the wide variety of secondary metabolites that are present naturally in shrubs belonging to the *Cleome* genus. From *Cleome* species, many terpenes, flavonoids, glucosinolates, anthocyanin alkaloids, and polyphenols have been extracted (Moustafa et al., 2019). Additional research is needed to investigate the active secondary metabolites of the shrubs of the *Cleome* genus and their potential as natural feed and food supplements that could be applied to improving animal and human health. In the last twenty years, various numbers of studies have been done on *C. droserifolia*, testing its different medicinal properties, and the resulting outcomes were remarkable. In the search for medicinal plants with anticancer properties, Ezzat and Motaal (2012) isolated new cytotoxic metabolites from *C. droserifolia*, which showed significant cytotoxic activities against two tested cell lines in comparison to those of the anticancer drug doxorubicin. In addition, the plant has shown strong antioxidant properties plus the ability to regulate blood insulin, the aqueous extract contained a very high percent of the total active flavonol glycosides that when tested at different doses showed a 63.3% activity similar to that of the commercially used metformin (Abdel-Kawy et al., 2000; EL-Shenawy and Abdel-Nabi, 2006; Motaal et al., 2014). Furthermore (Abdel-Kader et al., 2009) have tested significant hepatoprotective effects of *C. droserifolia* aerial parts extract (Figure 3). An anti-schistosomiasis activity of *C. droserifolia* has been detected by (El-Shenawy et al.,2006). They found that the plant extract has beneficial effects on thyroid hormone status, its direct effect on the parasite, and its enhancing effects on the antioxidant capacity of the host. Several sesquiterpenes, steroids, and flavonoids have been isolated from *C. droserifolia* (Hussein et al., 1994; El-Askary, 2005). Effects of this plant on the histopathological and ultrastructural changes of liver and kidney tissues of rats treated orally with *C. droserifolia* plant extract for three different periods. Diabetes, inflammations, stomach, and rheumatic aches, as well as snake and scorpion stings, can be treated with *C. droserifolia* (Reda et al., 2000).

Additionally, *C. droserifolia* extracts have particular biological properties that enhance the metabolism of carbohydrates (Mikhail, 2000). The continuous oral administration of an alcoholic extract of *C. droserifolia* over 12 weeks, according to (El Zorba, 1993), resulted in hyperemic capillaries in the renal tissues, indicating an increased blood supply to the kidney that may be the

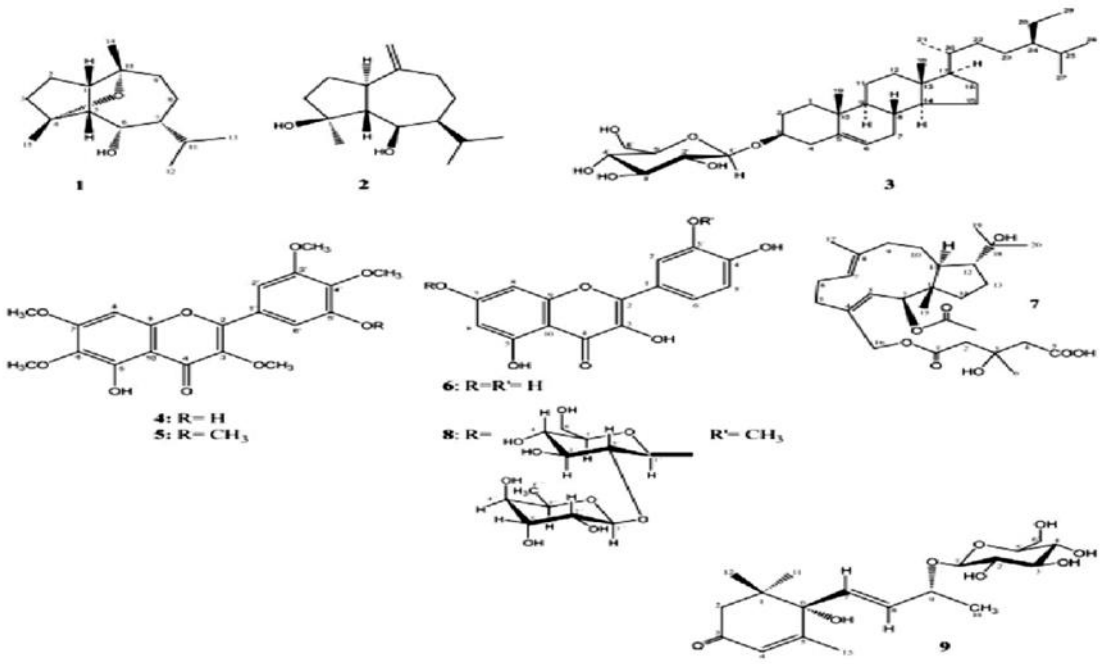

Figure 3. The structure of hepatoprotective compounds isolated from Cleome (Moustafa et al., 2019).

cause of diuresis. *Cleome viscosa* (Capparidaceae) was shown to have anti-diarrheal potential in rats (Devi et al., 2002). Also, Williams et al. (2003) proved the anti-bacterial and anti-fungal activities of *Cleome viscose* plant. *Cleome droserifolia* plant acts as an antiobesity (Helal et al. 2002), hypoglycemic or antidiabetic plant (Helal et al., 2002; El Naggar et al., 2005; El-Shenawy and Abdel-Nabi, 2006).

Also, the antioxidant and anti-schistosomiasis mansoni properties of the *Cleome droserifolia* plant were described by (El-Shenawy et al., 2006). Through biochemical measurements and histological changes, Abdel-Kader et al. (2009) demonstrated the hepatoprotective effects of the *Cleome droserifolia* plant against carbon tetrachloride-induced liver injury. The hepatoprotective components of the plant were also extracted by scientists, and the fractions produced three guaiane sesquiterpenes (buchariol, teucladiol, and daucosterol) and three recognized flavonoid derivatives. Additionally, the ethanolic extract of *C. viscosa* (Capparidaceae) was shown to have hepatoprotective action against carbon tetrachloride-induced hepatotoxicity in experimental animal models (Gupta and Dixit, 2009). El-Askary (2005) discovered drosericarpone, a new diacetyl triterpene lactone, along with buchariol and stigmasterol glucoside from the hexane extract of the herb *Cleome droserifolia*. According to Bouriche and Arnhold (2010), *Cleome arabica's* (Capparaceae) leaves, which contain several glucosylated and rhamnosylated flavonols, possess anti-inflammatory activity and are used for the treatment of abdominal and rheumatic pains. Toxic mosquito *Culexpipiens* L. larvae were killed by aqueous preparations of *Artemisia cina* (family Composite) and *Cleome droserifolia* (family Capparidaceae). At 24 hours following extract treatment, the EC50 for the mosquito was 4.0 g/l for *Artemisia cina* and 4.7 g/l for *Cleome droserifolia*. The plants can be utilized to inhibit mosquito larvae, according to (Aly and Badran, 1996).

BIOCHEMICAL STUDIES

A new diacetyl triterpene lactone, drosericarpone (**2**), was isolated from the hexane extract of the herb *Cleome droserifolia*, together with buchariol (**1**), a sesquiterpene oxide, isolated for the first time from Cleome species and stigmasterol glucoside (**3**). The structures of **1**-**3** were identified by spectroscopic means (El-Askary, 2005). The hexane fraction of the powdered herb ethanolic extract of *C. droserifolia* afforded three terpenoidal compounds 1-3. The identification of these compounds was accomplished by examination of their spectral data (1H-, 13C-NMR, HMQC, HMBC and EIMS) and supported by comparison with published data of related compounds (Harraz et al., 1995; El-Askary, 2003; Tsichritzis et al., 1993; Nagaya et al., 1997).

Sharaf et al. (1992) examined aerial parts of four *Cleome* species (*C. droserifolia*, *C. amplyocarpa*, *C. brachycarpa* and *C. chrysantha*) for their surface flavonoid content. Ten methylated flavonoids were

isolated and identified as isokaempferide, 5,7,4'-trihydroxy-3,3'-dimethyoxyflavone, Jaceosidin, penduletin, axillarin, 5,7,4'-trihydroxy-6,3',5'-trimethoxyflavone, chrysosplenetin,5,3'-dihydroxy 3,6,7,4',5'pentamethoxyflavone,5,4'-dihydroxy-3,6,7,8,3'pentamethoxyflavone and 5-hydroxy-3,6,7,3',4',5' examethoxyflavone. Flavonol glycosides isolated from *C. droserifolia* (Abdel-Latif et al., 2022). Chemical structure of 3 flavonol glycosides isolated from C. *droserifolia,* A Compound (1), isorhamnetin-3`-methoxy-3-O-β-d-glucoside, B compound (2), quercetin-3`-methoxy-3-O-(4``-acetylrhamnoside)-7-O-α-rhamnoside, C Compound (3), kaempferol-4`-methoxy-3,7-O-dirhamnoside (Figure 4). From *C. droserifolia*, three diterpenoid dolabellane esters were identified. Chemical and spectral techniques were used to determine the chemical structures of the isolated substances. These dolabellanes (I, II, and III) are 3-hydroxy-3-methyl glutaric acid (3-HMGA) ester derivatives. Compound III is the methyl ester of compound I, but compounds I and II do not include the second (3HMGA) carboxyl function (Fathy et al., 2008). Hashem and Shehata (2021) examined the antioxidant, antibacterial, and immunomodulatory properties of the shrub *C. droserifolia* (Forssk.) Del. (Cd), taking into account the biological activity of its phytogenic components. Several phenolic substances, primarily phenolic acids like benzoic acid, are included in *C. droserifolia* shrub. *Cleome droserifolia*'s methanolic extract has shown potent in vitro antibacterial and antioxidant properties.

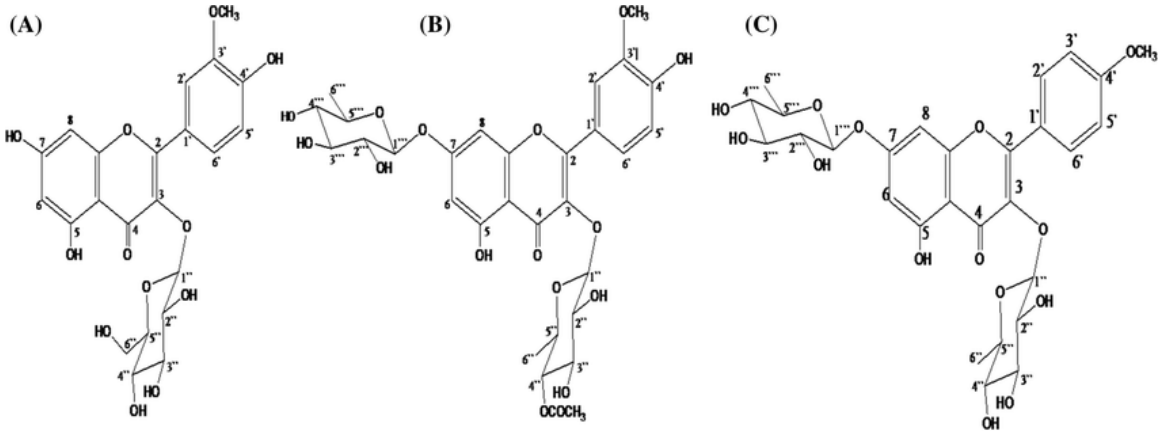

Figure 4. flavonol glycosides isolated from *C. droserifolia* (A) Compound (1), isorhamnetin-3`-methoxy-3-O-β-d-glucoside, B compound (2), quercetin-3`-methoxy-3-O-(4``-acetylrhamnoside)-7-O-α-rhamnoside, C Compound (3), kaempferol-4`-methoxy-3,7-O-dirhamnoside.

A powder made from *C. droserifolia* aerial parts has been shown to enhance humoral and innate immunity as well as gastrointestinal microbiota balance in an in vivo investigation utilizing rabbits as the animal model. According to Hashem and Shehata (2021), the *Cleome* shrub is a fresh source of secondary active metabolites that can be used as an antibiotic substitute in the field of animal production or for medicinal purposes involving humans. Hydro-distillation of the aerial parts of *C. droserifolia* yielded 0.64 % (w/w) of dark yellow color fragrant oil. On the other hand, the essential oil yield of the Jordanian ecospecies of *C. droserifolia* is lower than that of the results (0.43 %) of Muhaida et al. (2015), where this variation could be ascribed to the genetic and various ecological factors. The speed of germination index, shoot length, and root length of *Trifolium* and three associated weeds (*Chenopodium*, *Cuscuta*, and *Melilotus*) were reduced under the effect of different concentrations of the *C. droserifolia* (Marčetić et al., 2017). The inhibition was concentration-dependent; meanwhile, Chenopodium was more resistant to the allelopathic effect of the EO than the two other weeds (Abd El-Gawad et al., 2018). The allelopathic effects of *C. droserifolia* shoot extract were tested on its seed germination and seedling growth as well as the mycoflora in the soil. The study showed a negative effect of the shoot extract on seed germination and seedling growth indicating that *C. droserifolia is* autotoxic. The two species of *Penicillium chrysogenum* and *Penicillium funiculosum* in the Mycoflora were the most susceptible to the allelopathic effects of *C. droserifolia*. Meanwhile, *Rhizopus stolonifer* was the only isolated species found to be resistant to the allelopathic effects (Hegazy and Fadl-Allah, 1995; Hegazy, 1990). The effect of light and dark conditions on developed heterotrophic callus cultures and photomixotrophic cultures from whole seedlings of *C. droserifolia* were studied, to find that the heterotrophic callus cultures excreted allelochemicals (autotoxic) which inhibited callus induction and development. Badri et al., (1996) determined the mineral

composition (Ca, Mg, K, Na, Fe, Al, Mn, Co, Ni, Cu and Zn) of *Senna alexandrina* and *C. droserifolia* in the Eastern Desert of Egypt. It was found that the concentration of Fe, Al, Mn, Co, Ni, Na and Si in the leaves of *Cleome* was always higher than that in the leaves of Senna. Eventually, Salama and Fayed (1990) carried out phyto-sociological studies of thirty-nine species including *C. droserifolia* for comprising the vegetation of wadi Qena using the zurichmontpelliar technique.

Three chemicals were isolated using column chromatography and two consecutive solvents to extract *Cleome droserifolia* (Fathy, 2018). By using spectroscopic analysis, two steroidal substances were extracted and recognized as ergost-5, 7, 9, 24(28)-tetraen-3-one (1) and -sitosterolglucoside (3). (Fathy, 2018) also discovered 1-dodecanol (2) by using spectroscopic measurement. As a potential tumor necrosis factor inhibitor and prospective lead molecule for the treatment of rheumatoid arthritis, the new ergostane derivative isolated from the aerial portions of *C. droserifolia* is introduced (Fathy, 2018).

THREATS

Medicinal plants are at increasing risk from the destruction of their habitats, bioprospecting for new sources, and overharvesting of known medicinal species. Climate change was identified as the top threat to biodiversity by the Millennium Ecosystem Assessment. In addition to human disturbance, invasive species, habitat loss and degradation, and changes in land use (Chapin III et al., 2000). In the last decade, *C. droserifolia* has been subject to severe overexploitation to be used in folk medicine for diabetes. It has been eradicated from vast areas, especially in the Sinai and the Eastern Desert. However, in the far south of the Eastern Desert, the plant is still flourishing and is growing in many wadis in hot desert areas (Hassan, 2014). As a result, there is currently a significant effort being made to enhance conservation planning by taking potential distribution changes into account. It is subjected to great disturbance through unmanaged human activities, including overgrazing, overcutting, uprooting, tourism and quarrying. Due to the significant impact of grazing and human activities, plant species are in danger. Natural enemies (such as rodents, insects, and rotting fungi) as well as drought and floods are among the hazards. The region has had a cycle of wet and dry years (Zaghloul, 2003; Abd El-Wahab, 2003). While the drought itself affects the scarce vegetation in dry to severely arid habitats, it also exacerbates additional threats, particularly those that are caused by humans (Abd El-Wahab et al., 2004). The relocation of Bedouins to areas with access to fresh water supplies, the opening of schools, the building of roads, and allowing public transportation, Due to these initiatives, the region and the rest of Egypt were closely connected, and numerous locations in far-off deserts became easier to reach. The area has seen disturbances brought on by human activity, such as excessive grazing, over-collecting, uprooting, cutting excessive amounts of fuel wood, urbanization (building new towns and infrastructure), quarrying, solid waste, and clearing natural vegetation for cultivation projects. The loss of natural habitats and the disappearance of previously observed plant communities, in which distinct floristic elements coexist and interact, are the results of these disturbances, which also cause changes in the region's floristic composition and structure (Medicinal Plants Conservation Project, 2006).

STRATEGIES FOR CONSERVATION

A general lack of information on the population ecology of threatened or rare species is a major problem in devising conservation measures. The available data include simple studies in the form of annual records of the numbers of individuals and numerical data on the dynamics of a few species (Bradshaw and Doody, 1978; Griggs and Jain, 1983; Fiedler, 1987; Hutchings, 1987). The species under investigation [*Cleome droserifolia* (Forssk). Del. Capparidaceae] forms a coenopopulation census (Rabotnov, 1969). Because of ecological disasters such as several successive seasons with lower than average precipitation, and over-exploitation of mature plants by desert dwellers and herbalists for use in folk medicine (Osborn, 1968), the species is threatened. The study of its seed bank, seed rain, seed dispersal, seedling establishment, survival and reproduction will aid in the conservation of the species (Hegazy, 1990). As a population *C. droserifolia* has the potential to remain stable for several reasons firstly the species forms acoenopopulation including all phases of the life cycle from seed to senescing individuals.

Secondly, the cushion habit of the species makes it possible to sort the population into different age classes. This was the case of Hegazy (1990), who investigated *C. droserifolia* population near Kattamia station in the Eastern Desert, he observed that the oldest age class was only 0.5% of the adults, which insures high productivity. The coarse-grained soil guarantees moisture availability, meaning that, a cover of cobbles and stones would conserve more moisture than a cover of gravels (Hillel and Tadmor, 1962). Furthermore, the investigated population was isolated and had no sign of disturbance or human impact. Studies recommended several strategies for conservation; (Hegazy, 1990) suggested that some populations should be conserved in situ and protected from human activities. Harvesting should be restricted to the oldest individuals in the population, vegetation

propagation by creating optimum conditions for flowering seed setting and seedling, the establishment of more experimental research and seed storage techniques should be presented. Moreover, Abd El-Wahab et al. (2004) emphasized that providing detailed databases about productivity, biomass, and reproductive ecology, can help evaluate the ecological status of the plant along with detailed mapping and spatial distribution for *in situ* conservation. Establishing herbaria, botanical gardens and gene banks for the endangered plant is a strategy for *ex-situ* conservation. Besides the sustainable use of medicinal plants, increasing the awareness of herbalists training indigenous Bedouins and involving them in the conservation process would be of great support to the conservation process. From the previous literature, it's obvious how valuable *C. droserifolia* is, although it's shocking how sparse and ancient the ecological studies that have been done on the species about its significance as a medical plant. The plant's population ecology had only been studied in detail once in one location over a decade ago. Although the study had recorded no disturbance, the intense invasion of urbanization in the Egyptian deserts nowadays must have destroyed every wildlife left. Other ecological studies only referred to it either as a count or reported its presence. *C. droserifolia* has been known to have important medicinal properties and is very useful to indigenous Bedouins for traditional remedies consequently the major reason for the plant to be endangered is the overcollection for medicine and research. Thus it's crucial to carry out intensive population ecology studies targeting the plant distribution studying its growth forms over seasons managing to establish a gene bank and testing its capability of cultivation.

CONSERVATION PLAN

Nature conservation has changed from an idealistic philosophy to a serious technology (Harper, 1992). Using new biotechnologies such as molecular markers to study the genetic diversity of endangered plants is remarkable as well and molecular data has resolved the systematic dilemma of the family Cleomaceae. *C. droserifolia* is an endangered plant for its significant biomedical properties. Therefore implementing long-term conservation programs is a priority. The plant protection could be fulfilled through sufficiently studied autecology considering its propagation as a means of ecosystem rehabilitation raising public awareness since overcutting is the main stressor causing *Cleome* depletion. Furthermore, governmental environmental organizations and authorities must be involved in ensuring that protecting *C. droserifolia* is a national duty. There is a need to work in different directions to protect this species from extinction: conservation through creating a genome resource bank and build-up of seed banks that can act as reservoirs of genetic variation, thus delaying the loss of genetic variation and maintaining the evolutionary potential of populations (Zaghloul, 2008). It is necessary to carry out regular monitoring to keep updated on the population size distribution and its trends (Khafagi, 1998).

An efficient protocol for micropropagation of an endangered medicinal plant, *Cleome droserifolia* was conducted by (Hassan, 2014) to test the effect of different concentrations of sodium hypochlorite (Clorox) for different durations on seed sterilization and adenine sulphate (Ads) addition at (0, 10, 20 and 30 mg-1) with benzyl adenine (BA) at 0.0, 0.5, 1 and 1.5 mg -1 on micropropagation of the two types of *Cleome droserifolia* explants shoot tip and nodal explants.

CONCLUSION

To safely improve human and animal health, medicinal plants can be used as a natural source of therapeutic medications, pharmaceuticals/food supplements, and feed additives. The family Cleomaceae is a small family of flowering plants in the order Brassicales, comprising more than 300 species belonging to nine genera of which Cleome is the largest genus with about 180 - 200 species of medicinal, traditional and ecological importance. *Cleome droserifolia* are geographically distributed in Egypt, Libya, Palestine, Syria, and other arid and semi-arid regions. They are furthermore perennial, low, fragrant cushion-shaped shrubs with a length of 25–60 cm that have intricately branching stems and broad, oblong, three-nerved leaves with enlarged glandular hairs. Extracts from *Cleome droserifolia* contain unique biological characteristics that improve the metabolism of carbohydrates. The plant has been severely overused in the past ten years for use in diabetes traditional medicine. It has been eradicated from vast areas, especially in the Sinai and the Eastern Desert. However, in the far south of the Eastern Desert, the plant is still flourishing and is growing in many areas. Also due to the significant impact of grazing and human activities, plant species are in danger. Natural enemies (such as rodents, insects, and rotting fungi) as well as drought and floods are among the hazards. A general lack of information on the population ecology of threatened or rare species is a major problem in devising conservation measures. The available data include simple studies in the form of annual records of the numbers of individuals and numerical data on the dynamics of a few species. It is remarkable how modern biotechnologies, including molecular markers, may be used to examine the genetic diversity of threatened plant species. The Cleomaceae family's systematic conundrum has been answered using both molecular data and other sources. Since overcutting is the primary stressor causing Cleome depletion, plant

protection might be achieved through adequately studying ecology while taking its proliferation as a means of ecosystem repair and raising public awareness. Furthermore, governmental environmental organizations and authorities must be involved in ensuring that protecting *C. droserifolia* is a national duty.

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