Comunicación breve

Antioxidant activity of essential oils from leaves of *Schinus lentiscifolius* Marchand

Actividad antioxidante del aceite esencial de las hojas de *Schinus lentiscifolius* Marchand

Eliane Regina da Silva[1*] http://0000-0003-3993-3943
Ângela Pawlowski[2] http://0000-0002-6098-5118
Diana Carla Lazarotto[1] http://0000-0002-9811-289
Geraldo Luiz Gonçalves Soares[1] http://0000-0002-8976-1935

[1]Instituto de Biociências, Universidade Federal do Rio Grande do Sul. Brasil.
[2]Instituto Federal de Educação, Ciência e Tecnologia Farroupilha, Campus Santo Ângelo. Brasil.

*Corresponding author: anesilva.bio@hotmail.com

ABSTRACT

Introduction: Extracts and essential oils from *Schinus* spp. (Anacardiaceae) have been evaluated for their biological activities. Some *Schinus* essential oils have antioxidant properties.

Objective: Determine the antioxidant capacity of the essential oil from leaves of *Schinus lentiscifolius* Marchand (carobá).

Esta obra está bajo una licencia https://creativecommons.org/licenses/by-nc/4.0/deed.es_ES

Methods: Antioxidant activity was determined by the 1.1-diphenyl-2-picrylhydrazyl (DPPH) radical method. For analysis, the essential oil was dissolved in methanol at concentrations of 20, 40, 60, 80 and 100 mg/mL. Thymol was used as standard antioxidant.

Results: Antioxidant activity of *S. lentiscifolius* essential oil was found to depend on the dose, reaching 54.4 % at 100 mg/ml. However, thymol displayed stronger activity than *S. lentiscifolius* oil at a lower concentration (25 mg/mL).

Conclusions: Essential oil from *S. lentiscifolius* leaves displayed moderate antioxidant activity. This may be due to the presence of some monoterpenes in the oil.

Key words: DPPH method; free radical capture; terpenes; Anacardiaceae.

RESUMEN

Introducción: Los extractos y aceites esenciales de *Schinus* spp. (Anacardiaceae) han sido evaluados con respecto a sus actividades biológicas. Algunos aceites esenciales de *Schinus* poseen propiedades antioxidantes.

Objetivo: Determinar la capacidad antioxidante del aceite esencial de las hojas de *Schinus lentiscifolius* Marchand (molle ceniciento, aroeira-cinzenta).

Métodos: Se evaluó la actividad antioxidante por el método DPPH (1,1-difenil-2--picrilhidrazilo). Se utilizó el aceite esencial disuelto en metanol en concentraciones de 20, 40, 60, 80 y 100 mg/mL. Se usó timol como el antioxidante estándar.

Resultados: La actividad antioxidante del aceite esencial de *S. lentiscifolius* estuvo en dependencia de la dosis y alcanzó 54,4 % a 100 mg/mL. Sin embargo, el timol mostró una actividad más fuerte que el aceite de *S. lentiscifolius* en una concentración más baja (25 mg/mL).

Conclusiones: El aceite esencial de las hojas de *S. lentiscifolius* presentó actividad antioxidante moderada, lo cual puede estar relacionado con algunos monoterpenos presentes en el aceite.

Palabras clave: método DPPH; captación de radicales libres; terpenos; Anacardiaceae.

Esta obra está bajo una licencia https://creativecommons.org/licenses/by-nc/4.0/deed.es_ES

Recibido: 22/05/2018
Aprobado: 10/01/2019

INTRODUCTION

Schinus genus (Anacardiaceae) comprises 29 species, from subshrubs to tall trees. Natural distribution of the genus is generally limited to South America.[1] *Schinus lentiscifolius* Marchand is a tree with opaque, smooth, and glabrous leaves that is found in grasslands, especially in stony soils.[2] In folk medicine, *S. lentiscifolius* is used as antiseptic, antimicrobial and to treat wound healing.[3] The use of *Schinus* spp. in folk medicine has stimulated investigation of biological activities of their extracts and essential oils.[4] Nevertheless, little is known about biological activities of *S. lentiscifolius*, except by its phytotoxic[5] and antibacterial[3] effects.

The antioxidant activity of some *Schinus* essential oils and extracts has been reported. Regarding essential oils, antioxidant activity was observed for leaf and fruit oils of *S. molle* L. and *S. terebinthifolius* Raddi.[6,7,8] In addition, studies reported the activity of *S. areira* L., *S. longifolius* (Lindl.) Speg., *S. fasciculatus* (Griseb.) I.M. Johnst. and *S. praecox* (Griseb.) Speg. essential oils.[4,9] However, no study has investigated the potential antioxidant effects of *S. lentiscifolius.* Hence, this study aimed to evaluate the antioxidant activity of *S. lentiscifolius* leaf essential oil.

METHODS

Leaves of *S. lentiscifolius* were collected in the city of Encruzilhada do Sul (30° 31' S, 52° 31' W), Rio Grande do Sul State, Brazil. Samples were identified and a voucher (164708)

Esta obra está bajo una licencia https://creativecommons.org/licenses/by-nc/4.0/deed.es_ES

was deposited in the herbarium ICN of the Universidade Federal do Rio Grande do Sul, Brazil. Leaves were dried at room temperature. The essential oil was obtained by hydrodistillation in a modified Clevenger apparatus and stored at -80 °C. Chemical characterization of this essential oil was carried out in a previous study.[5]

Antioxidant activity was evaluated by the DPPH (1,1-diphenyl-2-picrylhydrazyl) method, which is based in evaluating the ability of compounds to scavenge the stable free radical DPPH. *Schinus lentiscifolius* leaf essential oil was diluted in methanol at the concentrations of 0 (control), 20, 40, 60, 80 and 100 mg/mL. The positive control was thymol, which was diluted in methanol at the concentrations of 1, 5, 10, 15, 20 and 25 mg/mL. Tests were conducted as described by Silva et al., [10] and all measurements were performed in triplicate. Antioxidant activity (%) was calculated according to the equation:

$$\text{Antioxidant activity (\%)} = [(Ac - As)/(As)] * 100,$$

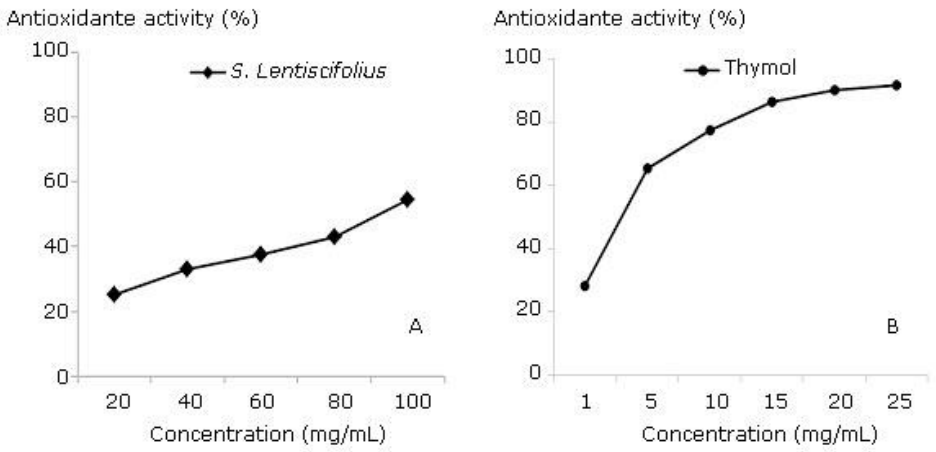
Where: Ac is the absorbance of control and As is the absorbance of the sample.

RESULTS

Chemical characterization of the *S. lentiscifolius* essential oil has been previously reported[5] (exactly the same essential oil sample used herein). The essential oil was mostly composed by sesquiterpene hydrocarbons (41.5 %), followed by monoterpene hydrocarbons (27.7 %), oxygenated sesquiterpenes (26.2 %), and oxygenated monoterpenes (4.6 %). Some compounds present in representative amounts were δ-cadinene (14.4 %), limonene (8.14 %), sabinene (5.08 %), α-cadinol (4.91 %), α-pinene (4.80 %) and terpinen-4-ol (3.85 %).

Schinus lentiscifolius leaf essential oil showed dose-dependent antioxidant activity (fig.), with 54.4 % activity at 100 mg/mL, the highest concentration in methanol (Fig. 1A). Thymol reached 91.6 % antioxidant activity at 25 mg/mL (Fig. 1B), which demonstrates about 37.2 % more effectiveness than the highest concentration of *S. lentiscifolius* essential oil.

Esta obra está bajo una licencia https://creativecommons.org/licenses/by-nc/4.0/deed.es_ES



(A) Antioxidant activity of *S. lentiscifolius* at the concentrations of 20, 40, 60, 80 and 100 mg/mL in methanol, according to the DPPH method. (B) Antioxidant activity of thymol, the standard antioxidant, at 1, 5, 10, 15, 20 and 25 mg/mL in methanol, according to the DPPH method.

Fig. - Dose-dependent antioxidant activity of *S. lentiscifolius* leaf essential oil.

DISCUSSION

Antioxidant activity of *S. lentiscifolius* may be related to some of the main components of the essential oil that present antioxidant activity, such as the monoterpenes sabinene (strong activity), limonene and terpinen-4-ol (moderate activity). The monoterpene hydrocarbons α-terpinene, γ-terpinene and terpinolene, which are present in minor amounts in the oil, also possess strong activity.[11] Nevertheless, *S. lentiscifolius* oil was not very effective compared to thymol, the standard antioxidant.

The activity of *S. lentiscifolius* essential oil observed herein was not as strong as of essential oils of other *Schinus* species. However, in some cases, *Schinus* species that showed effective antioxidant properties, such as *S. terebinthifolius* and *S. molle*, presented weak activity in other studies.[8,12] Differences in activity level can occur because composition of essential oils may vary according to climatic factors,[13] fertility regime,[14] location, plant density,[15] soil type[16] and methods for drying plant material.[17] Therefore, antioxidant activity of *S. lentiscifolius* should not be completely disregarded yet. Further studies should use other tissues *of S. lentiscifolius*, as well as other chemotypes that could present higher amounts of monoterpenes with strong antioxidant activity.

Esta obra está bajo una licencia https://creativecommons.org/licenses/by-nc/4.0/deed.es_ES

Acknowledgments

The authors thank Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) for the Ph.D. scholarship granted to the first author.

REFERENCES

1. Barkley FA. *Schinus* L. Brittonia 1944;5(2):160-98.

2. Stumpf ET, Romano CM, Barbieri RL, Heiden G, Fischer SZ, Corrêa LB. Características ornamentais de plantas do Bioma Pampa. Rev. Bras. Hortic. Ornam. 2009;15(1):49-62.

3. Gehrke IT, Neto AT, Pedroso M, Mostardeiro CP, Da Cruz IB, Silva UF, et al. Antimicrobial activity of *Schinus lentiscifolius* (Anacardiaceae). J Ethnopharmacol. 2013;148(2):486-91.

4. Murray AP, Rodriguez AS, Alza NP. Chemical constituents and biological activities of plants from the genus *Schinus*. In: Govil JN and Kaushik G (editors). Recent progress in medicinal plants: Ethnomedicine and therapeutic validation. Houston: Studium Press LLC; 2012.

5. Pawlowski Â, Kaltchuk-Santos E, Brasil MC, Caramão EB, Zini CA, Soares GLG. Chemical composition of *Schinus lentiscifolius* March. essential oil and its phytotoxic and cytotoxic effects on lettuce and onion. S Afr J Bot 2013;88:198-203.

6. El-Massry KF, El-Ghorab AH, Shaaban HA, Shibamoto T. Chemical compositions and antioxidant/antimicrobial activities of various samples prepared from *Schinus terebinthifolius* leaves cultivated in Egypt. J Agric Food Chem. 2009;57(12):5265-70.

7. Bendaoud H, Romdhane M, Souchard JP, Cazaux S, Bouajila J. Chemical composition and anticancer and antioxidant activities of *Schinus molle* L. and *Schinus terebinthifolius* Raddi berries essential oils. J Food Sci 2010;75(6):466-72.

Esta obra está bajo una licencia https://creativecommons.org/licenses/by-nc/4.0/deed.es_ES

8. Martins MR, Arantes S, Candeias F, Tinoco MT, Cruz-Morais J. Antioxidant, antimicrobial and toxicological properties of *Schinus molle* L. essential oils. J Ethnopharmacol 2014;151(1):485-92.

9. Murray AP, Gurovic MSV, Rodriguez SA, Murray MG, Ferrero AA. Acetylcholinesterase inhibition and antioxidant activity of essential oils from *Schinus areira* L. and *Schinus longifolia* (Lindl.) Speg. Nat Prod Commun 2009;4(6):873-6.

10. Silva ER, Lazarotto DC, Pawlowski A, Schwambach J, Soares GLG. Antioxidant evaluation of *Baccharis patens* and *Baccharis psiadioides* essential oils. J Essent Oil Bear Pl (accepted for publication).

11. Ruberto G, Baratta MT. Antioxidant activity of selected essential oil components in two lipid model systems. Food Chem 2000;69:167-74.

12. Jeribi C, Karoui IJ, Hassine DB, Abderrabba M. Comparative study of bioactive compounds and antioxidant activity of *Schinus terebinthifolius* Raddi fruits and leaves essential oils. Int J Sci Res. 2014;3(12):452-8.

13. Hassiotis CN, Ntana F, Lazari DM, Poulios S, Vlachonasios KE. Environmental and developmental factors affect essential oil production and quality of *Lavandula angustifolia* during flowering period. Ind Crops Prod 2014;62:359-66.

14. Jeshni MG, Mousavinik M, Khammari I, Rahimi M. The changes of yield and essential oil components of German Chamomile (*Matricaria recutita* L.) under application of phosphorus and zinc fertilizers and drought stress conditions. Journal of the Saudi Society of Agricultural Sciences. 2017;16(1):60-5.

15. Ullaha H, Honermeier B. Fruit yield, essential oil concentration and composition of three anise cultivars (*Pimpinella anisum* L.) in relation to sowing date, sowing rate and locations. Ind Crops Prod 2013;42:489-99.

16. Omer EA, Abou Hussein EA, Hendawy SF, Ezz El-din, Azza A, El-Gendy AG. Effect of soil type and seasonal variation on growth, yield, essential oil and Artemisinin content of *Artemisia Annua* L. International Research Journal of Horticulture 2013;1(1):15-27.

Esta obra está bajo una licencia https://creativecommons.org/licenses/by-nc/4.0/deed.es_ES

17. Rahimmalek M, Goli SAH. Evaluation of six drying treatments with respect to essential oil yield, composition and color characteristics of *Thymys daenensis* subsp. *daenensis*. Celak leaves. Ind Crops Prod 2013;42: 613-19.

Conflicto de intereses

Los autores expresan que no tienen conflicto de intereses.

Contribución de los autores

E. R. Silva, defined the experimental design, performed the experiments and wrote the manuscript.

Â Pawlowski and *D.C. Lazarotto,* defined the experimental design, performed the experiments and revised the manuscript.

G. L. G. Soares, defined the experimental design and revised the manuscript.

Esta obra está bajo una licencia https://creativecommons.org/licenses/by-nc/4.0/deed.es_ES