Indian Journal of Ecology (2022) 49 Special Issue (20): 143-146

Manuscript Number: S-1012
NAAS Rating: 5.79

Impact of *Conocarpus erectus* L. Leaf Extract on *Phoenix dactylifera* L. Seedlings

Azhar M. Abdul-Sahib, Eman M. Abdul-Zahra[1] and Ameer A.A. Hassan[2]

Center of Date Palm Researches, University of Basrah, Basra, Iraq
[1]Dept. of Biology, Faculty of Science, University of Basrah, Basra, Iraq
[2] Department of Environment, College of Physical Planning, University of Kufa, Najaf, Iraq
E-mail: azhar.sahib@uobasrah.edu.iq

Abstract: A pot experiment was conducted to determine the effect of 0, 5, 10 and 15 % of *Conocarpus erectus* L. leaves extracts on growth of date palm seedlings. There was significant reduction in plant growth and chemical composition of shoots and roots as the maximum values were in control. The seedlings treated with 15 % of leaves extract recorded 23.80, 31.14, 25.12 and 2.60 cm for shoot height, root length, leaf length and leaf width, respectively, and 9.10 and 9.48 g, for dry weights of shoots and roots respectively. The concentration of 15 % recorded 51.46 and 28.93 percent carbohydrates contents of shoots and roots, respectively. The nitrogen, phosphorus and potassium contents in shoots were significantly reduced in seedlings treated with 15 % of the extract. Roots content of nitrogen and phosphorus was reduced significantly, while, potassium content showed a non-significant inhibition.

Keywords: *Conocarpus erectus* L., Extracts, *Phoenix dactylifera* L., Seedling growth

Conocarpus erectus and *C. lancifolius* are the two main species of the genus which are widely planted as ornamental evergreen in yards, parking lots, streets, parks, and potted plants and belongs to Combretaceae family. These can tolerate extreme desert heat where summer temperature which may reach 47°C and grow in soil of very low fertility. *C. erectus* is dominant and widely planted over the last decade (Shams 2016). The wood is durable and is used to make railroad ties, posts, boats, fuel and charcoal. The bark and leaves have been used in tanneries and traditional medicine (Abdel-Hameed et al 2012). Many parts of *Conocarpus* tree are used in some countries as a medical plant for therapy of diabetes, anemia, flu, conjugative inflammatory, diarrhea, fever, catarrh, hemorrhage, orchitis, skin ulcers and syphilis (El-Sayed et al 2012). Roze et al (2011) and Agostini-Costa et al (2012) mentioned that secondary metabolites are organic molecules, largely generated during the transformation from active to stationary growth and have an important role in plant defense, as they can be classified into three groups: phenols, terpenes, and nitrogen-containing compounds. The amount of phenolic content in *C. erectus* methanol extracts differs according to the plant part. It contains 581.1, 433.9, 236.8, and 216.1 mg/g in its fruits, stems, flowers, and leaves, respectively (Bashir et al 2015).

Allelopathy refers to any process that involves secondary metabolites produced by plants, algae, bacteria and fungi that influence the growth and development of biological systems. These effects might generally be an inhibitory or stimulatory effects of one plant species on other plant species in terms of germination, growth and development along an important mechanism of plant interference mediated by the additional phytotoxins to the environment. Chemicals with allelopathic potential are present in virtually all plants as in most tissues as, they may be released into the environment in sufficient quantities to affect neighboring plants under applicable conditions (Patil 2007, Tahir 2011). This specie is considered very strong and tough and is suitable for urban conditions (Al-Wabel et al 2015). Date palm *Phoenix dactylifera* L. is one of the earliest (5500–3000 BC) farmed variety of palm trees that possess economic, nutritional, ornamental and environmental values.

In the present study, the effects of *C. erectus* L. leaves extracts were investigated as an allelopathic activity component on date palm seedlings and to find mathematical relationships that serve environmental studies.

MATERIAL AND METHODS

An experiment was carried out at the Center of Date Palm Researches, Basrah University during 2018- 2019 to determine the effect of four concentrations (0, 5, 10 and 15 %) of button mangrove *C. erectus* L. leaves extracts on growth characteristics of date palm seedlings.

Collection of plant material and the preparation of the extracts: Fresh mature leaves of *C. erectus* L. were

collected in February 2018 from living trees in Basrah University. The leaves were washed with tap water and once with sterile distilled water and dried at room temperature then ground into a fine powder by suitable grinder. Leaves extract was prepared by adding 100 g of the powder in an electric mixer and the extraction by ethanol was done according to AlMansour (1995) method which was modified from the method of Harborne (1984). Then filtered using Whatman filter paper No. 1 and three concentrations (5, 10 and 15 %) of the extract were prepared, while distilled water was used for control treatment plants. Extracts were kept in dark glass containers in a refrigerator.

Preparation of seedlings: Harmonized completely ripening date palm fruits were collected from a female date palm trees of cv. Hillawi, washed carefully and surface sterilized with 0.2% mercuric chloride solution for 5 minutes and rinsed thoroughly, with autoclaved distilled water three times then moisturized in dishes. Sprouted seeds were sown in poly bags of 28.5 ×12× 8.5 cm filled with peat moss and soil (1:3, v/v) as 0.5 g of NPK fertilizer was added to each pot after 15 days of seeds sown. The bags were divided into four groups and subjected to the treatments in a lath house. Thirty days from seed sown, treatments were applied as the seedlings were moisten weekly with the extracts solutions while distilled water was used for control treatment. Plants were monitored for another four months and all bags were irrigated as they needed. Five months later, plants were harvested, rinsed in distilled water and dried with paper towels. Data was recorded for shoot height, leaf length, leaf width and root length. The seedlings were separated into shoots and roots and fresh weights were tabulated then samples were dried in an aerated oven at 70 ºC for 48 h and their dry weights were recorded. Samples from the dried shoots and roots were used to estimate total soluble carbohydrates content (%) of each according to DuBois et al (1956); nitrogen, phosphorus, and potassium % contents in shoots and roots: N was estimated as described by Jackson (1958); P was evaluated by using spectrophotometer, while flame photometer was used for the determination of K (Page et al 1982).

Experimental design and data analysis: The bags of a single plant for each were arranged in a completely randomized design with nine replicates (Al- Rawi and Kalaf-Allah 2000). Data were analyzed using the SPSS statistical package.

RESULTS AND DISCUSSION

Conocarpus erectus leaves extracts reduced shoot and root growth of date palm seedlings. The minimum shoot height, root length, leaf length and leaf width was 23.80, 31.14, 25.12 and 2.60 cm in seedlings treated with 15 % of the leaves extracts. The maximum were 39.38, 39.02, 28.55 and 3.25 cm in control. The same trend was observed in shoot and root dry weights with maximum of 12.52 and 11.49 g in plants treated with 15 % of *C. erectus* leaves extract respectively and minimum in control (9.10 and 9.48 g, respectively) (Table 1). There was a significant linear relationship between leaf length and leaf width (Fig. 1) as r = 0.5. Similar trend was observed between shoot and root dry weight (Fig. 2).

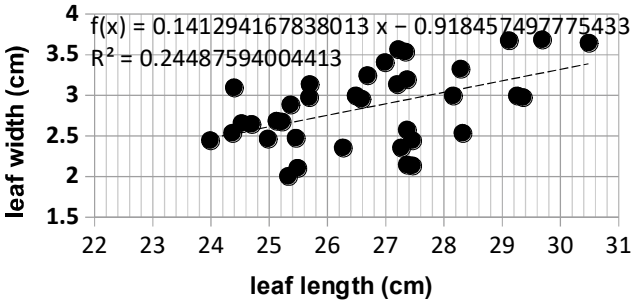

Fig. 1. Relationship between leaf length and leaf width (cm)

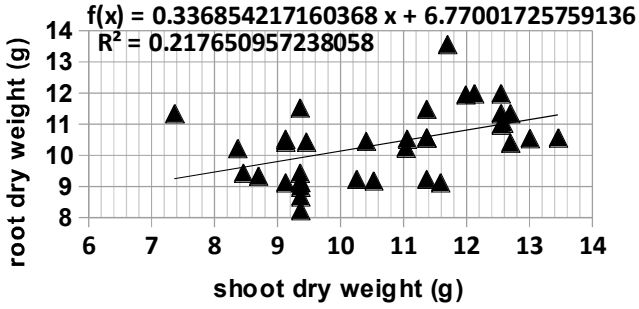

Fig. 2. Relationship between shoot dry weight and root dry weight (g)

Table 1. Effect of *C. erectus* L. leaves extracts on shoot and root growth of *Phoenix dactylifera* L. seedlings

Treatments (%)	Shoot height (cm)	Root length (cm)	Leaf length (cm)	Leaf width (cm)	Shoot dry wt. (g)	Root dry wt. (g)
0	39.38	39.02	28.55	3.25	12.52	11.49
5	33.72	33.88	27.29	2.95	10.81	10.40
10	30.01	31.82	25.90	2.63	10.15	10.05
15	23.80	31.14	25.12	2.60	9.10	9.48
R LSD (0.05)	2.45	1.98	1.00	0.39	0.98	0.88

The phytochemicals analysis of *C. erectuus* extract showed that it contains flavonoids and tannins as major phenolic components (Table 2). Quercetin-3-O-glucoside, kaemferol-3-O-glucoside, apigenin, catechin, rutin, quercetin, and quercetin-3- O-glucoside-6-O-gallic acid have also been identified in *C. erectus* (Abdel-Hameed et al 2012). The total soluble carbohydrates in shoot were inhibited by applying extracts and with mean of 69.11 % in control while the concentration 15 % recorded 51.46 % which was significantly low. The results of nitrogen, phosphorus and potassium contents of shoots also showed a significant inhibition when applying the extracts.

The total soluble carbohydrates content in roots were significantly inhibited when applying the concentration 15 % of *C. erectus* alcoholic extract (28.93 %) while control plants recorded 36.22 % (Table 4). The nitrogen, phosphorus and potassium contents of roots indicated that nitrogen and phosphorous contents were significantly inhibited by the effect of *C. erectus* leaves extract, while the inhibition in potassium content was not significant. The relationship between total soluble carbohydrates content in shoots and in roots (r = 0.5) is represented in (Fig. 3).

The present study indicated that extract inhibited physiological processes which affected the growth. The effect of this extract on seedling growth was expected to be that of inhibition to nutrient uptake which resulted in reducing growth parameters in proportion that was related to the extract concentration. The action of active compounds such as phenols is generally attributed to phenol interactions with proteins, though different mechanisms have been submitted such as the action on membranes and the inhibition of microbial enzymes or deprivation of substrates required for microbial growth by bioactivity of *C. Spp.* (Janecki and Kolodziej 2010, Touqeer et al 2015). Phenolic compounds are major plant allelochemicals in ecosystem and play a key role in allelopathy. Phenolics exert allelopathic effects on various physiological processes in plants: inhibition of cell division, elongation, and submicroscopic structures, changes in membrane permeability and inhibition of plant nutrients uptake, plant photosynthesis and respiration, various enzymes functions and activities, synthesis of plant endogenous hormones and protein synthesis, above and beyond polyphenolic compounds and/ or volatile oils are known to inhibit a wide range of organisms (Baaziz 2008, John and Sarada 2012). Nascimento et al (2016) and Ismaiel (2018) stated that tannins, saponins, flavonoids, tri-

Table 2. Phytochemicals analysis of water extract of *C. erectuus* L

Compounds	Water extract	Compounds	Water extract
Phenols	+	Alkaloids	+
Glycosides	+	Carotenoids	-
Saponins	+	Tannins	-
Terpenoids	-	Flavonoids	+

* (+) represents the positive result (-) represents the negative result

Table 3. Effect of *C. erectus* L. leaves extracts on chemical analysis of the shoots of *Phoenix dactylifera* L. seedlings

Treatments (%)	Carbohydrate (%)	N (%)	P (%)	K (%)
0	69.11	1.382	0.108	0.659
5	59.06	1.354	0.101	0.563
10	51.52	1.279	0.097	0.538
15	51.46	1.276	0.091	0.499
R LSD (0.05)	4.52	0.06	0.01	0.07

Table 4. Effect of *C. erectus* L. leaves extracts on chemical analysis of the roots of *Phoenix dactylifera* L. seedlings

Treatments (%)	Carbohydrate (%)	N (%)	P (%)	K (%)
0	36.22	1.17	0.10	0.34
5	34.57	1.15	0.10	0.33
10	32.89	1.14	0.09	0.33
15	28.93	1.12	0.08	0.32
R LSD (0.05)	3.78	0.03	0.014	NS

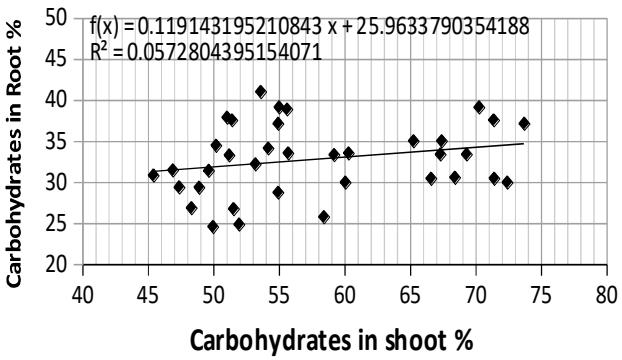

Fig. 3. Relationship between total soluble carbohydrates content in shoots and roots (%)

terpenoids were identified in the aqueous, n-hexane, meOH extracts of *C. erectus*, respectively, while coumarins, alkaloids and saponins were absent, however, pyrogallol, caffeine and e- vanillic were the major phenolic compounds in ethanolic extract 3500, 730 and 1020 ppm, respectively., Alsharekh et al (2022) reported that**,** HPLC analysis of total phenolic contents in *C. erectus* methanolic extracts showed that leaves have the highest contents of gallic acid, caffeic acid, and ferulic acid (153.963, 69.135, and 39.801 ppm, respectively).

CONCLUSION

Ethanolic extracts of *C. erectus* leaves caused an inhibition in Date palm seedlings growth, indicating that the effect was concentration dependent.

REFERENCES

Abdel-Hameed ES, Bazaid SA, Shohayeb MS, El-Sayed M and El-Wakil EA 2012. Phytochemical studies and evaluation of antioxidant, anticancer and antimicrobial properties of *Conocarpus erectus* L. growing in Taif, Saudi Arabia. *European Journal of Medicinal Plants* **2**: 93-112.

Agostini-Costa TS, Vieira RF, Bizzo HR, Silveira D and Gimenes MA 2012. *Secondary Metabolites. In Chromatography and Its Applications,* IntechOpen: London, UK, pp. 131–164.

Almansour N 1995. *The effect of some extracts of Unicorn Ibecilla lutea Van Eslet. On the biology of Whitefly Bemesia tabaci (Homoptera: Alyrodedeae)*, Ph.D. thesis. College of Science, University of Basrsh 165 pp.

Al- Rawi KM and Khalaf-Alla A 2000. *Design and Analysis of Agricultural Experiments*, College of Agriculture and Forestry. University of Mosul, Iraq, 487 pp. (In Arabic).

Alsharekh A El-Sheikh, MA. Alatar, A A and Abdel-Salam, EM 2022. Natural control of weed invasions in Hyper-Arid Arable Farms: Allelopathic potential effect of *Conocarpus erectus* against common weeds and vegetables. *Agronomy*, 12, 703.

Baaziz M 2008. Biotic and abiotic stresses of growing date palm *(Phoenix dactylifera* L.), examples relating to the Maghreb countries, in: III rd. *European Biennial of Palms Conference* "The palm pests", Sanremo, Italy. (in French). doi.org/10.1002/iub.77

Bashir M, Uzair M and Chaudhry BA 2015. A review of phytochemical and biological studies on *Conocarpus erectus* (Combretaceae). *Pakistan Journal of Pharmaceutical Research* **1**: 1-8.

DuBois M, Gilles KA, Hamilton JK, Rebers PA and Smith F 1956. Colorimetric method for determination of sugars and related substances. *Analytical Chemistry* **28**(3): 350–356.

El-Sayed S. Abdel-Hameed, AS Bazaid, MM Shohayeb, MM Sayed and EA El-Wakil. 2012. Phytochemical studies and evaluation of antioxidant, anticancer and antimicrobial properties of *Conocarpus erectus* L. growing in Taif, Saudi Arabia. *European Journal of Medicinal Plants* **2**(2): 93-112.

Al-Wabel MI, Usman AR, El-Naggar AH, Aly AA, Ibrahim HM, Elmaghraby S and Al-Omran A 2015. *Conocarpus biochar* as a soil amendment for reducing heavy metal availability and uptake by maize plants. *Saudi Journal of Biological Sciences* **22**: 503-511.

Harborne JB 1984. *Phytochemical Methods: A guide to Modern Techniques of Plant Analysis* 2nd ed. Chapman and Hall. London New York. pp 288.

Ismaiel GHH 2018. Antioxidant, antimicrobial and anticancer activities of Egyptian *Conocarpus erectus* L. leaves extracts. *Egyptian Journal of Food Science* **46**: 165-174.

Jackson ML 1958. *Soil chemical analysis.* Prentice Hall & Englewood, Cliffs, N. T. USA.

Janecki A and Kolodziej H 2010. Anti-adhesive activities of flavan-3-ols and proanthocyanidins in the interaction of group A-streptococci and human epithelial cells. *Molecules* **15**(10): 7139-7152.

John J and Sarada S 2012. Role of phenolics in allelopathic interactions. *Allelopathy Journal* **29**(2): 215-230

Nascimento DK, Souza IA, Oliveira AFD, Barbosa MO, Santana MA, Pereira Junior DF, Lira EC and Vieira JR 2016. Phytochemical Screening and Acute Toxicity of Aqueous Extract of Leaves of *Conocarpus erectus* Linnaeus in Swiss Albino Mice. *Anais da Academia Brasileira de Ciencias* **88**: 1431-1437.

Page AL, Miller RH and Keeny DR 1982 *Methods of soil analysis.* Part 2, 2nd ed., Madison, Wisconson, U.S.A., p. 1159.

Patil CK 2007. *Allelopathic effect of botanicals on major weeds of onion (Alium cepa* L.). M.Sc. Thesis submitted to the University of Agricultural Sciences, Dharwad, India.

Roze LV, Chanda A and Linz JE 2011. Compartmentalization and molecular traffic in secondary metabolism: A new understanding of established cellular processes. *Fungal Genetics Biology* **48**: 35-48.

Shams ZI 2016. Changes in diversity and composition of flora along a corridor of different land uses in Karachi over 20 years: Causes and implications. *Urban Forestry & Urban Greening* **17:** 71-79.

Tahir JF 2011. *Weeds control in forest ecosystem by the allelopathic potential of Black Walnut (Juglans nigra* L.*).* MSc. thesis, College of Agriculture, Duhok University Iraq.

Touqeer S, Saeed MA and Khalid S 2015. Thin layer chromatographic study of *Conocarpus lancifolius*, *Melaleuca decora* and *Syngonium podophyllum*. *Research Journal of Pharmacy and Technology* **8**(1): 74-77.

Received 26 June, 2022; Accepted 08 October, 2022