ARC Journal of Nutrition and Growth
Volume 4, Issue 1, 2018, PP 14-17
ISSN No. (Online) 2455-2550
DOI: http://dx.doi.org/10.20431/2455-2550.0401004
www.arcjournals.org

Argemone ochroleuca: Biology, Pharmacological Potential and Perspectives

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Abstract: *Argemone ochroleuca is a native Mexican plant and now is widely distributed in tropical and subtropical regions of the world. It has a wide type of applications in traditional medicine. The plant contains alkaloids as the main active ingredients. Currently, research studies have begun to demonstrate their biological activity both for use in agriculture and in pharmacological applications.*

Keywords: *Argemone, Alkaloids, Extracts, Biological Activity*

1. INTRODUCTION

The identification, collection and characterization of secondary metabolites of plants have been crucial in the search for compounds with biological activity capable of playing an important role in the prevention and treatment of diseases[1].

The papaveraceae family consists of annual or perennial herbaceous plants; they can grow in sunny and open environments. This group of plants is composed of approximately 45 genera with more than 400 species commonly distributed in different points of the Northern Hemisphere[2]. Papaveraceae family is included phylogenetically in a group known as "psychoactive families" because of it includes representative plants like *Papaver somniferum* L., "adormidera"; alkaloids such as morphine and heroin have been extracted from them, on the other hand these plants can be cultivated as ornamental plants[3].

Another representative group of the family is the genus Argemone, it is constituted mainly by herbaceous, and they can be annual or perennial plants composed of more than 30 species distributed in tropical regions of America, however *Argemone mexicana* L. and *Argemone ochroleuca* have been introduced in other parts of the world[2]. In Mexico they are commonly known as "chicalote", "cardo santo" and as "falsa amapola"[4]. The origin of the word Argemone derives from the word "argema" which means "catarata del ojo" since formerly the juice of the vegetative part was used in the treatment for such a condition[5].

Recently numerous findings have been reported about biological activity of vegetative parts extracts from these plants like leaf, root, seed, flower, and latex[6]. In the present work, we will address the biology, pharmacological potential and perspectives of *A. ochroleuca*.

1.1. Biology of *Argemone ochroleuca*

A. ochroleuca is a hybrid allotetraploid species[7]; itblooms from November to June and commonly colonizes highly disturbed sites such as agro-crops, roadsides, railways and abandoned lots. Its phenotype shows stems and leaves that are provided with straight spines and yellow latex. The flowers are solitary and present hermaphroditism, their structure has three sepals and shown 4-6 petals of whitish color, it is provided with 40-75 stamens with syncarpic gynoecium and discoid stigma, besides it has tricolpate pollen grains and reticulated aspect; the fruit is a prickly berry[2]. It is considered a weed capable of adapting and even displacing the native flora present[8].

The specie *A. ochroleuca* has been frequently confused with *A. mexicana* by their close biological relationship, because they share similarity phenotypic[9]. In 1958, Ownbey

suggested that *A. mexicana* played a very important role in the evolution of *A. ochroleuca* through the process of autopolyploidy[10]. One main biochemical characteristic of the genus is the presence of phytochemicals of great pharmacological importance, for example the alkaloids like Isoquinolines, from where compounds as Alocryptopine, Protopine and Berberine have been isolated and characterized[11]. The isolated alkaloids of *A. mexicana* and *A. ochroleuca* are listed in table1.

Table1. *Isoquinolines alkaloids found in A. Mexicana and A. ochroleuca*

Alkaloids Isoquinolines	***A. ochroleuca***	***A. mexicana***
Oxihidrastanine	-	+
Thalifoline	-	+
Reticuline	+	+
Alocriptopine	+	+
Sanguinarine	+	+
Queleritrine	+	+
Protopine	+	+
Alocryptopine	+	+
(-)- Canadine	+	-
(+)-Tetrahidropalmatine	+	-
Queilantifoline	+	+
Stylopine	+	+
Berberine	+	+
Coptisine	+	+

+ Presence, - absence. Modified from Amare et al. (8), Hussain et al.(12) and Fletcher et al. (13).

1.2. Traditional use of Argemone ochroleuca in Mesoamerican culture

The "chicalote" is a plant that was used in the pre-Columbian culture of Mesoamerican peoples as an aid in the treatment of ocular, dermatological, respiratory, and diabetes problems. The first reference corresponds to the Florentine Codex of the sixteenth century, which relates in detail the use of latex to relieve eye pain; more over the naturalist Juan de Esteyneffer, at the beginning of the eighteenth century referred it in a medical compilation as a purgative remedy.

In the 20th century, the National Medical Institute indicates the following uses: antiescabietic, to treat dental problems, wound healing, and as regenerative, against dermatosis, and eye problems. Other contemporary researchers such as Alfonso Herrera, and Maximino Martínez pointed out that the flowers, leaves, and juice of the plant are used in some diseases of the eyes and other activities as anticonvulsant, antidiarrheal, antispasmodic, antitussive, cathartic potential, to treat corneal spots, joint diseases, hypnotic, narcotic, and analgesic[14].

1.3. Scientific biological activity of Argemone ochroleuca

Although most of the scientific evidence is oriented to the biological activity of *A.mexicana*, there are some reports that refer to the use of the products obtained from *A. ochroleuca*, and are shown in table2.

Table2. *A. ochroleucastudies*

Reportedactivity	**Plant part/extract**	**Employedmodel**	**Year of completion**	**Reference**
Antiasthmatic	Leaf, and flower (ethanolic dichloride extract)	Guinea pig (trachealmuscle)	2008	15
Antibacterial	Freshlatex	Plate diffusion	2010	16
Antimicrobial	Aerialparts (methanolicextract)	Plate diffusion	2011	17
Antifungal	Fresh Latex, and (Hexane Extract)	Plate diffusion	2013	18
Insecticide	Aerialparts (ethanolicextract)	Larvae, and pupae	2017	19
Insecticide	Roots, and shoots (aqueous extract)	Germinationbioassay	2017	20

The following is described according to the date of appearance in the scientific literature: A study showed the relaxant activity of the dichloromethane extract using the aerial parts in smooth muscle of guinea pigs; they obtained an IC_{50} value of 118,50 ± 3,91 μM and identifyed the presence of the compound Berberine as an active principle[15]. Alamri, and Moustafa in 2010[16] reported the antimicrobial activity of crude, and diluted latex using the plate diffusion

method on strains such as *Bacillus subtilis*, *Enterobacter aerogenes*, *Micrococcus luteus*, *Escherichia coli*, and *Staphylococcus aureus*, showing their potential at the minimum inhibitory concentration (MIC) of 100µL / mL[16]. The research team showed too the antifungal activity of crude latex against 4 candida species isolated from patients (*Candida albicans*, *Candida glabrata*, *Candida krusei* and *Candida tropicalis*) and against 6 species of phytopathogenic fungi (*Alternaria alternante*, *Drechslera halodes*, *Fusarium oxysporum*, *Macrophomina phaseolina*, *Pythium ultimum*, and *Rhizoctoina solani*). They made the hexane extract of the latex, and analyzed by gas chromatography-mass spectrophotometry that revealed the presence of diethyl phthalate (81,57%), compounds of 6-nitro-imidazo (1,2-a) pyridine (8,833%), cyclohexasiloxane, dodecamethyl (5,607%), molecules of 4- (2,2-dimethyl-6-methylenecyclohexylidene)-3-methylbutan-2-one (2,410%) and cycloheptasiloxane, tetradecamethyl (1,574%)[17].

Reyes *et al*[18] showed the antimicrobial activity of extracts of hexane, ethyl acetate, and methanol from aerial parts of *A. ochroleuca*. The antimicrobial activity was evaluated in thirteen bacterial, and nine fungal strains. Only methanol extract showed antimicrobial activity, strains of *S. aureus* (MIC = 125 µg / mL) and *C. neoformans* (MIC = 500 µg / mL) were the most sensitive to treatment. The research team identified and isolated the alkaloid Berberine present in the methanolic extract[18].

Martínez *et al*[20] showed that the ethanolic extract (15 and 30%) inhibits the feeding and larval development of the "gusano cogollero" *Spodoptera frugiperda*. Finally, in 2017, Basharat observed possible allelopathic effects of the aqueous extract of *A. ochroleuca* on grasslands and farmland with species of wild plants native from Arabia: (*Farsetia aegyptia* and *Salvia aegyptiaca* L.) and plants used for forage (*Hordeum vulgare* L. and *Medicago sativa* L.) exhibiting sufficient allelopathic potential[20].

Although there are reports that describe the importance of the compounds identified in *A. ochroleuca*, the number of findings that support the study of *A. mexicana* (218 citations) exceeds the articles that analyze *A.ochroleuca* (20 citations). Both species are native to the Americas, however most of the reports found in the literature belong to research groups from the Asian continent, where these species were introduced. Al-Shanawany in 1996 mentioned that the indiscriminate use of *A. mexicana*, and *A. ochroleuca* in traditional Saudi medicine is due to the fact that they do not have significant morphological differences. Therefore, it is very important to update the taxonomic studies of the genus as well as to know the methods of identification that the researchers use to define the species in pharmacological studies.

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Citation: *Torres-González Omar Ricardo, Sánchez-Hernández Iván Moisés, Barragán-Álvarez Carla Patricia, Flores-Fernández José Miguel & Padilla-Camberos Eduardo. Argemone ochroleuca: Biology, Pharmacological Potential and Perspectives. ARC Journal of Nutrition and Growth.2018; 4(1): 14-17. DOI: dx.doi.org/ 10.20431/ 2455-2550.0401004.*