MEDICINE AND MATERIALS

Volume 3, Issue 1, 2023: 37-42| ISSN: 2784 – 1499 & e-ISSN: 2784 – 1537
DOI: 10.36868/MEDMATER.2023.03.01.037 | www.medicineandmaterials.com |

ACTIONS OF DROSERA SP IN DENTISTRY DISEASES. PHITOCHEMICAL COMPONENTS, PHARMACOLOGICAL ACTIONS

Oleg SOLOMON[1], Carmen GALEA[2,*] , Ramona FEIER[2,*] Andrei MOSTOVEI[1]

[1] Nicolae Testemitanu State University of Medicine and Pharmacy, Chisinau, the Republic of Moldova.
[2] „Dimitrie Cantemir" University, Faculty of Medicine, Târgu Mureș, România.

Abstract

The aim of this review is to establish the main phytoconstituents of Drosera species and to find interrelations between them and the pharmacological action of the extracts. We paid special attention to the possibilities of using the Drosera species in the field of dentistry. To achieve the proposed goal, a series of scientific publications on the chemical composition, pharmacological action and medicinal use of Drosera species were identified and evaluated. The analysis took into account different criteria: the establishment of the phytoconstituents, the chemical methods of isolation, the analysis and the pharmacological particularities, and the use in dental field. Results showed that Drosera species are rich in flavonoids, especially flavonols (gossypin and gossiptrin) and their glycosides (quercetin, isoquercetin, hyperoside, astralgin), naphthoquinone derivatives (plumbagin, naphthoquinone) and tannins (ellagic acid, dimethylellagic acid). These components are responsible for anti-inflammatory, antispasmodic, antioxidant and anti tumoral activity. The first studies related to the anti-inflammatory action are recorded in 2002 by Kolodziej [23] and refers to Drosera peltata. The latest studies on the anti-inflammatory action are those from 2022 led by Hake [22] and these lead to a better understanding of the mechanism of the anti-inflammatory action , respectively of its natural compounds (quercetin , isoquercetin and hyperoside) functioning as neutrophyl inhibitors. Drosera sp. can be used in dental diseases due to the anti-inflammatory and antibacterial action of its bioactive components.

Keywords*: Drosera sp,; antimicrobian activity; oral diseases; phytochemical aspects*

Introduction

Oral health is integral to general well-being and relates to the quality of life that extends beyond the function of the craniofacial complex. There is a considerable evidence linking poor oral health to chronic conditions, for example, there is a strong association between severe periodontal diseases and diabetes [1]. There is also evidence linking poor oral health and systemic diseases, such as cardiovascular diseases, rheumatoid arthritis and osteoporosis [2].

The link between oral diseases and the activities of microbial species that form part of the microbiota of the oral cavity is well established [3]. Over 750 species of bacteria inhabit the oral cavity (~50% of which are yet to be identified) and a number of these are involved in oral diseases [3]. The development of dental caries regards acidogenic and aciduric Gram-positive bacteria, primarily the mutans streptococci (Streptococcus mutans and S. sobrinus),lactobacilli and actinomycetes [4]. In contrast, periodontal diseases are subgingival conditions that have

Corresponding author: unicapharm@gmail.com, dr.ramonafeier@yahoo.ro

been linked to anaerobic Gram-negative bacteria such as Porphyromonas gingivalis, Actinobacillus sp., Prevotella sp. and Fusobacterium sp. [4,5].

The global need for alternative prevention and treatment options and products for oral diseases that are safe, effective and economical comes from the rise in disease incidence (particularly in developing countries), increased resistance by pathogenic bacteria to currently used antibiotics and chemotherapeutics, opportunistic infections in immunocompromized individuals and financial considerations in developing countries [6]. Natural phytochemicals isolated from plants used in traditional medicine are considered as good alternatives to synthetic chemicals [7,8].

Table 1. Plant extracts and phytochemicals with potential application agains oral bacteria *[7]*

Extract (solvent)	MIC[a]	Phytochemical (class)	MIC[a]
Propolis (ethanol)	2.0–64.0	Macrocarpals A,B,C (terpenes)	0.5–1.0
Mikania laevigata (ethanol)	12.5–100.0	Bakuchiol (terpene)	1.0–4.0
Mikania glomerate (ethanol)	12.5–100.0	Erycristagallin (flavonoid)	1.6–6.3
Drosera peltata (chloroform)	15.6–31.3	Beta acid	2.0
Helichrysum italicum (ethanol)	31.3–62.5	Xanthorrhizol (terpene)	2.0–4.0
Coptidis rhizoma (water)	31.0–250.0	Artocarpin (flavonoid)	3.1–12.5
Piper cubeba (aqueous ethanol)	90.0–200.0	Artocarpesin (flavonoid)	3.1–12.5
		Macelignan (flavonoid)	3.9
		Catechol (phenolic)	6.5
		Kuwanon G (flavonoid)	8.0
		Xanthohumol (flavonoid)	12.5
		Tetra iso-alpha acid	12.5
		Berberine (alkaloid)	13.0–20.0
		Compound 2[b] (terpene)	15.6
		Chlorhexidine[c]	1.0
		Triclosan[c]	0.1–20.0

Phytochemical Aspects of Drosera Sp

Drosera or Sundew plant is a very well-known insectivorous plant and as well as medicinal plant, consists of approximately 170 species in all over the world. Charles Darwin discovered the carnivorous nature of other Drosera species, wrote: “At this present moment I care more about Drosera than the origin of all the species in the world”. Naturally Drosera has various potential medicinal components like naphthoquinones and plambagin, ramentaceone [9].

Research (table 2) revealed that Drosera madagascarien flavonoids extracts like quercetin (IC50 0.8 µg/ml), hyperoside (IC50 0.15 µg/ml) and isoquercitrin (IC50 0.7 µg/ml) contributed in antioxidant activity [10, 11].

Other research revealed that Drosera has potential activity in cancer cell. Like- in previous study shown that Drosera burmanniiVahl has potent antioxidant activity which reduced the cancerous cell activity [12].

Table 2. Drosera species, medical properties and constituents [9].

Sl.No-	Name of the Drosera Species	Name of the constituents	Medicinal Properties
1	*Drosera madagascarien*	Quercetin, Hyperoside and Isoquercitrin	Anti-Oxidantactivity
2	*Drosera burmannii*	Reserpine, methyl gallate and rutin	Anti-Oxidant activity
3	*Drosera rotundifolia*	Myricetin-3-Ogalactoside, quercetin, ellagic acid	Anti-Inflammation
4	*Drosera madagascariensis*	Myricetin-3-Ogalactoside, quercetin, ellagic acid	Anti-Inflammation
5	*Drosera peltata*	Naphthoquinones	Anti-Inflammation
6	*Drosera Sp*	Naphthoquinones,Plumbagin	Anti-Cancer
7	*Drosera peltata*	Plumbagin	Anti-cancer
8	*Drosera peltata*	Plumbagin	Anti-bacterial
9	*Drosera communis, Drosera montana var. montana, Drosera brevifolia, Drosera villosa var. graomogolensisDrosera villosavar*	Quercetin, Hyperoside and Isoquercitrin	Anti-bacterial

Applications in Dentistry

Infections in the oral cavity and caries caused by bacteria from the Streptococcus class are very susceptible to Drosera extracts, action due especially to plumbagina. This inhibits the growth and development of strains of Streptococcus mutans, Streptococcus sobrinus, Streptococcus rattus, Streptococcus cricetus [25,26].

Studies have been developed on the pathogens involved in periodontitis and gingivitis caused by Prevotella intermedia, Porphyromonas gingivalis and Aggregatibacter atinomycetemcomitans [27,28]. In some studies, the minimum inhibitory concentration was determined in relation to amoxicillin / ac. cavulanic, respectively tetracycline used as standard antibiotics. The inhibition zones obtained were comparable to those obtained for antibiotics. These results might suggests that Drosera sp. can be used in periodontal therapy [29,30].

Conclusions

Drosera extracts are incorporated in various pharmaceutical forms , phytotherapeutic and homeopathic products such as : tincture , homeopathic granules and syrups in combination with ipecac and pine extracts.

As demonstrated by the examples included in this review, there is considerable evidence that plant extracts, essential oils and purified phytochemicals have the potential to be developed into agents that can be used as preventative or treatment therapies for oral diseases.

1. The extracts of Drosera sp. shows antibacterial action on Gram-positive strains of Bacillus thuringiensis and Staphylococcus aureus, responsible for the development of dental caries
2. Drosera species can be used in periodontal therapy due to the antibacterial action on Gram-negative strains of Prevotella intermedia, Porphyromonas gingivalis and Aggregatibacter atinomycetemcomitans, responsible for the occurrence of periodontal diseases

3. Due to the interactions between the secondary metabolites, present in the extract, it is possible to use very low doses of the Drosera sp extract according to the studies devloped
4. We consider that it is necessary to expand phytochemical studies as well as clinical and pharmacokinetic trials in order to add new data in the use of Drosera sp.

As a future direction we propose to collect samples from the periodontal pockets , to identify the bacterial strains causing infections. In the next stage we will establish zones for the aqueous extracts of Drosera on the bacterial culture medium inoculated with the strains found. Then we will compare the inhibition zones with those of specific antibiotics. If it tourns out that the extracts have antibacterial action , we can think about obtaining mouthwashes based on Drosera extracts.

References

[1] Rautemaa R., Lauhio A., Cullinan M.P., Seymour G.J., "Oral infections and systemic disease—an emerging problem in medicine," *Clinical Microbiology and Infection*,2007, vol. 13, 11: 1041–1047.

[2] Jenkinson J.H. Lamont R.J., "Oral microbial communities in sickness and in health," *Trends in Microbiology*,2005, vol. 13, no. 12 :589–595.

[3] J. Tichy and J. Novak, "Extraction, assay, and analysis of antimicrobials from plants with activity against dental pathogens (Streptococcus sp.)," Journal of Alternative and Complementary Medicine, vol. 4, no. 1, pp. 39–45, 1998.

[4] W. Loesche, "Dental caries and periodontitis: contrasting two infections that have medical implications," Infectious Disease Clinics of North America, vol. 21, no. 2, pp. 471–502, 2007.

[5] F. A. Badria and O. A. Zidan, "Natural products for dental caries prevention," Journal of Medicinal Food, vol. 7, no. 3, pp. 381–384, 2004.

[6] G. R. Prabu, A. Gnanamani, and S. Sadulla, "Guaijaverin— a plant flavonoid as potential antiplaque agent against Streptococcus mutans," Journal of Applied Microbiology, vol.101, no. 2, pp. 487–495, 2006.

[7] Enzo A. Palombo Review Article Traditional Medicinal Plant Extracts and Natural Products with Activity against Oral Bacteria: Potential Application in the Prevention and Treatment of Oral Diseases Australia, 2009.

[8] Rakesh Goswami, Tanmoy Sinha and Kishore Ghosh, Drosera Sp: A Critical Review on Phytochemical and Ethnomedicinal Aspect, International Journal of Pharmacy and Biological Sciences-IJPBSTM (2019) 9 (1): 596-601

[9] Melzig, M.F., Pertz, H.H., Krenn, L. Anti-inflammatory and spasmolytic activity of extracts from Droseraeherba. Phytomedicine 2001; 8:225–229

[10] Ellison AM, Gotelli NJ: Energetics and the evolution of carnivorous plants--Darwin's 'most wonderful plants in the world'. J Exp Bot. 2009; 60(1): 19–42.

[11] Baban Ghate Nikhil et al, An Antioxidant Extract of the Insectivorous Plant DroseraburmanniiVahl. Alleviates Iron-Induced Oxidative Stress and Hepatic Injury in Mice. PLoS One. 2015; 10(5): e0128221.

[12] .Banasiuk R., Kawiak A, Krolicka , In vitro cultures of carnivorous plants from the Drosera and Dioneae genus for the production of biologically active secondary

metabolites. Journal of Biotechnology ,Computational Biology and Bionanotechnology ,93 (2), 87-96.

[13] Culbreath David M.R. , A manual of Materia Medica and Pharmacology , Ed. Lea & Febiger. , 1927.

[14] Shaikh A. M. , Shrivastava B., Apte K., Navale S.D. , Medicinal plants as potential source of anticancer agents. A review. , Journal of Pharmacognosy and Phytochemistry , 5 (2) , 291-295, 2016.

[15] Raju A., Seeja S.R., Balaji , An in vitro evaluation of antimicrobial activity of Drosera peltata J.E. Sm against clinically isolated human periodontal pathogens, Journal of International Research in Medical and Pharmaceutical Sciences , 10(3)m, pp 115-120, 2016

[16] Durechova D., Kacaniova M., Terentjeva M., Petrova J., Hleba L., Kata I., *Journal of Microbiology , Biotechnology and Food Sciences*, 2016 , 5 (1) : 20-22.

[17] Kacaniova M., Durechova D. , Vukovic N., Kantor A., Petrova J., Hleba L., Vatlak A., Scientific Papers: Animal Science and Biotechnologies , 2014, 47 (2), 366-369.

[18] Lieberherr C., Zhang G., Grafen A., Singethan K., Kendl S., Vogt V., Maier J., Bringmann G., Schneider- Schaulies J., The plant -derived naphthoquinone droserone inhibits in vitro measles virus infection, *Planta Med*., 2016, 83(3) : 232-238.

[19] Kamarainen T., Uusitalo J.,Jalonen J., Laine K., Hohtola A., Regional and habitat differences in 7-methyljuglone content of finnish Drosera rotundifolia, *Phytochemistry* , 2003, 63 : 309-314.

[20] Tvorda E., Michalko J., Matusikova I., The Drosera extract as an alternative in vitro supplement to animal semen . Effects on bovine spermatozoaactivity and oxidative balance, Scientific Papers: Animal Science and Biotechnologies , 2015,48 (1) : 68-75.

[21] Hake A., Begrow F., Spiegler V., Symma N., Hensel A., Dufer M., Effects of extracts and flavonoids from Drosera rotundifolia L. On ciliary beat frequency and murine airway smooth muscle, MDPI, 2022, 27: 6622.

[22] Kolodzjeiev H., Pertz H.H., Humke A., Main constituents of a commercial Drosera fluid extract and theier agonist M3 receptors in guinea-pig ileum , *Pharmazie*, 2002, 57 (3) : 201-203

[23] Li S., Chen N., Gaddes E., Zhang X., Dong C., Wang Y., A Drosera bioinspired hydrogel for catching and killing cancer cells , Scientific reports

[24] Krenn L., Beyer G., Pertz H.A., Kremser M., Galambosi B., Melzig M., In vitro antispasmodic and antiinflamatory effects of Drosera rotundifolia , *Arzneimitteforschung* , 2004, 54 (7) : 402-405.

[25] Piercy M.A. , Bierma J.C., Crosby M.G., Carpenter B.P., Takahashi G.R., Paulina J., Hung I., Zhang R., Kelly J. E., Kozlyuk N., Chen X., Butts C:T:, Martin R .W., The droserasin 1 PSI : a membrane – interacting antimicrobial peptide from the carnivorus plant Drosera capensis , Biomolecules .2020, 10 (7) :1069

[26] Arruda-Silva F., Bellavite P., Marzolto M., , Low dose Drosera rotundifolia induces gene expression changes in 16 HBE human bronchial epithelial cells , *Scientific reports* , 2021, 10.1038

[27] Lupaşcu, A.,(2001), Biogeografie, Editura Fundaţiei România de Mâine, Bucureşti Madhavan V., Basnett H., Gurudeva M.R. (2009) Pharmacognostical evolution of Drosera burmanii Vahl, Droseraceae, Indian Journal of Traditional Knowledge 8 (3), pp 326-333

[28] Cortico F.P., Fleischmann A. (2016) The first record of the boreal bog species Drosera rotundifolia (Droseraceae) from the Philippines and a key to the Philippine sundews, Blumea ,6, pp 24-28

[29] Durechova D., Kacaniova M., Terentjeva M., et al., (2016) Antibacterial activity of Drosera rotundifolia L. against Gram -positive and Gram-negative bacteria, Journal of Microbiology, Biotechnology and Food Sciences , 5, pp 20-22.

Received: November 22, 2022
Accepted: March 15, 2023