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ORIGINAL ARTICLE

MORPHOLOGICAL, ANATOMICAL AND CHEMICAL STUDY OF AN EXOTIC PLANT *JATROPHA INTEGERRIMA* JACQ. 1763 (EUPHORBIACEAE) IN IRAQ

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ABSTRACT

Jatropha L. is an exotic genus to Iraq and it has been cultivated in gardens for ornamental purposes because of the shiny red color of the flowers. The plant adapted to environmental conditions and succeeded in growing and blooming, which is why the species was interested to study. The species *Jatropha integerrima* Jacq. was examined and diagnosed for the first time in Iraq. Morphological and anatomical characteristics for leaves (considering that the variations are the most reliable and taxonomically important) were provided. The Phytochemical screening showed the presence of alkaloids, flavonoids, terpenes, tannins and saponins. The qualitative analysis by TLC indicated the presence of alkaloids and flavonoid that was detected by special reagent and UV light, which included two orange spots of alkaloid with 0.71 and 0.63 Rf value one flavonoid yellow spot with 0.43 Rf value.

Key words: Euphorbiaceae, Exotic, Iraq, *Jatropha*, Phytochemical screening.

INTRODUCTION

Euphorbiaceae Juss. was first adequately delimited as a natural group of plant by A. L. de Jussieu in 1789 (Perry, 1943). The family is characterized by hypogynous flowers, actinomorphic, mostly unisexual; perianth rarely double, usually simple or wanting; androecium 1-∞; ovary of 3 carpels, trilocular, with 1 or 2 suspended ovules in each cell; micropyle directed upwards and outwards, and covered with a fleshy outgrowth (caruncle). Fruit almost invariably a schizocarp-capsule, splitting into carpels, often elastically (Heywood, 1978; Judd *et al.*, 1999). Petals in Euphorbiaceae usually absent but present in only two genera: *Jatropha* and *Aleurites* (Singh, 2006). *Jatropha* L. is a genus of 175 species (Aworinde *et al.*, 2009).

Changes in order Malpighiales that *Jatropha* belongs to- mainly reflected assignment to this order of six previously unplaced families and the dismemberment of broadly circumscribed Flacourtiaceae and Euphorbiaceae (APG II, 2003). *Jatropha* in Greek language is “iatros”: physician and trope: food; because they use the species *Jatropha*

Morphological, anatomical and chemical study

curcas as purgative (WFO, 2022 a). Researchers survey the antimicrobial activity of the leaves methanol extract of *Jatropha* sp. against many organisms like *Escherichia coli*, *Bacillus subtilis*, *Streptococcus aureus* and *Klebsiella pneumonia*, all treatments reduced the growth and activity of these pathogenic organisms (Seth and Sarin, 2010; Oyama *et al.*, 2016). Moreover, it has a pesticidal that effect on adult mortality and hatching eggs of many insects like Ticks and Mites and used as traditional therapy in Asia and Africa (Juliet and Ghosh, 2012).

This genus is exotic to Iraqi environment, and it is cultivated in gardens for ornamental purposes but it adapted to the environmental conditions and succeeded in growing. The current study aimed to examine, identify the *Jatropha* species recorded for the first time in Iraq.

MATERIALS AND METHODS

Identification:

The plant was identified by different classification keys (Welzen *et al.*, 2017; Flora of Pakistan, 2011; eFlora, 2014 a, b, c, d). Compared with reference herbarium specimens of GBIF organization gallery online those were collected from different Asian countries (GBIF secretariat, 2020). The acceptance of its binomial scientific name checked with the World Flora Online (WFO, 2022 a, b).

Morphological study

Different (vegetative and reproductive) parts were collected from cultivated trees grown in scientific garden in College of Science for Women- University of Baghdad and some other gardens, to examine the morphological characteristics by dissecting microscope while the morphology of pollen grains studied by light microscope under the oil immersion lens; the pollen grain was taken from mature floral buds.

Anatomical study

The study examined the orthogonal section of the blades, according to Al-Musawi, (1979) to examine the anatomical characteristics by light microscope.

Chemical study

- Plant extraction: The dry *Jatropha integerrima* leaf was extracted by hot alcoholic Soxhlet with (1:10; Water: Alcohol) for 6-8 hour at 60-80 C°, then the extract was filtered and dried (Al-Momen *et al.*, 2015).

- Phytochemical screening

The active constituents alkaloids, flavonoids, terpenes, tannins and saponins were detected according to Al-Momen *et al.* (2015). Each active compound was detected by using two different specific qualitative reagents (Tab.1).

- Thin layer chromatography (TLC)

TLC method analysis is used to analyze some active compound (alkaloids and flavonoids). TLC plate (Merck .25mm silica gel 60) was activated in oven at 100-120 C°

for one hour. The mobile phase was prepared, introduced to jar and saturated for one hour then the TLC was developed and the separated was compounds were detected.

(1) Alkaloid qualitative analysis.

The alkaloids were determined by TLC method using ethyl acetate: ethanol (4:1) according to (Kabesh *et al.*, 2015) and methanol: chloroform: ammonia (20:5:25) according to (Deshmukh *et al.*, 2012) development system then the alkaloids were detected using UV light (254 and 365 nm) and Dragendorff reagent and the R_f value was measured.

(2) Flavonoid qualitative analysis

The analysis of flavonoids was carried out by using ethyl acetate: glacial acetic acid: formic acid: water (100:11:11: 25) solvent system. Then after the plat was developed, the flavonoids were detected using UV light (254 and 365 nm) and aluminum chloride reagent and the R_f value was measured. (Kumar *et al.*, 2007)

Table (1): The types of detections and their reagents that used in the current study.

No.	Type of detection	Type of reagents
1	Alkaloids	A- Mayer reagent
2		B- Wagner reagent
3	Flavonoid	A- Magnesium crystals and 1% HCl
4		B- H ₂ SO ₄ reagent
5	Terpenes	A- Chloroform and H ₂ SO ₄
6		B- Anace aldehyde reagent
7	Tannins	A- FeCl ₃ reagent
8		B- Lead acetate reagent
9	Sapiens	A- Foam reagent
10		B- HgCl ₂ reagent

RESULTS AND DISCUSSION

Genus *Jatropha* belongs to Euphorbiaceae family, some species were imported to Iraq during the last few years as ornamental trees for gardens because of their colorful red flowers, it was adapted to the environmental conditions and established vegetatively in Iraq, and the current study did not observe any development for its fruits.

Gorvaets (2017) listed 15 synonyms for it and reported *Jatropha integerrima* Jacq. as an accepted name, and there were three more synonyms listed in by WFO (2022 b) shown in the list below:

1. *Adenoropium hastatum* (Jacq.) Britton & P. Wilson
2. *Adenoropium integrimum* (Jacq.) Pohl
3. *Adenoropium pandurifolium* (Andrews) Pohl
4. *Jatropha acuminata* Desr.
5. *Jatropha coccinea* Link
6. *Jatropha diversifolia* A. Rich.
7. *Jatropha diversifolia* var. *pandurifolia* (Anrdews) M. Gómez

Morphological, anatomical and chemical study

8. *Jatropha hastata* Jacq.
9. *Jatropha integerrima* var. *coccinea* (Link) N. P. Balakr.
10. *Jatropha integerrima* var. *hastata* (Jacq.) Fosberg
11. *Jatropha integerrima* var. *latifolia* (Pax.) N. P. Balakr.
12. *Jatropha moluensis* Sessé & Moc.
13. *Jatropha pandurifolia* Andrews
14. *Jatropha pandurifolia* var. *coccinea* (Link) Pax
15. *Jatropha pandurifolia* var. *latifolia* Pax
16. *Jatropha diversifolia* var. *pauciflore* (C. Wright ex Griseb.) M. Gómez
17. *Jatropha glaversifolia* Pax & K. Hoffm.
18. *Jatropha pauciflora* C. Wright ex Griseb

The tree is deciduous, blooming continues during the three other seasons, from February till December; so the red flowers of *Jatropha* tree give a very shiny view in the gardens. Flowers symmetrical, actinomorphic, pentamerous, tetracyclic (tricyclic). Polygamous, some flowers are bisexual (perfect) and some are unisexual (imperfect), with numerous male flowers; it was very difficult to find some female flowers and the bisexual were rare. During observations, the authors noticed that the pollen grains become free (anthers dehiscent) before the petals opened, protandrous however, the current study could not find ripened fruits but only growing ovary. The plant contains latex as all members of the family Euphorbiaceae, this latex comes out of broken parts and turns white after dryness (Pl. 1).

Morphological Characteristics:

Perennial, deciduous tree, stem erect, solid up to 3m. height with ascending branches. Leaves ovate- semi cordate, apex acute, margins either entire or almost dentate (one prominent dental shape in each side); the entire margin leaves 6.0- 8.0 cm x 3.0- 4.0 cm. petioles 1.3- 1.5 cm x 1.0 mm; leaves with dentate margin 10.5 cm x 6.6- 8.5 cm their petioles 5.7- 7.5 cm. x 1.5 mm., five main veins, exstipulate (Pl. 2).

Inflorescences are cymose compound dichasium, female flower exist at the top of the rachis and blooms before males (basipetal succession). Verticillasters 6- 9 flowers. Peduncle brown 8.0- 10.0 cm x 1.0-1.5mm, pedicel brown 8.0 mm x 1.0 mm. Bracts 2, deciduous, light green (yellowish), leafy, ligulate, sessile, acute apex, entire margin, 6.0 mm x 1.5 mm. (Pl. 3).

Calyx synsepalous, 5 sepals, petaloid, campanulate, 3.0- 4.0 mm x 2.5 mm in male flower, 5.0 mm x \pm 4.0 mm in female flower, teeth deltoid 1.5 mm x 1.5 mm in male flower, 4 mm x 2 mm in female flower. Five reddish brown gland bodies arranged opposite to sepals in male flowers but arranged as circle under the ovary opposite to petals in female flowers. Corolla red, 5 petals, twisted to the right, caryophyllaceous with very short claw, obovate, rounded- retuse apex, entire margin, 13- 14 mm x 9.0- 10 mm, dense white hairs at the inner surface of the base (Pl. 4).

Ali *et al.*

Androecium, 8 stamens, almost monodelphous, with fused filaments at the lower part as a white column and the upper free red parts, 4 stamens are short 2.0 mm and 4 are longer \pm 3.0 mm, anthers red, longitudinal dehiscence, 2 lateral extrorse splits. Gynoecium, 3 carpels, ovary 3 lobes, green with red lines change to green during ripening, styles fused, terminal, 3 black linear stigma, placentation free central, one pendulous ovule in each locule. Mature ovary is longitudinal spherical- trigonous (Pl. 5). Pollen grains yellow, spheroidal, dense verrucae or with papillae dense sculptured, processes are arranged in form of reticule, diameter \pm 203 μ (Pl. 6).

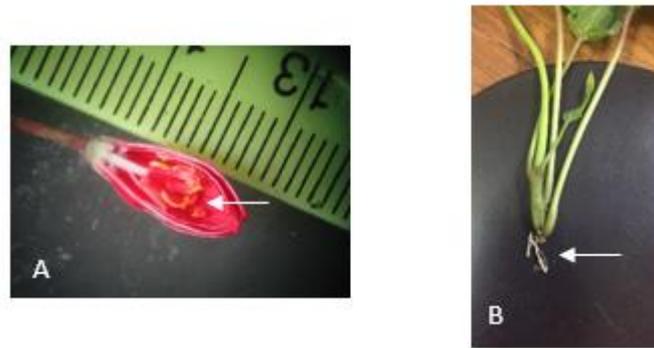


Plate (1): *Jatropha integerrima*; (A) Anthers dehiscent within the floral bud, (B) Broken part showing the white latex substance.

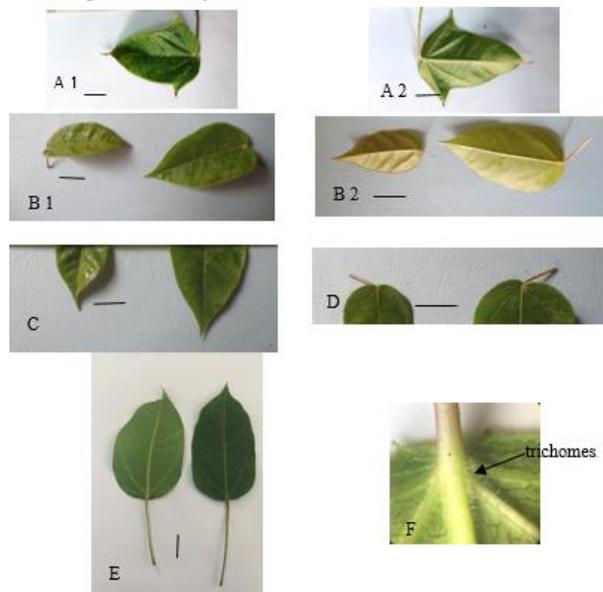


Plate (2): Different view of *Jatropha integerrima* leaves; (A1 and A2) Leaf with dentate blade margin, (B1 and B2): Leaf with entire blade margin, (C) Blade apex, (D) Blade base, (E) The two sides of the ovate leaves, (F) The base of main veins of abaxial surface. (Scale: 2 cm).

Morphological, anatomical and chemical study

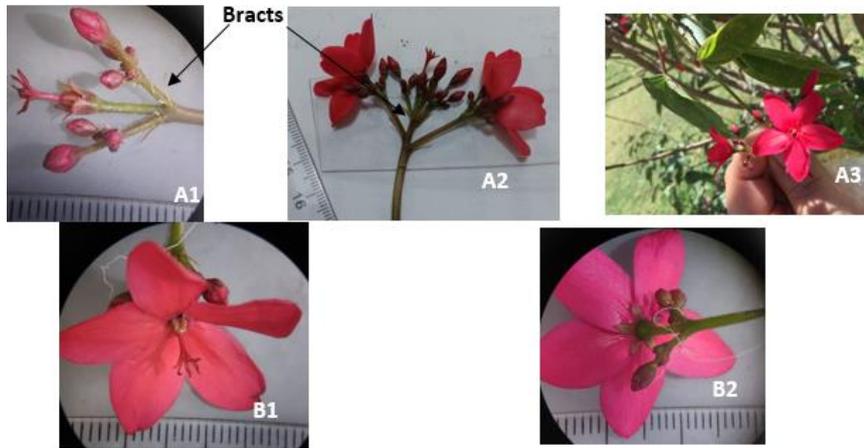


Plate (3): *Jatropha integerrima*; (A1, A2 and A3) Compound dichasium inflorescence with bracts, (B1) Female flower, (B2) Female flower at the top of inflorescence. (Scale 1mm between each black line).

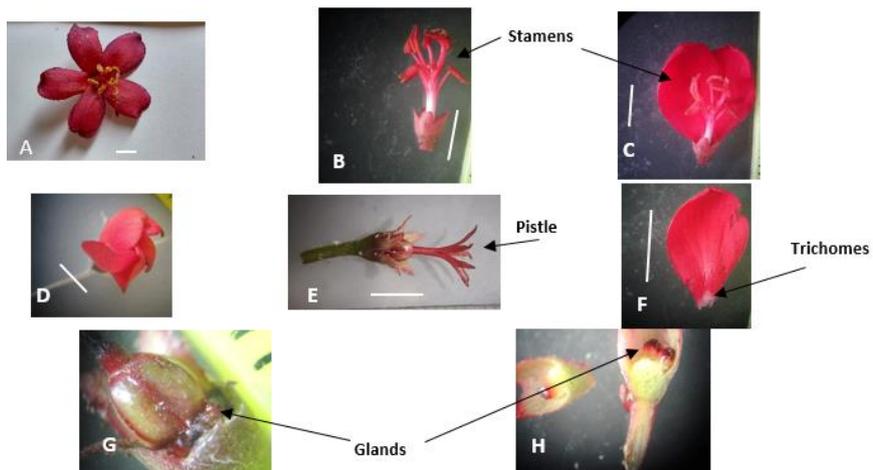


Plate (4): *Jatropha integerrima*; (A) Male flower, (B) Calyx of male flower, (C) Petals with rounded apex, (D) Twisted petals, (E) Calyx of female flower, (F) Petal with retuse apex, (A-F: Scale bar= 5mm), (G) Gland bodies under ovary, (H) Gland bodies in male calyx at the base of sepals (G, H: 400X).

Ali et al.

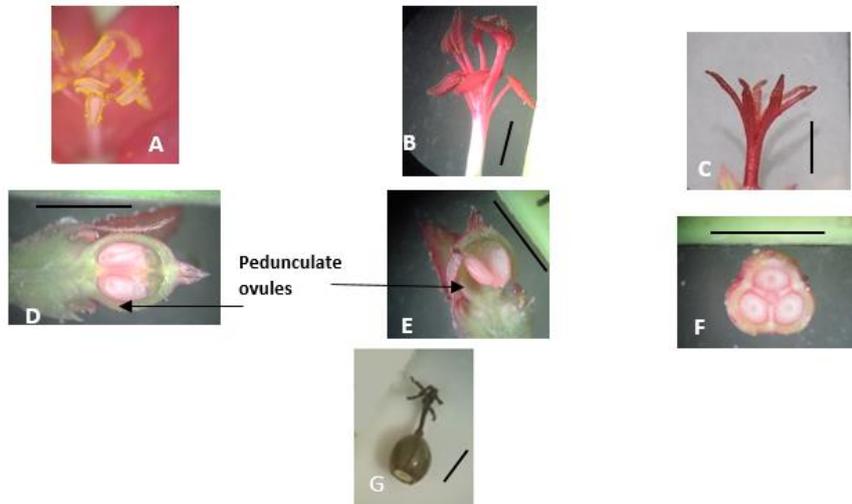


Plate (5): *Jatropha integerrima*; (A) Longitudinal dehiscence anthers (400X), (B) Androecium, (C) Liner stigmata, (D) L.S. in ovary, (E) Pedunculate ovules, (F) C.S. in ovary, (G) Enlarged ovary with dry style and stigma. (B-G: Scale bar=3mm).

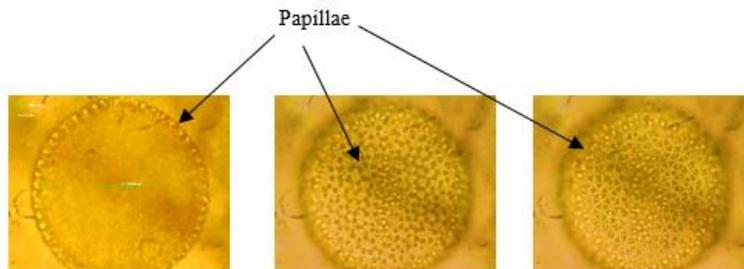


Plate (6): *Jatropha integerrima*, pollen grains under light microscope with different focusing degree to show the papillae at the same magnifying power (1000X).

Chemical study:

Jatropha integerrima methanol extract contains the active compound that is shown in Table (2) using phytochemical screening.

Table (2): Phytochemical screening of *Jatropha integerrima* methanol extract

Active compound	Reagent A*	Reagent B*
Alkaloid	+	+
Flavonoids	+	+
Terpenes	+	+
Tannins	+	+
Saponins	+	+

*The reagents mentioned in Table (1).

Alkaloid qualitative analysis:

The TLC of *Jatropha integerrima* alkaloids were isolated from the methanol extract of leaves eluted with ethyl acetate: ethanol and methanol: chloroform: ammonia mobile phase and the UV light showed separation of organic active compound followed by spray. The TLC plat with Dragendorff reagent showed the presence of orange spot with Rf value 0.71 and 0.63 respectively which confirming the presence of alkaloids (Pl. 7).

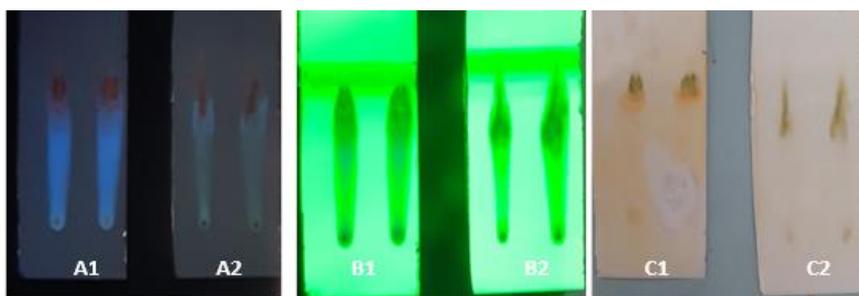


Plate (7): (A1, B1 and C1) dissolved in ethyl acetate: ethanol solvent system, (A2, B2 & C2) dissolved in methanol: chloroform: ammonia solvent system, (A1 and A2) TLC under 365 nm UV light, (B1 and B2) TLC under 254 nm UV light showed separation of organic compound, (C1 and C2) TLC after sprayed with Dragendorff reagent showed the presence of orange spot which mean the presence of alkaloids.

Flavonoid qualitative analysis:

The investigation of flavonoids isolated from *Jatropha integerrima* leaf methanol extract by TLC using ethyl acetate: glacial acetic acid: formic acid: water as a mobile phase and UV light detection showed the separation of some active compounds, then by sprayed the TLC plat with aluminum chloride reagent, it showed spot with yellow colour with 0.43 Rf value which represents an evidence of flavonoids finding (Pl. 8).

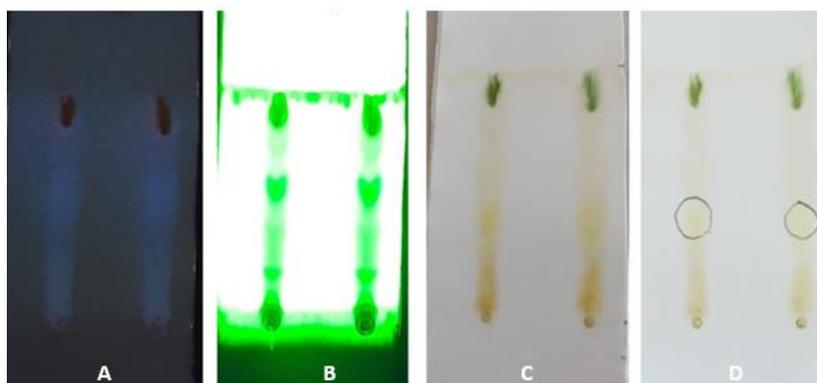


Plate (8): (A) TLC Under 365 nm UV light, (B) TLC under 254 nm UV light, (A and B) TLC Separation of active substance, (C and D) TLC after sprayed with aluminum chloride reagent the presence of yellow spot proved the presence of flavonoids.

Anatomical study:

The transverse section in leaf blade reflects that the blades are bifacial with palisade cells arranged under the abaxial epidermis in 2-3 rows, the shape of the palisade cells varied between square and rectangle. The sponge layer consists of many rows of different sizes of parenchyma thin walled cells, there were many cavities between the sponge layer cells and also in different sizes, but the study noticed that the cavities were lack around the main vascular bundle and the parenchyma cells were compact around it. The epidermal layer consist of one row of quadrangular transverse shaped cells, cells were with papillae protrusions which were missed at the main vein location. The cross section of the main veins showed a vascular bundle bigger than those in the smaller veins; vascular bundle longitudinal ovate, transporting elements are less not more than 3-4 columns. The cross section of the smaller vascular bundle are also longitudinal ovate, contain 3- 4 columns too. The cavities in the sponge layer are bigger, it seems that some small ones united and formed big cavities (Pl. 9).

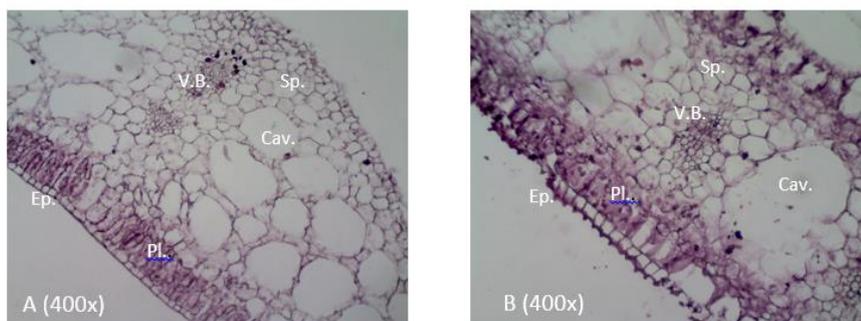


Plate (9): Orthogonal sections of the leaf blade; (A) The main vein, (B) The smaller vein (V.B.: Vacsuler Bundle; Pl.: Palisade cells; Cav.: Cavity; Sp.: Sponge cells; Ep.: Epidermis)

CONCLUSIONS

The current study was interested in this plant as exotic plant introduced to Iraq environment and succeeded in growing with shiny flowers. Up to this study, the authors did not find any negative biological effects for this plant. The study noticed that the fruits are not available and suggested to do more researches about it.

CONFLICT OF INTEREST STATEMENT

"The authors have not declared any conflicts of interest".

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Morphological, anatomical and chemical study

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دراسة الشكل المظهري والتشريحي والكيميائي للنبات الدخيل
Jatropha integrima Jacq., 1763 (Euphorbicaceae)
في العراق

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تاريخ الاستلام: 2021/12/22، تاريخ القبول: 2022/06/13، تاريخ النشر: 2022/06/20

الخلاصة

يعد جنس *Jatropha* L. من النباتات الدخيلة الى البيئة العراق؛ تمت زراعته في الحدائق لاعراض الزينة اذ ان ازهاره ذات لون احمر براق، وقد تكيف مع ظروف البيئة ونجح في النمو والازهار، وقد تم فحصه والتعرف عليه لتحديد نوعه لأول مرة في العراق، ووجد انه النوع *Jatropha integerrima* Jacq. 1763.

درست صفات الشكل الظاهري لهذا النوع والخصائص التشريحية للورقة والسويق باعتبار تغيراتها الاكثر اهمية من الناحية التصنيفية، وقد وجدت ان حبات اللقاح كروية الشكل سطحها الخارجي كثيف البروزات الحليمية ويبلغ قطرها حوالي 203 مايكرومتر. أظهر الفحص الكيميائي للنبات وجود قلويدات وتربينات وتانينات وصابونين، وقد كشف التحليل النوعي باستعمال TLC الى وجود قلويدات وفلافونويد تم الكشف باستعمال كاشف خاص وضوء UV ، ظهرت بقعتين برتقالية اللون من قلويد قيمة Rf 0.71 و 0.63 وبقعة صفراء فلافونويد قيمة Rf 0.43.