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STUDII ŞI CERCETĂRI

Biology

25-26

BISTRIȚA

2021

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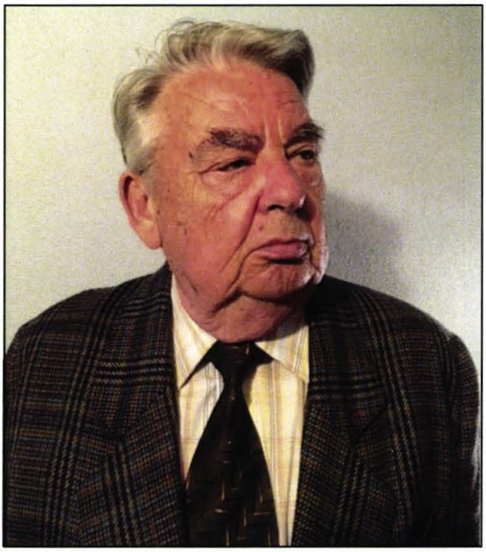
CUPRINS. CONTENT. SOMMAIRE. INHALT

LAUDATIO – PROF. UNIV. DR. MARTIN KEUL CU OCAZIA ANIVERSĂRII A 80 DE ANI

Rahela CARPA*, Marius HORGA**



Profesorul univ. dr. Martin Keul s-a născut la data de 29 septembrie 1939 în orașul Sighișoara, jud. Mureș. A absolvit Școala Medie nr. 3 cu limbă de predare în limba germană la Sighişoara (Şcoala din deal, Bergschule), azi Liceul Teoretic „Josef Haltrich" în iulie 1957 cu Diploma de Maturitate nr. 14174/20 iulie 1957. A urmat apoi Facultatea de Biologie-Geografie, secţia Biologie, Universitatea Babeş-Bolyai, Cluj, pe care a absolvit-o în anul 1963 ca Diplomat universitar în Biologie-Botanică cu Diploma nr. 167494/ 16.04.1964 însoţită de Anexa de studii nr. 10, eliberată cu nr. 10.889/ 16.04.1964.

În anul 1973 obține titlul științific de Doctor în Biologie cu teza intitulată *Efectul chimic şi fotodinamic al coloranţilor vitali asupra curenţilor protoplasmatici – Chemical and photodynamic effects of vital dyes on protoplasmic streaming"* la Centrul de Cercetări Biologice Cluj, conducător ştiinţific Acad. Prof. dr. Emil Pop, titlu confirmat la 30 iunie 1973 de Comisia Superioară de Doctorat şi atestat cu Diploma de Doctorat Seria B, nr. 101/8.02.1974 Centrul de Cercetări Biologice din Cluj.

Activitatea profesională a Dr. Martin Keul s-a desfășurat între anii 1963 și 2010 la Institutul de Cercetări Biologice Cluj-Napoca, ocupând succesiv următoarele trepte de încadrare: Cercetător stagiar, Cercetător stagiar atestat, Cercetător ştiinţific gradul III, Cercetător ştiinţific gradul II, Cercetător ştiinţific gradul I.

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Domeniile de cercetare abordate în acea perioadă s-au orientat spre Fiziologie şi Citofiziologie vegetală cu teme privind mişcarea intracelulară (dineză); modificarea desfăşurării ciclului celular din meristeme radiculare (în special la *Vicia faba, Allium cepa*) sub efectul unor factori fizici (UV) şi chimici (pesticide, metale grele); probleme de fotobiologie (efectul fotodinamic al unor coloranţi vitali (roşu neutru, eritrozina B), spectrul de acţiune pentru stimularea fotoindusă a mişcării citoplasmatice, fotoinducerea germinaţiei seminţelor şi sporilor, efectul radiaţiilor ionizante şi câmpului electromagnetic asupra plantelor; ecotoxicologie şi poluarea mediului (metale grele, pesticide, poluanţi) dar şi în domeniul plantelor medicinale privind valorificarea terapeutică a acestora (*Angelica archangelica*, specii de *Epilobium, Hypericum, Polygonum, Solidago*).

În perioada 1992-2010 dl. profesor a îndeplinit funcţii administrative precum cea de Director ştiinţific la Institutul de Cercetări Biologice Cluj-Napoca.

A condus şi, respectiv, a participat la numeroase contracte-proiecte de cercetare, iar la 4 dintre acestea, din domeniul de activitate, a avut calitatea de coordonator.

Dl. profesor a urmat specializări în ţară: Cursurile pentru utilizarea izotopilor radioactivi (CUIR), Bucureşti, 1966 (3 luni), Certificat nr. 884/1966, dar şi în străinătate:

- în anul 1969 (2 săptămâni) – schimb de experienţă în RDG (Universitatea Humboldt din Berlin; Institutul pentru Biochimia Plantelor din Halle al Academiei Germane de Ştiinţe Berlin; Institutul Botanic al Universităţii din Jena; Sectia Biologie a Universitatii Rostock).
- în perioada 1974-1975 (12 luni) – bursă acordată de Fundaţia Alexander von Humboldt pentru specializare în fotobiologie vegetală la Institutul Botanic al Universităţii Friedrich Alexander Erlangen-Nürnberg, Erlangen (conducător ştiinţific Prof. Dr. Wolfgang Haupt), cu reluări de câte 2-3 luni în 1990, 1992, 1993, 1995.

În calitate de fost bursier Humboldt a solicitat şi primit din partea Fundaţiei Humboldt pentru Institutul de Cercetări Biologice, diverse donaţii în aparatură (dozimetru pentru UV-B, UV-A, PAR cu software Windows 2000, aparatura de electroforeza pentru proteine şi acizi nucleici, termocycler Eppendorf, Termostat RUMED, accesorii microscop), care au stat efectiv la dispoziţia tuturor colegilor cercetători.

Activitatea didactică a început în anul 1995 cu predarea de cursuri la masterat (Noţiuni de citofotometrie, Introducere în fotobiologie), iar din 1997 devine cadru didactic asociat la linia didactică în limba de predare germană de la Departamentul de Ecologie şi Protecţia Mediului din cadrul Facultăţii de Biologie şi Geologie a Universităţii Babeş-Bolyai Cluj-Napoca. Din 1972 a condus numeroase teze de licenţă. De asemenea, a participat ca referent în comisii pentru susţinerea unor teze de doctorat la Universitatea Babeş-Bolyai Cluj-Napoca şi la Universitatea din Oradea.

Activitatea de cercetare a fost diseminată la foarte multe conferinţe naţionale şi internaţionale, fiind încununată cu peste 150 de articole publicate ca autor principal sau coautor, în reviste de prestigiu din ţară şi din străinătate. Importantă este şi apariţia monografiei: Wittemberger C., Keul, M., 1987, *Mecanismele mişcării în lumea vie – Mechanisms of Motility in the Living World*, Ed. Acad. Rom., 176 p.

Marcantă şi deosebit de importantă este şi activitatea întreprinsă de Dr. Martin Keul pentru traducerea (îndeosebi din română în germană) a zeci de manuscrise (articole, rezumate) semnate de cadre didactice şi colegi cercetători în vederea publicării şi/sau susţinerii la conferinţe sau manifestări ştiinţifice. Deşi rareori menţionată sau recunoscută ca atare de către autorii beneficiari, această activitate intelectuală de traducere a contribuit esenţial la perfecţionarea pregătirii generale în biologie a sărbătoritului.

Pentru toate cele amintite mai sus, pentru faptul că aţi fost un profesor exemplar dar şi pentru multe care nu sunt spuse aici, colegii de la Facultatea de Biologie şi Geologie împreună cu colegii de la Complexul Muzeal Bistriţa-Năsăud vă mulţumesc şi vă doresc multă sănătate şi bucurii.

La Mulţi Ani, dragul nostru profesor!

LAUDATIO – CSI. DR. GHEORGHE COLDEA, M.C. ACADEMIA ROMÂNĂ

Sorina FĂRCAȘ*, Marius HORGA**

Academicianul Dr. Gheorghe Coldea s-a născut la data de 16.01.1939 în localitatea Mănăstireni, jud. Cluj. A terminat liceul în Huedin, iar în 1963 a absolvit Facultatea de Biologie, Geografie, Geologie a Universității „Babeș-Bolyai" din Cluj, secția de Biologie, specializarea botanică, unde în 1972 și-a susținut, sub coordonarea prof. Al. Borza, **teza de doctorat cu titlul *Flora și vegetația Munților Plopiș*.**

Și-a început activitatea ca cercetător stagiar în Laboratorul de ecofiziologia plantelor din cadrul Stațiunii horti-viticole din Blaj, unde a activat în perioada 1963-1965. Din 1965 și-a desfășurat activitatea neîntrerupt în cadrul **Institutului de Cercetări Biologice din Cluj-Napoca,** fostul Centru de Cercetări Biologice, parcurgând toate etapele de încadrare (cercetător stagiar, CS, CP III, CPII, CSI). A fost numit ca director al institutului imediat după Revoluție, în 1990, funcție în care a activat o lungă perioadă, până în 2010. Abilitățile sale manageriale s-au concretizat în dezvoltarea institutului atât ca infrastructură, direcții noi de cercetare cât și ca resursă umană specializată.

În cadrul activității de cercetare dr. Coldea a efectuat **numeroase specializări**, la instituții de prestigiu din străinătate, consolidându-și și diversificându-și astfel expertiza științifică.

Dintre acestea enumerăm:

* Institute of Biological Research Cluj-Napoca, 48 Republicii Street, 400015, Cluj-Napoca, Romania, e-mail: sorina.farcas@icbcluj.ro

** Bistrița-Năsăud Museum Complex, 19 Gen. Gr. Bălan Street, Bistrița, e-mail: horgaro@yahoo.com

1. Curs de specializare fitosociologie, Univ. Viena, Institutul Geobotanic, Austria, 1978;
2. Grant DAAD pentru finalizarea monografiei Muntii Rodnei, studiu geobotanic (care a apărut în 1990), Univ. Gottingen, Germania, 1987;
3. Grant DAAD Univ. Gottingen, Institutul Geobotanic, Germania, 1990;
4. Grant DAAD Univ. Hanovra, Institutul Geobotanic, Germania, 1996;
5. Grant DAAD Univ. Gottingen, Institutul Geobotanic, 1996;

De-a lungul anilor dr. Coldea a abordat numeroase **direcții de cercetare**: **botanică sistematică și taxonomie** (a identificat trei specii noi pentru România – „*Ophrys sphegodes* Miller", „*Empetrum hermaphroditum* Hag.", „*Daphne laureola* L." și o specie nouă pentru Transilvania – „*Ophrys cornuta* Steven"); **fitosociologie** (a descris 38 de asociații noi specifice pentru Carpații românești și trei alianțe regionale: „Festuco saxatilis-Seslerion bielzii" Coldea 1984, „Veronici baumgarteni" Coldea 1990 și „Seslerio rigidae-Pinion" Coldea 1991); **bioproductivitatea ecosistemelor** (a inițiat primele cercetări de acest gen în România și a investigat jnepenișurile și molidișurile de limită din Munții Retezat și Munții Maramureșului); **conservare și protecția mediului** (a fost implicat în fundamentarea rețelei de situri Natura 2000 din România și validarea acestora, în elaborarea unor Planuri de management al ariilor protejate etc.); **palinologie cuaternară** (a întreprins studiul palinologic al mlaștinii de la Iaz, jud. Sălaj și a colaborat la explorarea mlaștinii subalpine Zănoguța din Munții Retezat la care s-a făcut pentru prima dată și datarea fazelor silvestre cu C14) și altele.

Datorită competențelor științifice și manageriale, dr. Coldea a fost implicat în **conducerea ca responsabil partener ICB Cluj a trei proiecte europene** de mare anvergură:

1. *The European dimension of the Global Observation Research Initiative in Alpine Environments - a contribution to GTOS - GLORIA-EUROPE*, proiect coordonat de Univ. Viena, în perioada 2001-2003, focusat pe studiul impactului climatic asupra comunităților de plante alpine;
2. *Tracking surrogates for intraspecific biodiversity: towards efficient selection strategies for the conservation of natural genetic resources using comparative mapping and modelling approaches* - INTRABIODIV, proiect coordonat de Univ. Joseph Fourier, Grenoble, în perioada 2004-2006, axat pe evaluarea diversității plantelor alpine-subalpine din Alpi și Carpați, și pe relația dintre diversitate și factorii climatici și ecologici;
3. *Challenges in assessing and forecasting biodiversity and ecosystem changes in Europe* – ECOCHANGE, proiect coordonat de aceeași universitate franceză în perioada 2007-2012, având ca subiect influența schimbărilor climatice asupra ecosistemelor naturale.

Parteneriatul în cadrul proiectelor europene, dar şi coordonarea a numeroase proiecte naţionale în domeniul biodiversităţii şi conservării s-au concretizat în numeroase publicaţii ştiinţifice internaţionale.

Astfel, **rezultatele cercetărilor** dr. Coldea se regăsesc în peste 135 de lucrări ştiinţifice (cărţi, capitole în cărţi colective, studii apărute în reviste de prestigiu din ţară şi din străinătate).

Enumerăm câteva dintre cărţile/ monografiile publicate:

- Coldea Gh., 1990. *Munţii Rodnei. Studiu geobotanic.* Ed. Acad. Rom., Bucureşti.
- Coldea Gh., 1991. *Prodrome des association végétales des Carpates du sud-est (Carpates Roumaines),* Documents Phytosociologiques, Nouv. Serie, Bd. 13, Camerino.
- Coldea, Gh., (Editeur) 1997, 2012, 2015. *Les associations végétales de Roumanie.* Tom I., II, III, Presses Universitaires de Cluj, Cluj-Napoca.
- Coldea, Gh., Cristea, V., 2022. *The vascular plant communities of the Retezat National Park (Southern Carpathians),* Springer Nature.
- Coldea, Gh., Fărcaş, S., Ciobanu, M., Hurdu, B., Ursu, T., 2008. *Diversitatea floristică şi fitocenotică a principalelor situri protejate din Parcul Natural Apuseni,* Ed. Presa Universitară Clujeană, Cluj-Napoca.
- Donita N., Ivan D., Coldea Gh., Sanda V., Popescu A., Chifu Th., Pauca-Comanescu M., Mititelu D. Boscaiu N., 1992. *Vegetaţia României.* Ed. Tehn. Agr., Bucureşti.
- Ivan D., Donita N., Coldea Gh., Sanda V., Popescu A., Chifu Th., Boscaiu N., Mititelu D., Pauca-Comanescu M., 1993. *Végétation potentielle de la Roumanie.* Braun-Blanquetia, 9, Camerino.
- Colectiv, coordonat de N. Doniţă, C. Chiriţă şi V. Stănescu, 1990. *Tipurile de ecosisteme forestiere din România.* Min. Ape. Păd. şi Mediu, CMDPA, Red. de Propag. tehn. agr., Bucureşti.
- Colectiv, coordonat de N. Doniţă, 1992. *The Vegetation of Romania*, Ed. Tehnica Agricola, Bucureşti.
- Colectiv, coordonat de L. Nagy et al., 2003. *The Alpine Flora and Vegetation of South-Eastern Carpathians.* In: Alpine Biodiversity in Europe, Berlin-Heidelberg.
- Colectiv, coordonat de Burga et al., 2004. *Die Süd-Ost Karpaten*, in: Gebirge der Erde. Landschaft. Klima. Pflanzenwelt. Ulmer Verlag, Stuttgart.
- Colectiv, coordonat de Jules Pavillard, 2019. *Elements de Sociologie Vegetale (Phytosociologie),* Hermann Ed., Paris.
- Colectiv, coordonat de Mirek Z., 2020. *High mountain vascular plants of the Carpathians. Atlas of distribution.* W. Szafer Institute of Botany, Polish Academy of Sciences, Cracow.

Activitatea prodigioasă și experiența vastă în aceste domenii de cercetare au fost încununate prin **publicații recente în reviste științifice prestigioase**, cum sunt *Nature Climate Change, Science, Global Change Biology, Ecology Letters* etc., referitoare în special la modificările diversității plantelor alpine și subalpine din Europa în raport cu schimbările climatice.

Merită menționată distincția primită de dr. Coldea în 1992, și anume **Premiul Academiei Române**, ***Grigore Antipa***. Mai mult, în 2006, o specie nou descrisă din Carpații Orientali, *Hieracium coldei* Szelag a fost numită în cinstea Domniei sale.

Pe lângă activitatea de coordonare proiecte de cercetare, dr. Coldea a contribuit la formarea unor generaţii de botanişti, fiind şi referent în comisii la numeroase teze de doctorat având ca subiect flora şi vegetaţia diferitelor regiuni din România.

De asemenea, a fost **expert consultant** la fundamentarea şi elaborarea publicaţiei CE "A classification of Palaearctic Habitats" (*O clasificare a habitatelor palaearctice*), 1996, dar şi expert în elaborarea metodologiei de cartare, şi cartarea la nivel naţional a pajiştilor din România (proiect PIN-MATRA), expert consultant la fundamentarea instituirii reţelei Natura 2000 în România (pentru habitatele umede), expert consultant UE la validarea ulterioară a siturilor Natura 2000 pentru România, expert în stabilirea IPA (Important Plant Areas) din România şi coautor în publicaţiile aferente, expert la fundamentarea şi coautor la elaborarea "Manualului de interpretare a habitatelor Natura 2000 din România" (Ed. Gafta şi Mountford, 2008).

Expertiza științifică în domeniul conservării și protecției naturii s-a concretizat și prin prezența în consiliile științifice ale unor arii protejate din România (presedintele Consiliului Stiintific al P.N. Muntii Rodnei, membru în C.S. al P.N. Munții Maramureşului), iar competenţele deosebite acumulate în domeniile de referință au dus la cooptarea ca membru în asociații profesionale prestigioase (International Association for Vegetation Science – IAVS, Reinhold-Tüxen Gesellschaft E. V. – Hannover, Amicale International de Phytosociologie – AIP, Societatea Fitosociologică Română – SFR, Societatea Naturaliştilor pentru Transilvania - SNT, Societatea Ecologică Română).

Şi, nu în ultimul rând, o încununare a activității deosebite desfăşurate de dr. Coldea și o recunoaștere a meritelor sale științifice a constituit-o alegerea Domniei sale în anul 2015 ca **Membru corespondent al Academiei Române.**

În numele comunității științifice de specialitate din țară și străinătate, pentru întreaga activitate complexă desfăşurată, vă dorim un călduros ***La mulți ani***, multă sănătate, putere de muncă și satisfacţii, precum și realizări remarcabile în continuare!

BIOLOGY

CHARACTERIZATION OF AROMATIC SPECIES IMPLICATED IN VARIOUS PHYTOTHERAPIES

Carla Andreea CULDA*, Rahela CARPA*

Abstract. This paper aims to present a brief biological description of the plant species *Cinnamomum verum, Syzygium aromaticum* and *Geum urbanum* as well as their action on diseases encountered in humans. The types of natural therapies applied to these plants and the various diseases treated will then be presented. The indicated remedies represent a support of the treatments and possible recommendations offered to the conventional medicine. At the same time, the precaution and contraindications regarding their use will be reviewed. These aromatic species were chosen due to their strong antimicrobial and antioxidant activity.

Key words: natural therapy, *Cinnamomum verum, Syzygium aromaticum, Geum urbanum.*

Biological description of some plant aromatic species

Spices improve aromas and are considered a special group due to gold compounds, dietary phytochemicals, identified in various researches with the ability to suppress the initiation of carcinogenesis, inflammatory processes, to defend against heart disease and other chronic diseases. This principle makes them an ideal natural source to be developed as an anticancer agent (Kumar et al., 2014).

***Cinnamomum verum* – cinnamon.** The original botanical name of *Cinnamomum verum* was *Cinnamomum zeylanicum,* popularly known as Sri-Lanka or Ceylon cinnamon. Cinnamon is the bark of is an aromatic tree (*Cinnamomum verum*), robust that belongs to the family Lauraceae and the genus *Cinnamomum* (Figure 1). It includes 250 species spread from East Asia to Australia and the Pacific Ocean archipelago (Hammid et al., 2016).

Cinnamomum verum has adapted to harsh soil and temperature conditions, and its height is 2-3m. The ideal high quality seeds are small, flat, uniform and yellowish in color. The bark (*Cortex Cinnamomi*) has a consistency in essential oils of 5% to 75%, including cinnamic aldehyde and cinnamon acetate, eugenol etc. The presence of volatile oils gives a fine and pleasant aroma; much appreciated by Europeans (Buturã, 1979; Sharif et al., 2018; Qais et al., 2019).

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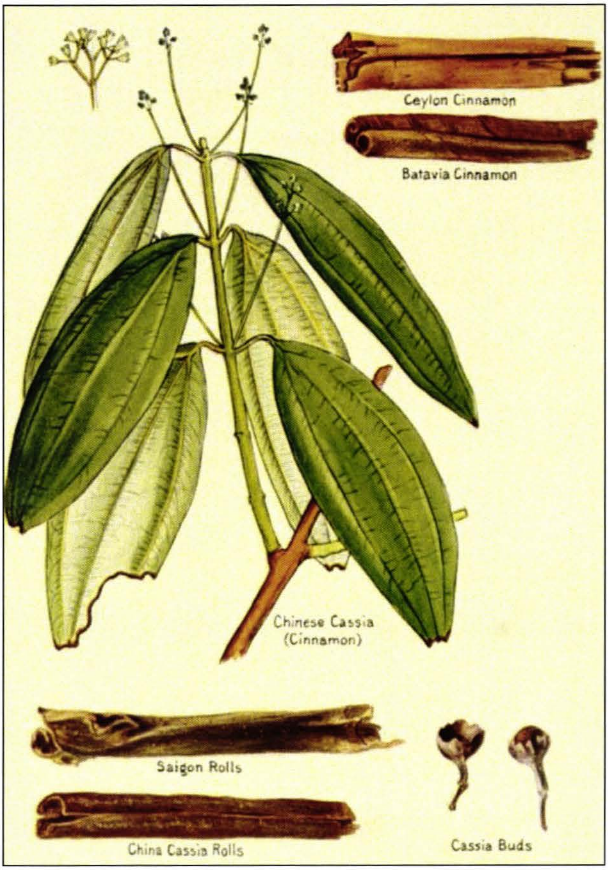

Fig. 1. *Cinnamomum verum*
(https://commons.wikimedia.org/wiki/File:Cinnamon-cassia.png)

***Syzygium aromaticum* – cloves.** Cloves are obtained from the dried flowering buds of an exotic tree (*Syzygium aromaticum*) which belongs to the Myrtaceae family, the subfamily Myrtoideae and the genus *Syzygium*, native to the Moluccas Islands of Indonesia. It is currently found in other tropical or equatorial regions, especially in Asia and Africa. The clove tree is evergreen and reaches heights of up to 8-12 m. It generally has an average height with a small base of the crown, and the branches are semi-erect and numerous. The bark of the tree is gray, the leaves are dark green, oval in shape and are very fragrant due to the presence on the underside of many glands with volatile oils. The flower buds initially have a pale color, and gradually turn green. The flowers are small, purple and grow in the shape of an umbel, the flower stalks having the same length, grouped 4-5 at the ends of the branches. The flower consists of a long calyx, consisting of 4 sepals, and 4 unopened petals that form a small ball in the center, the fruit (Figure 2). It is purple in color, about 2.5 cm long (Goni et al., 2016; Mbaveng and Kuete, 2017).

Fig. 2. *Syzygium aromaticum*
(https://www.google.com/search?q=Syzygium+aromaticum&source=lnms&tbm=isch &sa=X&ved=2ahUKEwiasO7Gn97qAhXI16QKHXu7C7MQ_AUoAXoECBkQAw& biw=1280&bih=842#imgrc=Exa-8bw2_xfvxM&imgdii=A15VVQxOwnuZPM)

***Geum urbanum* – wood avens.** *Geum urbanum* is a herbaceous plant that belongs to the Rosaceae family, the subfamily Rosoideae and the genus *Geum*, being native to the humid forests of Europe and Asia. It is known under several popular names, of which we only mention: wood avens, clove. Its preferred habitat is shady, growing in wet places, the edge of forests, waters, bushes, orchards (Piwowarski et al., 2014).

Geum urbanum is a perennial, erect herbaceous plant with hairs on the stem, the basal leaves are rosette-shaped, and the stem ones are short petiolate with 3-5 lobes. The flowers are long pedicellate, type 5, with 5 outer sepals and 5 inner sepals longer than the outer ones, green, free and 5 yellow petals, obovate, with numerous stamens and numerous carpels located on a convex receptacle, with long, terminal styles, articulated. The fruits are multiple, mummy-looking nuts (Figure 3). It has rhizomes and adventitious roots. Fresh rhizomes have a characteristic clove odor due to the presence of eugenol. It also contains tannins, volatile oils, geine (glycide geine), flavonoids (Butură, 1979; Dimitrova et al., 2017).

Fig. 3. *Geum urbanum*
(https://www.ballyrobertgardens.com/products/geum-urbanum)

Types of natural therapies

Aromatherapy: is based on the use of essential oils (volatile / essential) from various parts of plants (roots, stems, leaves, seeds and flowers), stimulating the balance and harmony of body, mind and spirit. The therapeutic properties of these oils come from the influence on hormones and other messenger chemicals, which are found in the body (Adăscăliței et al., 2004; Lee et al., 2012; Anina et al., 2018; Toda and Matsuse, 2020).

The use of essential oils dates back to antiquity, when the Egyptians created perfumes and medicines from them. Ancient knowledge has been preserved by Greek, Roman, and Arab physicians, whose works have influenced medicine for centuries.

Floral essences: obtained from the flowers of plants and trees. Their preparation is done in water, and storage is done in alcohol. Dr. Edward Bach, a bacteriologist and anthropologist from Wales, the first to create floral essences, believed that flowers have the ability to relieve mental stress, using intuition and experiments, he studied the therapeutic effects of a wide variety of flowers. It is believed that floral essences can have a beneficial influence on the mind and spirit and can also combat pessimism and intervene in regaining emotional balance (Adăscăliței et al., 2004; Llonch, 2005; Salles and Silva, 2014; Poinar and Poinar, 2018; Du et al., 2019).

Phytotherapy: is the oldest form of medicine, through which the use of herbal remedies were used in combating and curing diseases. . It is believed that phytotherapy appeared as a result of the use of plants in food and will be developed by acquiring knowledge from those who lived closer to nature, the aborigines, transmitting them later from generation to generation. Scientific progress through in vivo, in vitro analysis and clinical evaluation of therapeutic actions, has made it possible to isolate compounds and identify chemicals, which are secondary metabolites in plants, which have obvious therapeutic properties. Some plants contain active compounds extracted from the whole plant, and others contain only one or two compounds that have been isolated from the plant. Researchers claim that the natural balance of active ingredients in plants is more effective and less harmful than synthetic drugs with active ingredient unique, used in modern conventional medicine (Haraguchi et al., 1998; Adăscăliţei et al., 2004; Ferreira et al. 2015; Hedayat and Lapraz, 2019; Haraguchi et al., 2020).

Homeopathy as a treatment system is due to the German physician, chemist and linguist Samuel Hahnemann. Remedies are prepared using various sources (plants, minerals, even poisons), but being administered in extremely small amounts are gentle and risk-free. This may represent first-line therapy or may be used as adjunctive therapy (Adăscăliței et al., 2004; Ernst, 2011; Bergquist, 2018).

Homeopaths believe that if taken in high doses a substance can cause the symptoms of a disease, administered in small doses it has the ability to cure the same symptoms. This treatment can be applied without causing any harm to the patient (Ernst, 2011; Irnich, 2013).

Massage is one of the oldest natural therapies. It contributes to physical and emotional health and can, depending on the movements practiced, stimulate or relax the muscles, improve circulation and promote the healing of a wide variety of diseases. In combination with aromatherapy, essential oils or lotions penetrate the skin with the help of massage, offering a wide range of therapeutic benefits. In Chinese medicine, massage is part of traditional medicine, along with acupuncture (Adăscăliţei et al., 2004; Imamura et al., 2012).

Massage therapy has been shown to reduce anxiety levels; it is also considered to have a positive impact on quality of life and the immune system through stress mediation (Dahmer and Kligler, 2018).

Nature therapy is based on a wide range of natural treatments, among the most important are healthy eating, herbal remedies adapted to the patient's needs. This type of natural medicine emphasizes the importance of restoring and promoting the self-healing capacity of the human body (Adăscăliţei et al., 2004; Loo, 2009; Nair and Salwa, 2018).

Preparation and administration

a. ***Cinnamomum verum***

Cinnamon tea is consumed, preferably in combination with honey, lemon/orange peel. It is often consumed during viruses and colds. It has been found that tea stimulates digestion and helps metabolize fats, and is often used in diets. In order to regulate menstruation, drink cinnamon tea, prepared as follows: a teaspoon of grated powder is put in a cup of hot water, sweetened with honey and lemon can be added to taste.

Cinnamon essential oil has essential antimicrobial actions that act on antibiotic-resistant microorganisms. By using it, colds and flu are treated, consuming a drop of oil (with a little honey) three times a day.

Cold **maceration** is an effective preparation for soothing sore throats caused by dry cough. Affected people can consume a cup of water in which several cinnamon sticks have been left to infuse for 24 hours.

Cinnamon powder, is obtained by fine grinding of dried cinnamon sticks. In order to reduce bad cholesterol, consume half a teaspoon of ground cinnamon a day.

Macerate with honey and cinnamon, is a natural preparation with multiple uses. It is beneficial in rheumatism (arthritis and polyarthritis) and is a great immunostimulator. The preparation is obtained by mixing 50g of ground cinnamon with 100ml of honey. The mixture is left to dry for two weeks. In the morning, before breakfast, consume a tablespoon of maceration before main meals.

Cinnamon mask, is obtained by mixing 3 tablespoons of honey with a teaspoon of cinnamon powder and apply on acne, on the affected areas of the face. In approx. The results will be observed for above 2 weeks.

b. ***Syzygium aromaticum***

Over time, cloves have been a growing interest among other aromatic species due to its strong antimicrobial and antioxidant activity. The effective role of cloves in inhibiting various degenerative diseases is attributed to the presence of various chemical compounds in significant concentrations with antioxidant activity (Batiha et al., 2020).

Clove tea made by boiling dried cloves in water is used to cure nausea, aid digestion, cure stomach ailments and relieve pain.

The infusion of 4 g of dried shoots and flower buds to a liter of boiling water, from which one cup is consumed before main meals, with effects in stimulating digestion in the lazy stomach and increasing appetite, moderate diarrhea, bloating, flatulence, indigestion, gastritis, nausea and combating fermentation and bloating.

Clove tincture soaked in alcohol and cooking oil, has an action against leukemia.

Poultice is a medicinal paste, with emollient and revulsive action, which is applied in case of wounds, infected wounds, in combination with plant extracts (centella asiatica powder), essential oils, floral waters.

Boiled wine with cloves and cinnamon has effects in stimulating the secretion of the digestive glands and, implicitly, in appetite, as well as in treating colds, having antibacterial effects and relaxing the smooth muscles in the lungs.

c. *Geum urbanum*

Wood avens **baths**, used to cure hemorrhoids, skin diseases, treatment being possible due to the astringent properties of tannins.

Gargle, from the root of the wood avens is beneficial for healing inflammation of the gums and mucous membranes, performed 3-4 times a day, for 3-5 days in such situations. In infectious diseases of the pharynx it is recommended to extend the treatment up to 14 days. It also reduces irritation of the stomach and intestines.

The infusion or **decoction** is made from 1/2 powdered root or aromatic plant to 1 drop of boiling water, heated and taken cold. **The infusion** is used at the beginning of chills, for some skin conditions, removing blemishes, freckles or rashes on the face. **The decoction** of the whole plant is mixed with wheat flour and used as a poultice for frost. Furthermore, **the decoction** being rich in tannins and volatile oils is very effective in stopping bleeding, intervening in treating diseases of the respiratory system.

Tincture (1:5 plant extract in 70% ethyl alcohol, 20-30 drops in a glass of water, 2-3/day) beneficial for its astringent and antidiarrheal properties. It can be used for external ailments, being effective in combating dental pain. The tincture should be applied topically, on compresses.

Tea from the root/rhizome of *Geum* prepared by boiling about 5 min. You can consume three cups a day for therapeutic purposes. Tea can also be used as a mouthwash or gargle.

The powder obtained by grinding the rhizomes of the requirement is perhaps the most concentrated of the preparations. It is effective in relieving digestive and intestinal symptoms, has an important role in maintaining physical and mental tone.

Precautions and contraindications

a. *Cinnamomum verum*

Some people who are sensitive to cinnamon may be at increased risk of developing liver damage due to the content of coumarin, a substance that, when consumed in excess, can become toxic. Note that Ceylon cinnamon has a low concentration of coumarin.

Used externally, cinnamon oil can cause redness of the skin, irritation and burning sensation in the epidermis. Also in large quantities, cinnamon can cause sores on the lips and irritate the oral cavity, some people can even cause allergic reactions.

It requires great care for people who have treatments, as it may interact with medications such as antibiotics, diabetes medications and heart medications.

Cinnamon consumed in excess by people with gastritis or ulcers can lead to irritation of the gastric mucosa. In the case of liver disease and cancer (certain forms), the consumption of cinnamon is not recommended, and people with diabetes should take the action of cinnamon seriously, as it can reduce blood sugar levels. It is also not recommended to use cinnamon by pregnant women, as it can cause uterine contractions, but beware of breastfeeding women.

b. *Syzygium aromaticum*

Clove oil is very strong and can irritate the gums, it is recommended to be diluted before administration. Even easier dilution is required in infants. Use should be avoided during pregnancy because it causes contractions of the uterus and also people who have problems with blood clotting.

It should only be used diluted (max. 2%), it is not recommended to apply directly on the skin, especially in people with sensitive skin as it can cause irritation. Certain natural compounds in the composition of essential oils may present a risk of allergic reactions, especially in people with more sensitive skin.

As a general rule, it is recommended to perform a sensitivity test: apply a mixture of 2 drops of essential oil diluted in a teaspoon of vegetable oil in the elbow bag and wait 48 hours to detect any adverse reaction. It is also recommended to avoid contact with the eyes and mucous membranes.

When consumed in excess, cloves become irritating and corrosive, causing damage to the epidermis and internal mucous membranes.

c. *Geum urbanum*

The aromatic wood avens plant should only be used for therapeutic purposes. Due to its high tannin content and uncertainty about the toxic effect, it should not be used in excessive doses or for a long time. It is known that this plant affects the menstrual cycle and should also be avoided during pregnancy and increased attention to breastfeeding women.

Excessive consumption of cereal preparations can cause some mild intestinal problems, such as diarrhea and dysentery. They can also cause certain side effects that can be manifested by vomiting and nausea. Preparations of this species should not be used by people suffering from liver or kidney problems.

Do not use between meals, as it may cause gastrointestinal irritation.

Rezumat. Această lucrare își propune să prezinte o scurtă descriere biologică a speciilor de plante *Cinnamomum verum, Syzygium aromaticum* și *Geum urbanum* precum și modul de acțiune al acestora asupra unor boli întâlnite la om. Se vor prezenta

apoi tipurile de terapii naturiste aplicate acestor plante şi diversele afecţiuni tratate. Remediile indicate reprezintă un sprijin al tratamentelor şi posibile recomandări oferite medicinei convenţionale. Totodată se va trece în revistă şi precauţia şi contraindicaţiile privind utilizarea acestora. Aceste specii aromatice au fost alese datorită activităţii lor puternice antimicrobiene şi antioxidante.

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https://www.ballyrobertgardens.com/products/geum-urbanum

GENERAL CONSIDERATIONS ON THE IMPACT OF *REYNOUTRIA JAPONICA* INVASION IN THE ENVIRONMENT

Călin N. DEJEU*

Abstract. One of the most dangerous invasive species is *Reynoutria japonica*, a species with significant environmental impact in several countries. The most impacted are the riparian habitats. After decades of heterogeneous attempts to control this species, no efficient method was found. Further research is needed, and the answer might lie in biological control.

Key words: *Reynoutria japonica, Fallopia,* invasive, riparian, control.

Introduction

Species characterization and classification. *Reynoutria japonica* is listed by the World Conservation Union as one of the world's worst invasive species. It is a frequent colonizer of temperate riparian ecosystems, roadsides, and waste places (Lowe at al., 2000). The success of the species has been partially attributed to its tolerance of a very wide range of environmental conditions (Walls, 2010).

Reynoutria japonica (syn. *Fallopia japonica* and *Polygonum cuspidatum*), is a perennial herbaceous species in the knotweed and buckwheat family, Polygonaceae. *R. japonica* belongs to *Reynoutria* genus, Polygonaceae family, Caryophyllales order, Eudicots, Angiosperms, Tracheophytes clade, Plantae kingdom (*). It is a shrub up to 3 meters tall and forms leafy thickets.

Species origin and distribution. This species has its native range in Japan, China and Korea. In the rest of the Northern Hemisphere, at similar latitudes, the species has invaded several habitats, and is classified as an invasive species (Shaw, 2013). There are a few infestations even in Australia, in Victoria State.

Negative impact on the environment

Reynoutria japonica is, according to IUCN, in top 40 in the list of the most invasive species. Thus, it represents an extremely dangerous species for nature conservation, in the areas prone to its invasion. This species completely removes the native plant cover, nothing else is able to grow in the *Reynoutria japonica* brush.

Unfortunately, Romania is one of the countries severely impacted by the invasion of this species, not even the protected areas, not even the mountain areas being spared.

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Environmental conditions favorable to this species, cumulated with specific political-social factors, already form a kind of lethal cocktail for the most impacted habitats, the riparian habitats. Because in Romania are also present two additional factors that potentiate this invasion: the anachronistic, absolutely outdated waters management and endemic pollution of river banks.

The first factor manifests itself through river regulation projects, in total disagreement with the paradigm shift in the rest of Europe, where the harmful grey infrastructure projects are replaced by virtue of the principle:"space for rivers". All the disturbances of the river banks at the implementation of such projects are favoring the invasive species, mostly *Reynoutria japonica*. Anthropogenic disturbances are tightly associated with invasions in the riparian habitats (Meyer et al., 2021). It is even able to grow on the concrete reinforced banks (Fig. 1).

Fig. 1. *Reynoutria japonica* on the concrete reinforced bank from Western Jiu River (Aninoasa, Hunedoara County)

As regards the second potentiating factor, *Reynoutria japonica* is not only facilitated by disturbances, it is also a species with high tolerance to pollution. So, unlike other species, is spreads unhindered on the garbage littered banks of the rivers in Romania.

Reynoutria japonica has a devastating impact on the invaded surfaces. All the native plant species are removed and even the soil is impacted, via secondary metabolites (Abgrall et al., 2018). The species also increases the erosion of the river banks, in the cold season, when the aerial parts of *Reynoutria japonica* decompose and the soil, deprived of the native vegetation, becomes exposed (Hapca, 2013).

Control methods

Several methods (chemical, biological, mechanical, thermal) to remove this extremely invasive species were tested, with modest results so far. The mechanical means need a huge and sustained effort, since even rhizome segments only 2 centimeters long have a regeneration rate of 60%! (Sásik and Eliáš, 2006).

Hand pulling is a method which needs systematic relapse on very long periods of time (even years), so that the rhizomes are exhausted (Fig. 2).

Fig. 2. Hand pulling of *Reynoutria japonica*

Grazing of the targeted areas can help exhaust the plants, but the higher preference of herbivores for other plants is a hindering element. Goats in electric wiring enclosures can provide significant help.

Smothering it with tarps must be performed in spring, it is a feasible solution on gardens, but not on the rough terrain often found in the invaded areas of the river courses in protected areas, where control is mostly needed.

Thermal means are ineffective because the root system remains untouched, allowing rapid regeneration. Glyphosate-based herbicides have a moderate impact.

Attempts are being made to find biological control methods. The psyllid *Aphalara itadori* provided some results (Andersen and Elkinton, 2022). Fungal species such as *Mycosphaerella polygoni-cuspidati* show severe infectivity to *Reynoutria japonica* and show high potential for biological control of this species. Other studies show promising results for *Puccinia polygoni-amphibii var. Tovariae* (Kurose et al., 2012).

Conclusions

Being so difficult to remove *Reynoutria japonica*, an urgent need is for prevention. There are still many areas in Romania, even large areas, where the species did not invade yet. In Romania and other countries with natural condition prone for *Reynoutria japonica* invasion law provisions with harsh sanctions for planting this species are needed. First steps are made. For instance, in the UK one can be prosecuted if allows it to spread onto anyone else's property. *Reynoutria japonica* is prohibited in Michigan, it is illegal to sell, trade, move, plant, or share it.

Rezumat. Una dintre cele mai periculoase specii invazive este *Reynoutria japonica*, o specie cu un impact de mediu semnificativ în multe țări. Cele mai afectate sunt habitatele ripariene. După decenii de încercări heterogene pentru combaterea acestei specii, nu a fost găsită nicio metodă eficientă. Este nevoie de cercetări mai aprofundate, iar răspunsul s-ar putea să fie în combaterea biologică.

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HEPATIC RECOVERY FOLLOWING *SANGUISORBA OFFICINALIS* L. ADMINISTRATION IN CCl_4-INTOXICATED RATS

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Abstract. In this study we aimed to emphasize the protector potential of a 1:10 sorbestrea (*Sanguisorba officinalis* L.) hydro-alcoholic extract (in a dose of 1 ml/100 g b.w) on the liver recovery function after CCl_4 intoxication. The extract was administered for 12 days in white female Wistar rats, weighing 135 ± 15 g, alone, or at the same time with CCl_4 (0.02 ml CCl_4 + 0,5 ml oil/100 g b.w.) for 6 days starting with 5 days of *Sanguisorba* treatment. In the 13^{th} day, animals were killed by decapitation after a previous anesthesia with ether and blood and liver were collected for biochemical, histological and histoenzimological analysis. In the liver, the CCl_4 intoxicated group shows moderate lesions such as clear dystrophy, necrosis, steatosis and some areas of tissue destruction accompanied by a reduction in enzyme activity. The group treated with *S. officinalis* extract does not show morphofunctional lesions. The group intoxicated with CCl_4 and treated with plant extract shows a reduction or diminution of the changes induced by CCl_4. The favorable action of the of *S. officinalis* vegetable extract is caused by the presence of polyphenols with antioxidant action. *S. officinalis* extract, administered alone, does not produce pathological changes in the liver, and administered together with the toxic CCl_4 shows some favorable effects. In conclusion, the results of our experiment suggest that the *S. officinalis* extract in the conditions of subacute intoxication with CCl_4 induces positive modulatory effects on the dynamics of the functional and morphological analyzed parameters.
Key words: CCl_4 intoxication, *Sanguisorba officinalis* extract, liver, rats.

Introduction

Many natural products confer health benefits against various diseases due to their antioxidant activities. The *Sanguisorba* genus (family: Rosaceae) comprises nearly 148 species, widely distributed in the temperate and subtropical regions of the northern hemisphere. It is an Eurasian species, spread from the Atlantic Ocean coast and from France to South China. In Northern Europe it is absent or rare (Zhou et al., 2021).

At least two species are known in the Romania flora: *Sanguisorba officinalis* (sorbestrea) and *Sanguisorba minor*.

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Ecology – sorbestrea is a typical species of wet and swampy meadows from the hilly to the subalpine floor. Tolerates dryness, heat and frost. The leaves contain a lot of vitamin C, sometimes used in salads, having a cucumber taste. In Germany it is used together with other herbs (parsley, chives, watercress, lamb's tongue etc.) in the preparation of green sauce (Grűne Soce) (Bączek, 2015, Zhu et al., 2019).

Composition: Sorbestrea includes mainly saponins, tannins, flavones, vit. C (derived from cuparins and saponins), mineral salts etc., quinone, steroid triterpenoids, bitter principles, essential oil, catechins. Tannins and flavones are part of the category of polyphenols.

Medicinal use: preparations from both the root and the herbaceous part are used. Due to the composition shown above, the plant has some qualities: anti-inflammatory (Su et al., 2018, Guo et al., 2019, Yasueda et al., 2020), anticancer (Liu et al., 2016, Nam et al., 2017, Tan et al., 2019, Bai et al., 2020, Liao et al., 2020), anti-lipid peroxidation (Zhang et al., 2012a, Romojaro et al., 2013, Kim et al., 2018, Lenzi et al., 2019), anti-bacterial (Su et al., 2019, Zhu et al., 2020), antidiabetes (Kuang et al., 2011, Son et al., 2015), hepatoprotective (Stojiljković et al., 2019, Meng et al., 2020), and anti-obesity (Jung et al., 2016, Ji et al., 2018) properties, both *in vitro* and *in vivo*. *Sanguisorba officinalis* L. has long been used in China as a hemostatic drog and to treat scalding (Zhou et al., 2021). It is widely used in Asia for the treatment of inflammatory and metabolic diseases, including diarrhea, chronic intestinal infections, duodenal ulcers, bleeding, and diabetes (Zhang et al., 2012b; Seo et al., 2016; Zhang et al., 2018).

CCl_4 is a xenobiotic well known for its toxic, hepatotropic effects caused by its highly reactive free radicals, especially CCl_3^-. Carbon tetrachloride (CCl_4) is often used in animal experiments to study the effects of substances on liver damage and related mechanisms of action (Ahn et al., 2014, Peng et al., 2016, Slater et al., 1985), among which oxidative stress is a major pathogenic factor.

Accidental poisoning with CCl_4, as well as numerous experimental studies, have primarily highlighted the serious damage of the liver and other important organs in the case of acute exposures, and in chronic exposures can ocur, steatosis, fibrosis, cirrhosis, liver cancer and serious nephrotoxicity (Weber et al., 2003). CCl_4 intoxicates hepatocytes (and not only) *in vivo* and *in vitro* during a cascade of changes that includes, chronologically (Brenet and Rumack, 1993): lipoperoxidation; inhibition of protein synthesis; inactivating or reducing the activity of some enzymes (oxido-reductive and hydrolytic); imbalance of normal Ca^{2+} homeostasis; increasing cell permeability by damaging the cell membrane; cell necrosis and cell apoptosis.

Through their antioxidant activities, many natural products have been shown to exert protective effects against various diseases related to oxidative stress, such as cardiovascular disease, cancer, and liver disease (Meng et al., 2018, Cao et al., 2019, Tang et al., 2017). There have been identified substances with antioxidant effects, which can neutralize or limit the harmful effects of some free radicals.

Polyphenols also belong to this category. The action mechanisms of polyphenols are complex and rather little known.

The most remarkable aspects refer to the antioxidant activity, which involves reducing the production of free radicals and lipid peroxidation processes, especially at the cell membranes level, which provides protection to the entire cell.

Another mechanism of polyphenols action is blocking the toxins and free radicals through competitive inhibition for some receptors in the cell membrane. Medicinal plants and other plants, which contain many polyphenols, constitute a sought-after category of plants due to their possible uses in phytotherapy.

Thus, the aim of our research was to testing the effects of the the *Sanguisorba officinalis* L. bioproduct, rich in gallic acid and catechins, on the liver recovery in CCl_4 intoxicated rats.

Material and Methods

The experiment was carried out in the form of a unique experiment lasting 12 days, as follows: in the first 4 days only *Sanguisorba* extract was administered, then for 6 days CCl_4 + *Sanguisorba* extract was administered. After that for 2 days was administered only *Sanguisorba* extract.

Experimental animals:

We used white Wistar rats, adult females, weighing 135 g ± 15 g, raised in appropriate animal hygiene conditions, fed with pellets and water *ad libitum*, lighting regime of 12 hours.

The plant extract: consisted of a hydroalcoholic solution of *Sanguisorba officinalis* in a ratio of 1:10. The doses were prepared from the stock solution, and was administered by gavage, with a suitable probe.

Experimental groups:

1. control group (C).
2. the CCl_4 intoxicated group (CCl_4), in a dose of 0.02 ml CCl_4 + 0.5 ml oil/100 grams b.w.
3. the *Sanguisorba* extract treated group (S), in which each rat received 1 ml extract/100 g b.w.
4. the group intoxicated with CCl_4 and treated with *Sanguisorba* extract ($SCCl_4$), under the same conditions as above.

In the 13^{th} day, animals were sacrificed by decapitation after deep narcosis with diethyl ether according to our previously studies (Roman and Puica, 2013; Roman et al., 2015). The liver was removed and then processed according to analyzed morphological evaluation and blood was collected for serum biochemical analysis. Blood samples were immediately centrifuged, serum harvested and then put in sample vials. It was measured transaminases (Biomaxima Lublin, Poland, reading with EVOLUTION 2000 Semi-automatic biochemistry analyzer).

Biochemical data were statistically processed by means of Student's „t" test. Aberrant values were eliminated by means of Chauvenet's criterion. A probability value of $p \leq 0.05$ was considered significant.

Histopathological investigations

The liver was removed and weighed. Fragments of tissues were fixed in Bouin solution for 24 hours; the parts being processed for inclusion in paraffin. The fragment was sectioned at the Reichert - Austria type microtome with a thickness of 7 µm. Fragments were stained with haematoxilin-eosin method for histological structure of liver (Muresan *et al.*, 1974). For the histoenzymological and histochemical study, the liver fragments were frozen and cut at 7 µ with the Shandon S.A. cryotm. We determined lactate dehydrogenase (LDH) on these sections, with usual methods (Mureşan et al., 1974). For histochemistry, black Sudan staining was used for lipids. The histological examination of the slides was performed with a microscope Olympus BX-51 and the images were captured with a coolsnap-Pro CF color CCD camera (Roper Scientific Photometric, Tucson, USA) using the Image-proplus 4.1 - 4.5 data acquisition software (Media Cybernetics Inc., Bethesda, USA).

Results

Level of serum transaminases ALT and AST

- The ALT level: in the CCl_4 group it increases by 29.82%, in the S group by 30.03%, and in the $SCCl_4$ group by 0.67% compared to the control values.

- AST level: in CCl_4 group it increases by 7.14%, in group S it increases by 7.38%, and in group $SCCl_4$ it decreases by 3.38% compared to the control values. The values are not statistically significant.

Biochemical results are shown in Fig. 1.

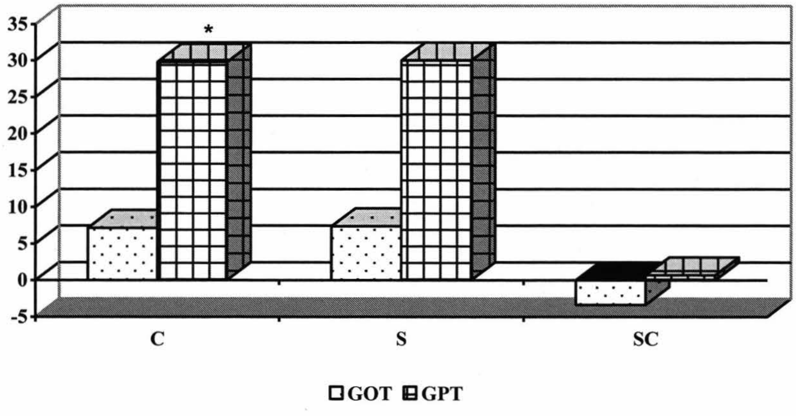

Fig. 1. Level of serum transaminases (ALT and AST) concentration in rats treated with *Sanguisorba officinalis* extract and intoxicated with CCl_4

Histological results in liver

Staining with hematoxylin-eosin:

In groups C and S can be observed cords of liver cells with cytoplasm colored in red and the nuclei in blue-black. Group CCl_4 presents a liver damage with multiple elements such as: numerous necrosis, centro-lobular hepatic steatosis, etc. Looking at the images observed in CCl_4 group, it can be concluded that they are moderate.

The SC group shows less damages compared to the CCl_4 group, although they are composed of the same elements. Thus, the areas of the destroyed liver parenchyma are less extensive, and the severity of the injuries is reduced. No liver damage is observed in group S, being similar to group C. (Fig. 2 a, b, c, d). All these lesions shown above express the toxicity of the free radical CCl_3^- for the liver, through lipid peroxidation followed by other harmful extra and intra cellular actions, which can be seen in the disturbance of the liver architecture (Rusu et al., 2007), as well as in reducing the activity of the studied cytoplasmic (LDH) enzymes (Fig. 3 a, b, c, d).

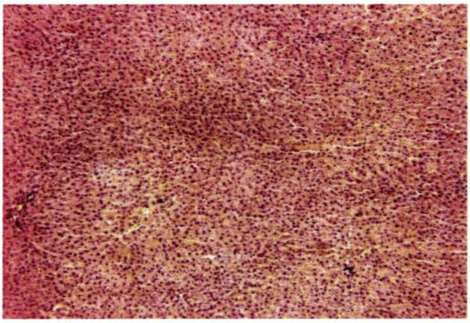

Fig. 2a - Liver. Group C, HE, 10x

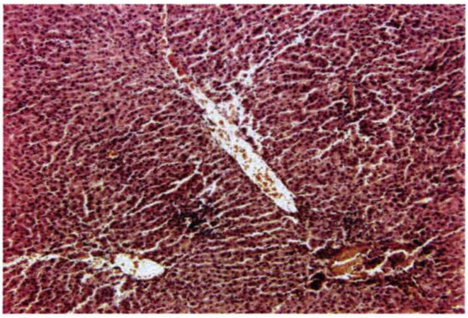

Fig. 2b - Liver. Group CCl_4, HE, 10x

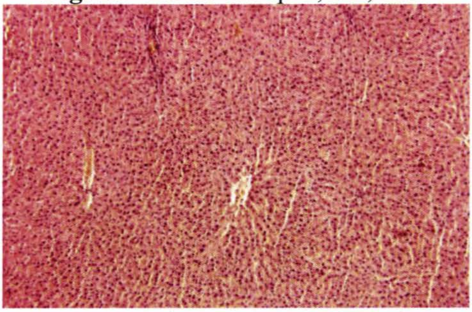

Fig. 2c – Liver. Group S, HE, 10x

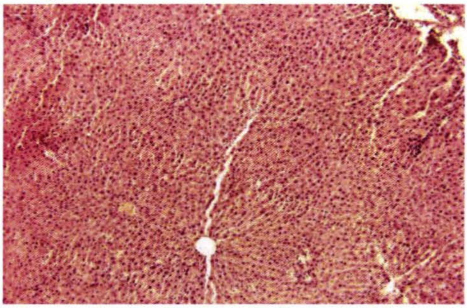

Fig. 2d - Liver. Group $SCCl_4$, HE, 10x

Histoenzymological - histochemical results in liver

Lactate dehydrogenase (LDH): is a cytoplasmic enzyme, non-specific marker for tissue damage, used as a diagnostic for liver damage. It is highlighted by a bluish coloration, distributed zonally, more intense periportally or in the first acinar zone. In experimental groups C and S, the enzymatic activity is similar. This decreases in the group intoxicated with CCl_4, and in the $SCCl_4$ group it approaches to the C group. (Fig. 3a, b, c, d)

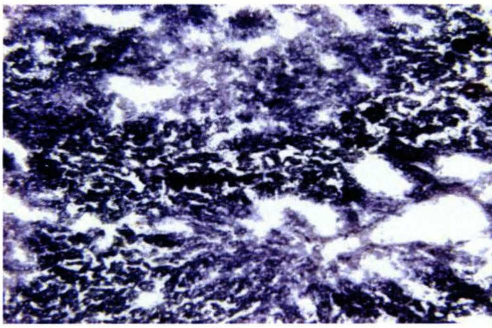

Fig. 3a - Liver. LDH, Group C, 10x

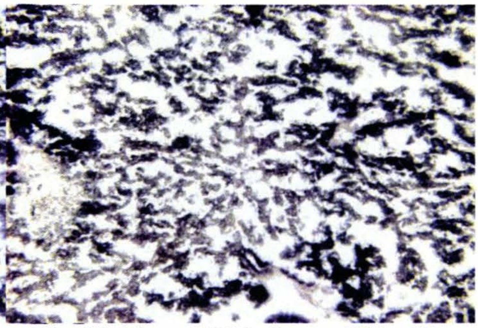

Fig. 3b Liver. LDH, Group CCl_4, 10x

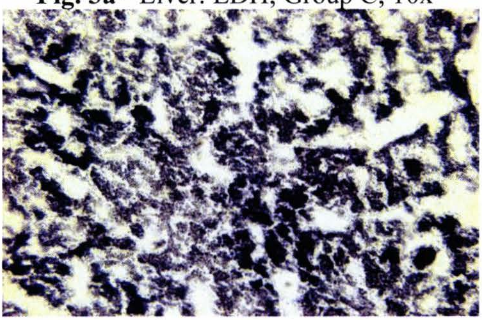

Fig. 3c - Liver. LDH, Group S, 10x

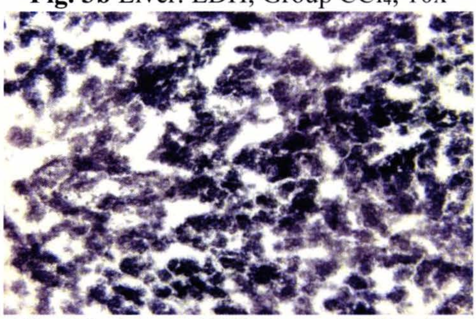

Fig. 3d - Liver. LDH, Group $SCCl_4$, 10x

Black Sudan stain for lipids.

The black Sudan reaction shows the agglomerated blue-black lipid granules in the liver cells. In groups C and S, the amount of lipids is reduced. In group CCl_4, the amount of lipids in the hepatic cords increases, observing a true steatosis. In the $SCCl_4$ group, the amount of lipids is lower compared to the CCl_4 group (Fig. 4a, b, c, d).

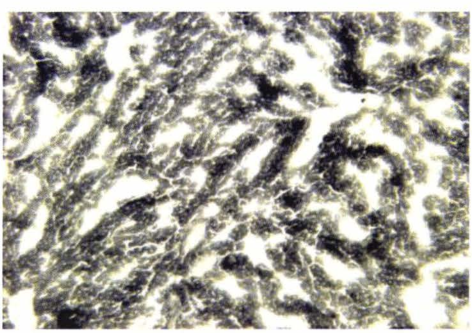

Fig. 4a – Lipid. Liver, Group C, 10x

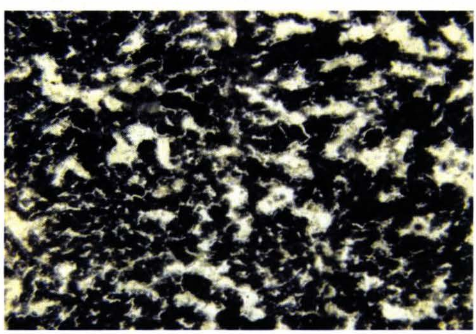

Fig. 4b - Lipid. Liver, Group CCl_4, 10x

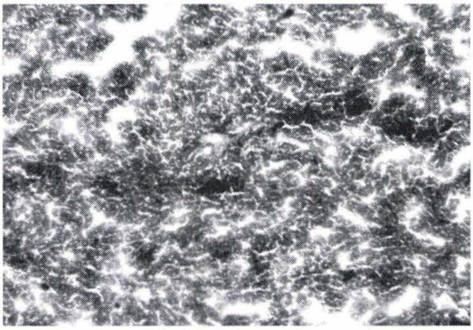

Fig. 4c – Lipid. Liver, Group S, 10x

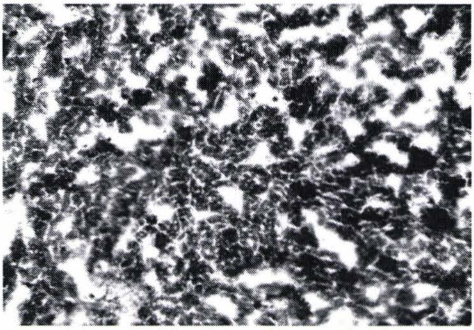

Fig. 4d – Lipid. Liver, Group $SCCl_4$, 10x

Discussions

AST and ALT are predominantly distributed in liver cells. When the liver is affected, they enter the blood. Clinically, serum elevations of AST and ALT can be considered indicators of liver disease, although ALT is more specific than AST (Wu et al., 2015). From the analysis of the results, typical changes of steatosis and necrosis are observed in group C. Areas with more or less extensive cellular damage also appear. We note the reduction of the activity of some investigated anaerobic and aerobic redox enzymes. Serum transaminases show no significant changes.

We emphasize that the liver is the most affected organ. Our results confirm the data from the literature (Rusu et al., 2005; Rusu et al., 2007; Qureshi, 2007; Raja et al., 2007; Jadon et al., 2007).

The prevalence of free radicals, such as reactive oxygen species and reactive nitrogen species, at a desirable level can contribute to cell growth and their differentiation (Druge, 2002). However, the overproduction of free radicals is destructive, leading to oxidative stress and contributing to various diseases such as cardiovascular, cancer, diabetes, obesity, neurodegenerative disorders and liver diseases (Lichtenberg and Pinchuk, 2015, Meng et al., 2018, Ke et al., 2019, Li et al., 2019).

During CCl_4 metabolism in the liver, hepatotoxic metabolites and excessive free radicals are generated, such as trichloromethyl radical ($\cdot CCl_3$) and trichloromethylperoxy radical ($\cdot OOCCl_3$), accompanied by other free radicals (eg, O_2^- and H_2O_2). Thus, reductants (eg, glutathione, GSH) are depleted and antioxidant enzymes (eg, superoxide dismutase (SOD) and catalase (CAT)) are inhibited, inducing oxidative stress (Slater et al., 1985). Meanwhile, toxic metabolites and free radicals bind to phospholipid molecules embedded in the membranes of mitochondria, endoplasmic reticulum, and hepatocytes, which can lead to lipid peroxidation and dysfunction or membrane damage to cell death. Therefore, oxidative stress is a major pathogenic factor for CCl_4-induced liver injury. Group S that received the plant extract does not differ in analyzed parameters from the control group, which shows that the extract of *S. officinalis* under the conditions of our experiment is not harmful for the liver. Regarding the $SCCl_4$ group that was intoxicated with CCl_4 and treated preventively and then curatively with the extract of *S officinalis*, we noticed in comparison with group CCl_4 an improvement of the main parameters, which approaches the level of the control group.

Briefly, CCl_4 is metabolized in the liver by cytochrome P_{450} enzymes, biotransformed into CCl_3^- radical and then oxygenated $-OOCCl_3$. Both of these radicals are highly reactive and can induce reductant depletion, inhibit antioxidant enzymes, induce lipid peroxidation, hypomethylate proteins and can move nucleic acids, leading to oxidative stress, inflammation, apoptosis and necrosis (Scholten, 2015).

We believe that the rich content of polyphenols (tannins, flavones, catechins) of the extract could exert an antioxidant effect that more or less blocked the action of the CCl_3-free radical. Thus, the complex of factors that favored the protection of liver and kidney tissues in particular, but also of the other investigated organs, was able to manifest itself.

Conclusion

The *Sanguisorba officinalis* extract, under the our experiment conditions, does not exert harmful, damaging actions on the liver morphology and function. On the contrary, it has a moderately favorable influence on the evolution of CCl_4 intoxication.

Rezumat. În acest studiu ne-am propus să evidențiem potențialul protector al unui extract hidroalcoolic 1:10 de sorbestrea (*Sanguisorba officinalis* L.) în doză de 1 ml/100 g greutate corp. asupra refacerii funcției hepatice după intoxicare cu CCl_4. Extractul a fost administrat timp de 12 zile la Șobolani albi Wistar female în greutate de 135 ± 15 g singur sau în același timp cu CCl_4 (0.02 ml CCl_4 + 0,5 ml ulei/100 g greut. corp.) timp de 6 zile începând cu a 5-a zi de tratament cu *Sanguisorba*. În a 13-a zi animalele au fost omorâte prin decapitare, după o prealabilă anestezie cu eter, iar sângele și ficatul au fost colectate pentru determinări biochimice, histologice și histo-enzimologice. În ficat, lotul intoxicat cu CCl_4 prezintă leziuni moderate, cum ar fi distrofii clare, necroze, steatoze și unele zone de distrucție tisulară cu o reducere în activitatea enzimatică. Lotul tratat cu extract de *S. officinalis* nu prezintă leziuni morfofuncționale. Lotul intoxicat cu CCl_4 și tratat cu extractul vegetal prezintă o reducere sau diminuare a modificărilor induse de CCl_4. Acțiunea favorabilă a extractului vegetal de *S. officinalis* este determinat de prezența polifenolilor cu acțiune antioxidantă. Extractul de *S. officinalis* administrat singur nu produce modificări patologice în ficat, iar administrat împreună cu CCl_4 prezintă unele efecte favorabile. În concluzie, rezultatele experimentului nostru sugerează că extractul de *S. officinalis,* în condițiile intoxicației subacute cu CCl_4 induce efecte modulatoare pozitive asupra dinamicii parametrilor funcționali și morfologici analizați.

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THE IMPORTANCE OF VITAMIN A IN COSMETIC PRODUCTS

Anghel Tudor CIOLOCA*, Rahela CARPA*

Abstract. The human body requires the essential vitamin A, a fat-soluble compound which is usually stored in the liver. Vitamin A in fact comprises several compounds able to perform the biological activity of retinol (vitamin A), such as retinoic acid and retinal. Vitamin A is found in animal-based as well as plant-based foods, plus fortified food products and several supplements.

Specifically, this paper discusses vitamin A, its general information, dietary recommendations, biological roles, its status assessment, as well as the effects of deficiency or even excess on human health and also the prevention measures.

Key words: vitamin A, retinoic acid, retinal, cosmetic products.

Introduction

Vitamin A, also known as retinol – this being its main form in nature – is a very important vitamin for physiological development, the visual sense, epithelial cell differentiation, and also reproduction. Retinol is often used in different cosmetic products; however, this compound must have a 1% concentration (Ries and Hess, 1999; Stewart, 2006).

According to IUPAC (International Union of Pure and Applied Chemistry) and IUBMB (International Union of Biochemistry and Molecular Biology), „retinoids" are compounds comprising 4 isoprene units, with a "head to tail" structure. The term "retinoid" compounds refers in fact to those natural or synthetic substances which are analogous to vitamin A (Fig. 1). Thus, retinoids are a class of compounds derived from vitamin A or having structural and/or functional similarities with vitamin A. They are classified into three generations based on their molecular structures: retinol, retinal and retinoic acid. (Khalil et al., 2017). Retinol is a primary alcohol and represents the most active form and thus the most used form of vitamin A. Retinal represents its aldehyde form. Retinoic acid regulates the genes by nuclear receptors and is needed for maintenance of epithelial tissue. This acid or its derivatives are used in the cure of several skin conditions, mainly acne and psoriasis. The mild cases of acne and the skin aging are treated by topical application of tretinoin, also called all-trans retinoic acid. In case of severe acne a form of vitamin A called isotretinoin is used, as capsules taken orally.

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Retinoids have a wide applicability in different cosmetic products, these compounds being considered dermatological agents for treating acne, psoriasis and other skin conditions as well (Zasada and Budzisz, 2019).

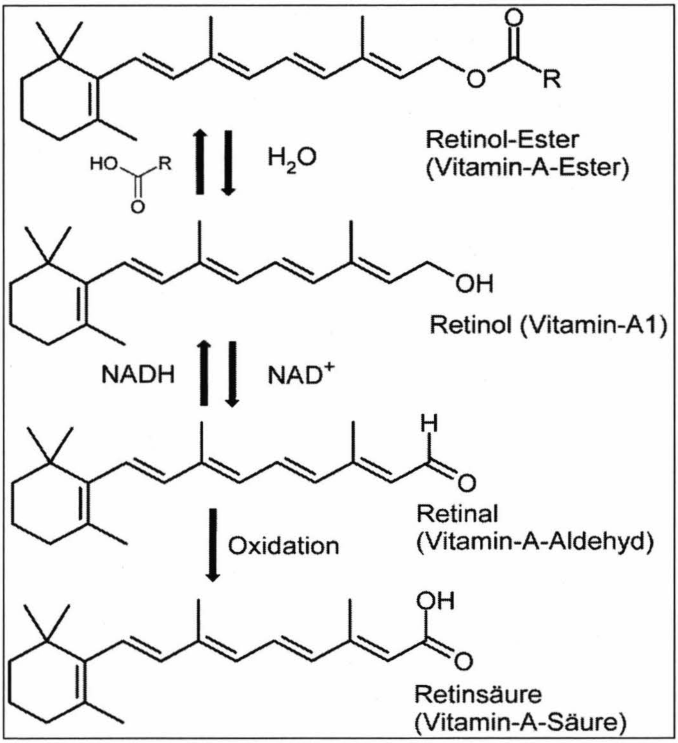

Fig. 1. Chemical formulas of different retinoic compounds

Vitamin A is a liposoluble (soluble in fats) naturally occurring compound, found in many foods: preformed vitamin A, category including retinol, retinal and retinoic acid, which are ingested from animal sources – dairy products, fish, meat, etc.; and provitamin A or carotenoids (α-carotene, β-carotene, β-cryptoxanthin), these being converted to active forms in the human body, being able to be ingested form fruits and vegetables. Usually, in different supplements, both foods and cosmetic products, are found the following: retinol acetate, retinol palmitate (preformed vitamin A), β-carotene (provitamin A) or a combination of these (Orfanos et al., 1997).

1. Vitamin A sources

The natural sources of retinol, as mentioned above, include esters of fatty acids with a long chain of carbon and carotenoids, mainly β-carotene. Some of these are hydrolyzed at intestine level and then absorbed (retinyl esters); while others are split in the intestinal mucosa, where will be transformed into retinal or retinaldehyde which will further be converted by an enzyme to retinol (Tozer et al., 2019).

We mention these notions because, decades ago, in order to cure different skin conditions, and in some therapies, the oral administration of vitamin A as retinol and its precursors was applied. But there was the possibility to cause symptoms similar to those of overdose, often this effect was present at long term therapies.

Vitamin A includes a group of compounds that affect vision, bone growth, reproduction, cell division, immunity, and healthy surface linings of the respiratory tract and mucous membranes. There are two categories of vitamin A, depending on whether the food source is animal or plant. Vitamin A found in animal foods is called preformed vitamin A and is absorbed as retinol. Sources include liver, whole milk, and some fortified food products. In the body retinol can be made into retinal and retinoic acid (other active forms of vitamin A).

Food sources of vitamin A consist in:

- Green, yellow and orange fruits and vegetables (broccoli, melon, potatoes, carrots, tomatoes, spinach) (Fig. 2) – for β-carotene or provitamin A (Huang et al., 2009).

Fig. 2. Plant food sources of vitamin A
(https://www.citizensbee.com/food/nutritional-facts-on-vitamin-a-and-carotenoids/)

- Meat products, dairy products and other products rich in vitamin A: fish, liver (in high concentrations, especially in fish), milk, yogurt, cheese, egg yolk – for retinol (Fig. 3).

Fig. 3. Food sources of vitamin A
(https://www.citizensbee.com/food/nutritional-facts-on-vitamin-a-and-carotenoids/)

2. The role of vitamin A in the body

Numerous physiological functions require vitamin A, including preserving the health and functionality of all epithelial surface tissues, as: the skin, the lining of upper and lower respiratory tract, the intestines, the bladder, the eye and the inner ear. Vitamin A contributes in the continuous regeneration of the skin cells and ensures in tissues such as the conjunctiva the mucous output which acts as barrier against infections. Additionally necessary for vision in low-light circumstance, it is involved in the maintenance of the immune system, as well as for growth, development and reproduction (Gilbert, 2013).

Retinol or preformed vitamin A, besides the most pregnant need, for crepuscular vision, is needed for a good vision in general and, besides vision, involved further in cell growth and differentiation, in bone growth, the reproductive process, and embryo development, in syntheses of several glycoproteins, cancer and cardiovascular diseases prevention. Along with other products vitamin A also increases immunity and can decrease the risk of infection with different pathogens.

Vitamin A also has an antioxidant effect, it has the role to regulate the cholesterol level, thus helping the fats storage. At the same time, it protects the oral and digestive mucosa, as well as protecting the respiratory system.

3. The use of vitamin A in different cosmetic products

Vitamin A has an important role in sustaining the good health of dermis, thus retinol is often used in different cosmetic products.

Vitamin A was one of the first vitamins used in cosmetic industry, as early as 1937, and it is now used in many products. In 1937 the first skin cream with vitamin A was placed on the market. It was called Pond's Cold Cream, and thus the use of vitamins in cosmetic products gained momentum in the following years, maintaining itself in the cosmetics market even today.

Vitamin A stimulates the production of elastin and collagen, fact that causes wrinkles and fine lines to fade and improves the blood circulation at skin level. Vitamin A also reduces the accumulation of melanin granules, reduces sebum secretion and repairs the cellular structure of the epidermis, thus optimizing protection against UV rays, cures acne and reduces hyperpigmentation. This is why vitamin A is used in cosmetic products as sun protection lotions, creams against acne and against wrinkles (Sofen et al., 2016).

- Another role of vitamin A on skin is as stimulating agent of the production and synthesis of collagen; thus, retinol is used in different anti-aging products as well as products for protection against long sun exposure, involving especially UV and infrared radiation (Kowalska et al., 2021).

- Vitamin A applied on skin helps invigorate the connective tissues, making them firmer. People with acne will notice an improvement in their condition due to vitamin A. They will notice a relief of sebum secretion and implicitly a reduction of acneiform eruptions.

- Skin also benefits from local use of vitamin A, in the composition of biocosmetics. This use prevents clogged pores (main cause of acne), stimulating the removal of dead cells from the skin surface. Retinol also helps preventing wrinkles and premature skin aging (Kong et al., 2016).

- Different cosmetic products often contain retinol or preformed vitamin A or different compounds of retinol (for example, retinoic acid), in concentration of 1%. The action of vitamin A on the skin is to control the level of sebum that is produced, but it also has an anti-inflammatory effect. This, combined with the action of other vitamins, as vitamin E or C, can help heal acne scars (Fig. 4) (McDaniel et al., 2017).

- Creams enriched with vitamin A are able to render the skin a normal glow and brightness. Retinol is also compatible in most cases with all the skin types; yet many specialists and dermatologists recommend the use of cosmetic products containing vitamin A or pharmaceutical supplements for mature and dry skin, but it is also indicated for people with mixed and oily skin, with acne tendencies (Araviiskaia and Dréno, 2016).

- Local use of vitamin A can be very beneficial for skin care and for the prevention of its aging. Vitamin A, as retinol, can be directly applied on skin to reduce wrinkles, fine lines and also acne. Products with a high retinol content can be prescribed at a consultation at dermatologist. The researches proved that treatment with vitamin A leads to hindering of the signs of skin aging. This vitamin, Vitamin A, especially in the form of retinol, increases the production of some components specific to skin, procollagen and glycosaminoglycan. These components help retain water in the tissues, fact that gives a healthy and radiant appearance to the skin and help the formation of new cells (Tran et al., 2014).

- Vitamin A has an anti-aging influence. Retinol is the form of vitamin A best used by the organism. Retinol primarily plays the role of antioxidant so it helps reducing wrinkles, being thus included as an important component of anti-wrinkle creams. As a strong antioxidant, it is involved in removing free radicals and cell catabolites (Sathasivam and Kit, 2018).

Fig. 4. Effect of a cream containing Vitamin A on acneous skin (Tretinoin cream) (https://shopee.com.my/vitamin-a-acid-cream-0.025-vitamin-a-acid-cream-retinol-20g-for-acne-pimple-i.95941290.7613841252)

- By inhibiting the production of DNA in the cancer cells, vitamin A is also helpful in the fight against cancer. It slows the growth of tumors in the already activated cancers and impedes division of leukemic cells. Vitamin A taken orally and applied locally apparently has promising prevention and even healing properties for skin cancers. (Kim et al., 2021).

- This vitamin has also an important role in reducing stretch marks on the skin. People who face this problem can use this vitamin due to the fact that it helps soften the skin and cell regeneration (Ud-Din et al., 2016). When cell regeneration is stimulated, new and healthy cells will take the place of those in the tissue showing stretch marks, so that their appearance and severity will be reduced. In some cases this type of scars even disappeared. (Hague and Bayat, 2017).

- The treatment of eczema and psoriasis benefits of vitamin A. In many cases, treatment with vitamin A is recommended as a natural alternative in trying to cure these conditions. Vitamin A is very effective in treating psoriasis, especially in the form of retinol. Retinol helps to normalize the function of cell growth and implicitly to treat psoriasis. Psoriasis is a skin condition manifested by the reproduction of cells at a faster rate than normal, leading to the appearance of clumps of cells, as horny layers of skin, with the appearance of scales, overlapping and red (Mukherjee et al., 2006).

- Vitamin A also stimulates the healing process - bruises, minor wounds, burns and scratches will reduce and even heal when treated with vitamin A. Ointments and creams based on vitamin A naturally help to cure these problems.

- Due to its antioxidant effect, vitamin A is very effective in stopping the formation of free radicals in the dermis; alleviates the formation of dark circles and reduces the appearance of irritated skin, because creams enriched with vitamin A also have the role of moisturizing and softening the skin (Zouboulis, 2001).

4. Effects of vitamin A excess and deficiency

Excess of vitamin A or hypervitaminosis A is a condition that occurs when the liver's capacity to store retinoids is exceeded, thus causing various harmful/toxic effects. Two types of hypervitaminosis A are known (Tozer et al., 2019):

- Acute hypervitaminoses: occur as a result of the ingestion of large amounts of vitamin A in a short period of time;
- Chronic hypervitaminoses: are caused the continuous and long-term excessive intake of some products, especially food products, rich in vitamin A.

Among the many symptoms of excess vitamin A we mention the following:

- Dizziness;
- Asthenia;
- Bone pain;
- Irritability;
- Changes in the skin and appendages: alopecia, seborrhea, dry skin, skin hypersensitivity to sun exposure (Nohynek, 2017).

However, these symptoms were observed only in those people who orally consumed different products containing vitamin A, it is not about those people who used different cosmetic products such as creams, lotions or cosmetic masks.

Vitamin A deficiency is one of the causes of vision loss, more precisely of decreased visual acuity at night; but there are other effects of vitamin A deficiency, such as: growth slowdown, drying and accelerated aging of the skin, etc.

Conclusions

Vitamins are important ingredients in the production of cosmetics due to all their properties, which provide a multitude of useful benefits for the skin, hair, cuticles and nails. In conclusion, the presence of vitamin A in various cosmetic products is of particular importance, this being a first factor that we use in the fight against the appearance of aging marks, but also against other various skin conditions.

Rezumat. Corpul uman are nevoie de esențiala vitamină A, un compus liposolubil care este de obicei stocat în ficat. Vitamina A de fapt cuprinde mai mulți compuși capabili să efectueze activitatea biologică a retinolului (vitamina A), precum acidul retinoic și retinalul. Vitamina A se găsește în alimente de origine animal sau vegetală, precum și în alimente îmbogățite și anumite suplimente.

În mod specific, această lucrare prezintă vitamina A, informații generale, recomandări nutritive, rolul biologic, evaluarea acesteia, precum și efectele deficienței sau ale excesului asupra sănătății umane și măsuri de prevenție.

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THE EFFECT OF COLOURED LED-LIGHT ON *RAPHANUS SATIVUS* AND *PHASEOLUS VULGARIS* PLANTS GROWTH

Andreea Gabriela BODOCZI FLOREA*

Abstract. Different colored LED lights (red, yellow, blue/green) were used to study the effect of light on the seed germination and on the growth of the radish and bean plants. The results obtained revealed a different response of the vegetative organs to the different wavelengths of the light. Such methods of plants growth offer the possibility to control the light quality of illumination according to the needs of species for an increased growth efficiency, even more, if it would be associated with the hydroponic crop technology.

Key words: LED agriculture, radish seedlings, beans seedlings.

Introduction

Light is one of the most important factors which influence the growth and development of plants. The quantities and qualities of solar radiations, as well as the lighting period, influence photosynthesis and plants development.

Light has a morphogenic action on plants, called photomorphogenesis. This process includes all the regulatory effects of visible light effect on plants, independent from photosynthesis. Certain colors from the light spectrum trigger vital metabolic processes throughout the life of plants. If in photosynthesis the photoreceptors are represented by assimilating pigments, in photomorphogenesis they are represented by phytochromes.

The metabolic processes in plants are based on certain forms of energy to produce a healthy growth and flowering. Some colours from visible lights trigger vital metabolic processes throughout the life of plants. Red and blue colours, provide the energy needed to promote healthy plant development. Researches have shown that the intensity of photosinthesys is maxium in red spectral light (620-740 nm) and control germination, bulb formation, roots development as well as flower appearence and fruit formation (Samuoliene et al., 2010; Shuerger et al., 1997), the blue light (450-500 nm) stimulates the leaf growth, chlorophyll biosinthesys, stomata opening and the photosinthesys (Tibbitts et al., 1983). The blue light it is responsible for the growth of the plant in the direction of light and even for the amout of water retained by the plant. The absence or reduction of the period of exposure to blue light, results in the yellowing of the leaves and the drying of plants.

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Recent studies have shown that light can affect the plant growth and its development depending on the wavelenght, the intensity and the period of lighting (Bayat et al., 2018).

As LED lights are widely used in various fields of activity. In the recent years, there have been debates about their efficiency. Recently there are discussions about their environmental sustainability, especially in the field of plant growth, in agriculture (greenhouses, organic agriculture, possible food sources cultivable on other planets).

The main purpose of our research was to study the effect of the colored LED lights on seed germination and the growth of radish seedlings *Raphanus sativus var. sativus Cherry Belle* and beans *Phaseolus vulgaris*. In this respect, the plants were exposed to the various colored LED lights (red, yellow, blue/green). *Phaseolus vulgaris*, also known as the common bean and French bean, is an herbaceous annual plant grown worldwide for its edible dry seeds or unripe fruit (beans) (Gentry, 1969). Common beans acquire the nitrogen through an association with rhizobia, which are nitrogen-fixing bacteria (Kuypers et al., 2018). *Raphanus sativus* (radish) is an edible root vegetable of the family Brassicaceae (Lewis-Jones et al., 1982). Radishes are annual or biennial brassicaceous crops grown for their swollen tap roots which can be globular, tapering, or cylindrical (Takeshi and Hiroyasu, 2017).

Materials and methods

Plants material:

Radish (*Raphanus sativus var. sativus Cherry Belle*) and beans (*Phaseolus vulgaris*) seeds were used. Seedlings were planted in the ground and expossed to various colored LED lights (red, yelow, blue and green). The control group was raised in natural light, with south expossure.

The germination process was evaluated and morphological studies were conducted starting from the seed stage and following the reaction of each plant organ during the growth according to the colour of the light to which they were subjected.

The lighting sources used were: artificial LED light with various wavelenght blue (465 nm), green (520 nm), yelow (590 nm, red (650 nm) and natural light - solar light for the control batch.

The lighting period was between 12 -14 hours, according to the time of natural light in February – March in our country.

Determination of the rate of growth and development of radish and beans plant: in this respect, measurements of the height of the radish stem were made weekly for four weeks for radishes, and in the first, the second week and one month after their planting for the beans. The recorded data were statistically processed, their mean average was calculated (X), SD (standard deviationa) and (SE) standard error were calculated and the results were reported to the control sample.

Results and Discussions

The effect of colored LED light on radish seedlings

The results obtained in the case of radish seeds showed a maximum of germination in the presence of the yelow light (80%), followed by those exposed to the green light. Lower germination was registered in samples exposed to blue and red light, where less than half of seeds germinated. The lowest seed germination was recorded in the case of control sample, exposed to natural light, where only 35% of seed germinated (Figure 1).

A conclusion could be drawn, that the different colored light affects the seed germination process differently depending on the light intensity. Similar results were obtained for spuce seeds, where germination was stimulated by white and green light, and inhibated in the presence of the red light (Matioc-Precup and Cachiță-Cosma, 2012; Burescu, 2014).

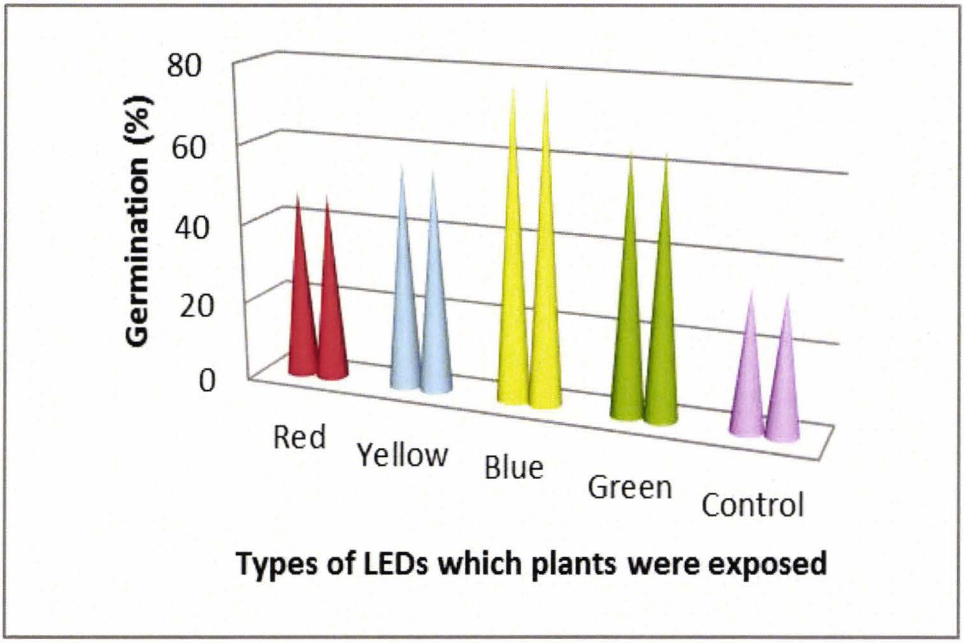

Fig. 1. The percentage of radish seeds germination

Following the evolution of radish plants stem growth (Figure 2) one may notice a more pronounced growth registered in the case of the plants exposed to the green light, followed by those exposed to the LED`s red light. The weakest growth was registered in case of plants exposed to the yellow light. Studies made on pine, beet and white cabbage plants highlight stimulating effects on the elongation of these plants in red, yellow and green light and inhibitory effects in the blue light.

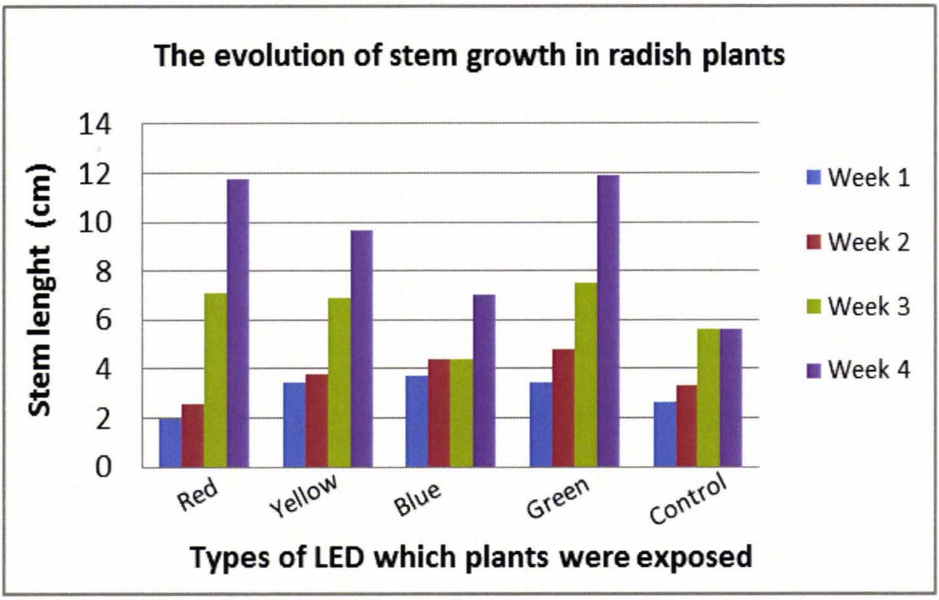

Fig. 2. The evolution of stem growth in radish plants

According to the control sample, the results achieved in the first two weeks after planting have shown a more significant increase compared to the samples raised in the presence of the red light. Starting with the third week it can be observed how the growth of the plants in the red light is stimulated, the stalk lenghtnes noticeable compared to the plants from the control sample.

The weakest development was registered in the case of the plants exposed to the blue light, where a stagnation on growth was noticed in the second and the third week.

The effect of the colored LED light on beans seedlings

The results recorded in the case of beans plants show a different germination compared to those obtained in the case of radish seeds.

On what concerns the beans seeds (Figure 3) the germination was stimulated in the red light where over 50% of the seeds germinated, followed by those exposedd to the blue light where germination occured in 47% of the cases. The least significant influence on germination was registered in seeds kept in green and yellow light, where only 30% of the seeds germinated. Compared to the seeds exposed to the various colored lights, the seeds from control sample kept in natural light germinated over 66%.

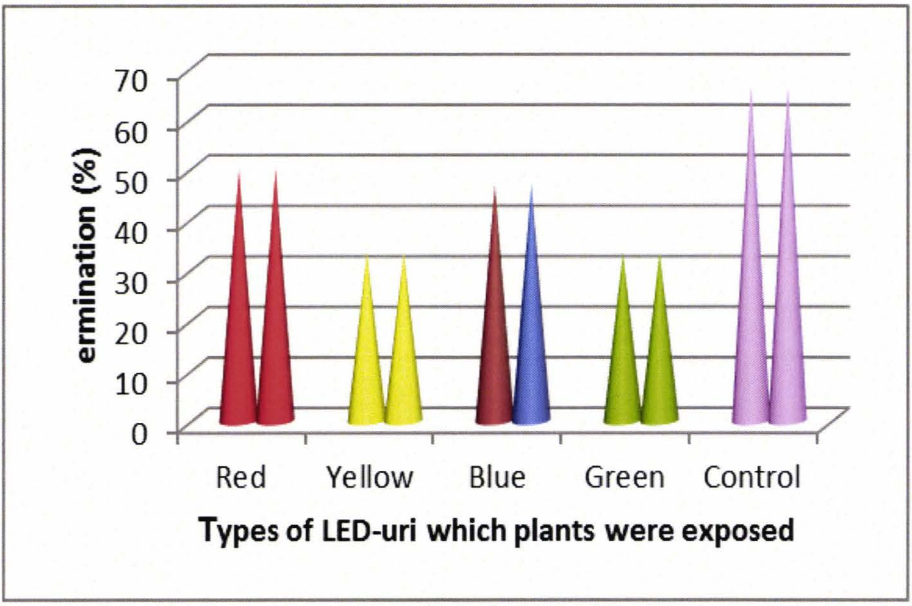

Fig. 3. The percentage of germination of the bean seeds

Watching the growth and the development of the bean's plants (Figure 4) we can see the growth stimulation in the blue light followed by those exposed to the green LEDs light. The lowest growth was registered in the case of plants exposed to the yellow light.

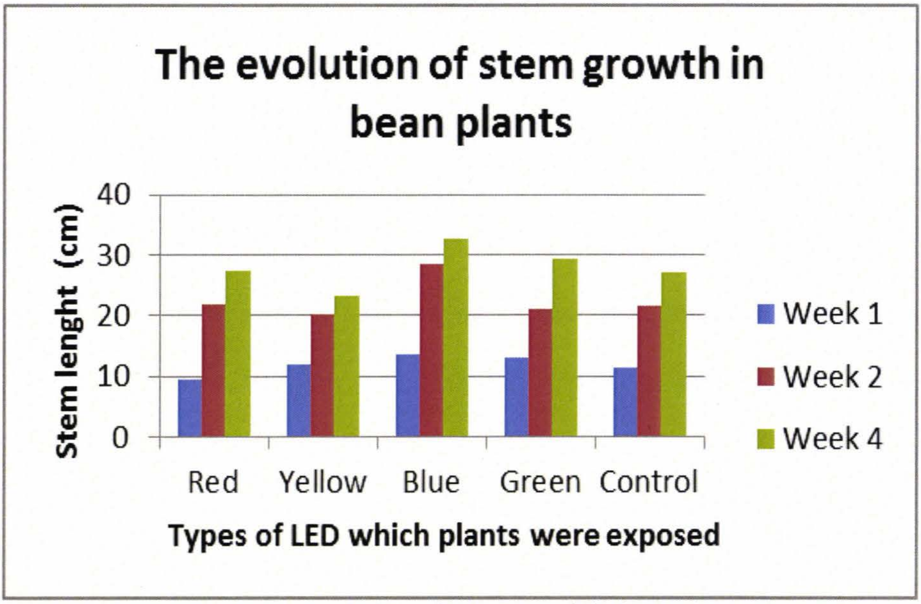

Fig. 4. The evolution of stem growth in bean plants

According to the evolution of beans stem growth during the four weeks of experiment, a constant increase can be noticed for each sample compared to those observed for radish plants.

The plants in the control sample exposed to natural light show a more significant growing comparing to those exposed to the yellow light which has stimulated in the least degree the plant`s growth.

The observation made on the foliar lamina outline a colour fading process of the leaves exposed to the red, yellow and green light, comparing to those exposed to the blue light. The plants in the control group did not undergo changes in colour of the foliar lamina, having remained green thoughout the whole experiment.

Conclusions

1. The cultivation of plants on shelves or vertical supports in enclosed spaces (greenhouses, growth rooms) and the possibilty to control the light intensity of illumination according to the needs of species for an increased efficiency, and also offering the possibility of extending the growth of the plants in the cosmic space in the case of populating other planets.

2. Climate control in the greenhouse through the more eficient management of the heat produced by LED`s and a high efficiency of the lighting through the positioning close to the plants beacuse less heat is released. The LED`s can be positioned in such a way as to ensure the uniformity of lighting.

3. By reducing the costs of energy consumed by lighting, LED agriculturing can succesfully replace traditional farming by reducing pesticide and fertilizer use and increase its efficiency by combining it with the hydroponic crop technology.

4. In our research, one can notice until the present moment growth and development of plants exposed to various coloured LED lights. In the case of radishes, a more pronounced growth was registered under the green light, followed by those exposed to the red light. Plants growth was not favoured in the presence of blue or yellow light. A diminished evolution was noticed also in the case of the control group (plants grown in natural light) comparing with those exposed to the coloured light.

5. The results obtained in the case of germination show that the germination was stimulated in the presence of the yellow light followed by the green light, while, in the presence of the red light they only managed to germinate almost 47% of the seeds. The lowest efficiency on seeds germination had the natural light in the case of the control group, where only 35% of seeds germinated.

The stimulative effect of the yellow light on the germination of radish seeds can be confirmed, but not related to the further growth and development of the vegetative organs of the plant.

For the bean plants, the germination was stimulated when exposed to the red light and inhibated in green and yellow light; the most intense germination was registered in control group exposed to natural light (66% of seeds germinated). Regarding the growth of the bean plants, the measurement of the stem showed a significant growth in the presence of the blue and red light, while the growth of the stem was reduced in the presence of the yellow light.

6. The comparisons made between the results registered on the growth and development of radish and bean plants (the lenght of the stalk) and the type of the light used (red, yellow, blue, green and natural light) demonstrate the existence of significant differences both between the colours of light and the type of plant, as well as between species. Radish plants respond differently from those of beans to the same type of light they were exposed to.

7. LED`s light is an ecologycal lighting alternative, with a long-lasting life, increased safety, emitting light with the corresponding wavelenght for the plant's growth.

Rezumat. Diferite culori ale luminii LED (roşu, galben, verde/albastru) au fost utilizate în acest studiu privind efectul luminii asupra procesului de germinație și creștere asupra plantelor de ridiche şi fasole. Rezultatele obținute au evidențiat răspunsuri diferite ale organelor vegetative la diferite lungimi de undă ale luminii. Astfel de metode de studiu de creștere a plantelor oferă posibilitatea de a controla calitatea și intensitatea luminii în funcție de necesitățile fiecărei specii, având ca rezultat o creștere a eficienței dezvoltării, putând chiar să fie asociată cu tehnologia culturilor hidroponice.

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INDIGENOUS AND PATHOGENIC MICROBIOTA ON THE SKIN LEVEL

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Abstract. The skin is the largest organ in the human body. It fulfills many roles: prevents water from being removed from the body, regulates body temperature, offers protection against UV radiation and adjusts the pH. Many microorganisms live on the surface of the skin, most of them beneficial to the human body. They make up the skin microbiome whose structure is determined by sex, occupation, cosmetic products, and used clothing, geographical area, diet, etc. The purpose of this work is to describe the indigenous microbiota of the skin but also the main infectious agents and implicitly of the diseases that produce them.

Key words: microbiome, infectious agents, skin infections treatment.

Introduction

The skin is the organ with the greatest extent and together with its attached structures (hair, glands, and nails) constitutes the tegumentary system. It has an area of 1.5-2 m^2 and contributes 1/7 to 1/6 of the body weight. It represents the dynamic surface located between the external and the internal environment, helping to maintain homeostasis (Sterry et al., 2006).

The main role of the skin is to stop the entry of harmful chemicals, infectious organisms and prevent the release of water and other chemicals. The skin is an important sensory organ that controls heat and water loss. It reflects internal changes and reacts to external ones (Weller et al., 2008).

All organisms must have an outer covering that interacts with the environment, thus helping them to survive more exogenous threats while maintaining their structural integrity (Sterry et al., 2006). When the skin is confronted with "insults" from the outside, it usually adapts easily and returns to a normal state, but sometimes fails to do so and a skin disorder appears (Weller et al., 2008).

Bacterial infections of the skin and soft tissue are a common problem encountered in clinical practice (Templer and Brito, 2017).

The causal agents of infectious diseases are very numerous, being well studied and known today.

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These infectious agents are organisms in the environment capable of penetrating and multiplying in the human body causing different pathological reactions. The multiplication of bacteria is determined by the possibilities of their adaptation to the tissues of the host (Voiculescu, 1989).

The normal flora of the skin is subject to variations, depending on the contact with the environment near the holes of the mucosal cavities. Sometimes the skin may be contaminated with coliform germs, pathogenic staphylococci resistant to antibiotics (Voiculescu, 1989). The fungal infection can be of endogenous origin (saprophytic commensal fungi eg *Candida*) or of exogenous origin, with fungi existing in nature. The pathogenicity caused by fungi is due to their local multiplication, which triggers mechanical injuries, necrosis and local inflammatory reactions (abscesses), in which the degree of sensitivity of the organism also participates (Voiculescu, 1989).

The outer, dense, keratinized skin layer is a natural barrier against infection, and low skin pH and the presence of fatty acids inhibit the growth of microorganisms outside the normal flora. The skin is normally colonized by bacteria and fungi, which include microorganisms: *Staphylococcus aureus* and *Candida albicans* (Kumar et al., 2015).

Microorganisms can enter the host's body through skin lesions, inhalation, ingestion, or sex. The first mechanisms of defense against infection refer to the integrity of the skin and mucous membranes, which act as physical barriers and produce antimicrobial substances. Most skin infections in healthy people are caused by less virulent microorganisms that penetrate the skin through continuity solutions (cut wounds and burns). These include superficial stinging (fungal infections), wounds (staphylococci), burns (*Pseudomonas aeruginosa*) and diabetic ulcers (pluribacterial infections) (Kumar et al., 2015).

Bacterial infections are common causes of illness. Bacteria have a cell wall consisting of a peptidoglycan, a polymer of long polysaccharide chains linked by peptide bridges. The cell wall of bacteria can be of two types: a thick cell wall that stains with gentian purple (Gram-positive bacteria) and a thin cell wall surrounded by an outer membrane (Gram-negative bacteria). Bacteria are classified according to Gram stain (positive or negative), shape (bumps or bacilli) and the need for O_2 (aerobic or anaerobic). Bacterial mobility is achieved by the use of flagella, and some bacteria have cells that can be attached to the guard cell. Many bacteria remain in the extracellular space when they develop in the host organism, and other bacteria survive and replicate on the outside or inside of the host cells (Kumar et al., 2015).

1. Structure and anatomy of the skin

The skin has a complex structure, being richly vascularized and innervated, fulfilling several functions, such as protection (mechanical, chemical, antimicrobial), sensory, excretion by the sweat glands, thermoregulation and metabolic function (Ognean et al., 2000; Weller, 2008). Body temperature is regulated by controlling the blood flow through the skin and the activity of the sweat glands. Small amounts of "waste" and secretions of the glands are lost through the skin (Marieb, 2008).

The skin is divided into three parts: epidermis, dermis, and hypodermis (Weller et al, 2008).

The epidermis is a *keratinized* epithelium made up of a hard, horny superficial layer that forms the outer protective shell above the basal layer. Its main function is to act as a protective barrier (Moore et al., 2012; Gawkrodger and Ardern-Jones, 2012). The epidermis (Fig. 1) represents the upper layer of the skin and contains four distinct cell types: *keratinocytes* (containing 80% of cells), *melanocytes*, *Langerhans cells,* and *Merkel cells*. Keratinocytes play an important role in ensuring the internal structure of the skin and come from the cells of the basal layer that are permanently divided and the daughter cells are pushed to the surface (Bruce, 2018). Melanocytes are found in a smaller number in the epidermis and give each person a unique skin color. Langerhans cells are considered to mediate the immune responses within the skin and are derived from the bone marrow. Through its dendritic processes, Langerhans cells capture and process antigens in the skin and present them to skin-specific lymphocytes. Merkel cells are mechanosensory cells, especially in sensitive areas of the skin (for example, fingertips) (Bruce, 2018; Tortora and Derrickson, 2012).

The epidermis is divided into four layers, from the deepest to the most superficial, as follows: the germinal layer (consisting of the basal and thorny layer), the grainy layer, the glossy layer and the horny layer (Bruce, 2018; Tortora and Derrickson, 2012).

The dermis (Fig. 1) is a layer of collagen and elastic fibers that provides its elasticity, but at the same time, it confers strength (Moore et al., 2012; Gawkrodger and Ardern-Jones, 2012). It represents the inner layer of the skin between the epidermis and the hypodermis. It consists of two layers: a thin superficial papillary dermis and a thicker reticular dermis, which is deeper (Bruce, 2018). In *the papillary layer* are the dermal papillae, which are elevations, and at the surface of the fingers form papillary ridges with importance in legal medicine. *The reticular layer* consists of collagen fibers and elastic fibers forming thick bundles. The dermis is crossed by the secretory segments of the sweat glands, contains the sebaceous glands, the upper part of the hair follicles, vessels and nerves (Bruce, 2018).

The hypoderma is the deep layer of skin made up of loose connective tissue and has a variable number of fat cells (Fig. 1). In the hypodermis are found the glomeruli of the sweat glands, the deep part of the hair follicles, the vascular and nervous elements, as well as the corpus Vater-Pacini (Bruce, 2018).

The skin also includes some attachments divided into two categories: horny attachments (hairs and nails) and glandular attachments (sweat and sebaceous glands) (Bruce, 2018; Tortora and Derrickson, 2012).

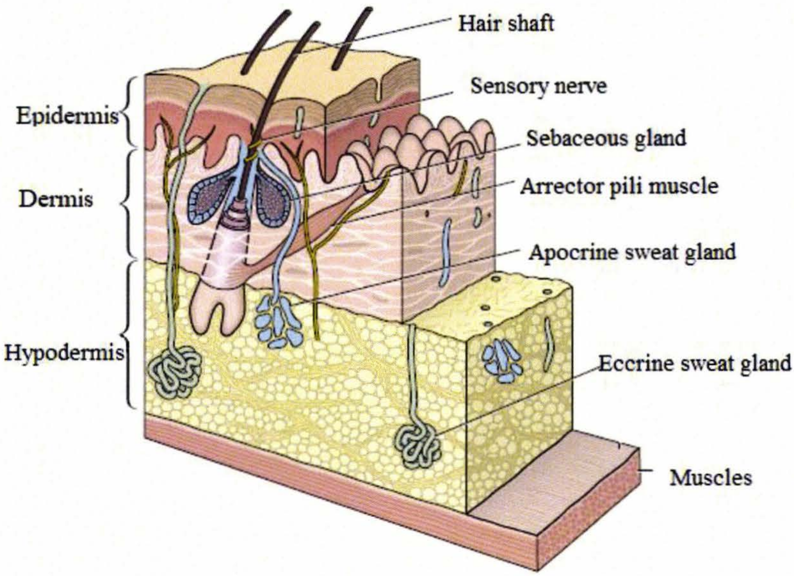

Fig. 1. Skin structure (Sterry et al., 2006)

2. The indigenous microbiota of the skin

The term indigenous microbiota of the skin defines all the microorganisms that normally live in the healthy human body, on its skin, without being affected by any contagious disease (Muntean, 2017).

Since birth, our body is colonized by different microorganisms. Depending on the connection established between the host and microorganisms, there are three types of relationships: commensalism, parasitism, and mutualism. However, with the vast majority of microorganisms that colonize our bodies, we have a relationship of mutualism; they form what is called the microbiome (Cogen et al., 2008).

The skin microbiome is made up of bacteria, fungi, viruses, and arthropods (mites); most studies being done on bacteria. The vast majority of the bacteria that make it up are part of the strains: Actinobacteria - 51.8%, Firmicutes - 24.4%, Proteobacteria - 16.5% and Bacteroidetes - 6.3%. The main genera are *Corynebacterium*, *Kocuria*, *Propionibacterium*, *Microbacterium*, *Micrococcus* (*Actinobacteria*), *Staphylococcus*, *Streptococcus*, *Clostridium (Firmicutes)*, *Pseudomonas*, *Janthinobacterium*, *Serratia*, *Halomonas*, *Stenotrophomonas*, *Delftia* and *Comamonas* (*Proteobacteria*).

The main fungi that make up the skin microbiome are *Aspergillus*, *Rhodotorula*, *Cryptococcus*, *Epicoccum*, *Malassezia* and among the viruses, we can mention: *Human Papilloma Virus* (HPV), etc. Also from the skin microbiome are the arthropods: *Demodex*, etc. (Schommer and Gallo, 2013).

Depending on the region analyzed in the body the distribution of the microbiome is different (Table 1).

Table 1. Specific microorganisms to each region of the body (after Grice and Segre, 2011; Chen and Tsao, 2013)

The region	Microorganisms		
The ocular region	***Corynebacterium***	*Propionibacterium*	Other actinobacteria
Nasal region	*Corynebacterium*	***Propionibacterium***	Other actinobacteria
Ears	***Corynebacterium***	***Propionibacterium***	Other actinobacteria
Occipital region	***Staphylococcus***	*Corynebacterium*	*Proteobacteria*
Back	***Propionibacterium***	*Bacteroidetes*	
Hands	***Proteobacteria***	***Staphylococcus***	***Bacteroidetes***
Navel	***Corynebacterium***	Other actinobacteria	
The groin region	***Corynebacterium***	***Staphylococcus***	
Feet	***Staphylococcus***	*Proteobacteria*	*Bacteroidetes*
Soles	***Staphylococcus***	*Proteobacteria*	*Bacteroidetes*
Foot finger	***Staphylococcus***	***Proteobacteria***	***Micrococciaceae***

In order to determine the composition of the microbiome, the researchers isolated samples by punch biopsy, tamponade and skin scraping. From the samples thus obtained the DNA was isolated and individually amplified, for each sample separately, with conserved primer genes, 16S rRNA. The sequencing followed, then the obtained sequences were grouped into operational taxonomic units, depending on their genetic distance to determine the strains of the found microorganisms. Regarding the determination of biodiversity, Shannon and Simpson diversity indices were calculated. Quantitative PCR reactions were performed to verify the microbiological loading of the skin, which led to the conclusion that up to 106 microorganisms can exist on each cm^2 of skin (Grice et al., 2008; Chen and Tsao, 2013; Zeeuwen et al., 2013).

The structure of the microbiome of each individual is unique and is influenced by several factors such as age, gender, region in which the individual lives, climate, immune system, genotype of the host, hygiene, occupation, pathobiology of the individual, medicines, clothing, cosmetics used etc. (Grice and Segre, 2011), however, in some studies, it was determined that there is a similarity of about 10% concerning the microbiome in different individuals (Sanford and Gallo, 2013). Even if this is well-defined, various changes occur throughout life. These changes may be permanent, as in the case of old age: if in the first year of life, the microbiome is largely represented by *Staphylococcus, Streptococcus* (Firmicutes), when the predominant adult age will be found organisms from the Actinobacteria, Firmicutes and Proteobacteria, or temporary, in case of disturbances (Capone et al., 2011).

Symbiosis relationships are realized between the human body and the microorganisms of its indigenous microbiota. Thus, the microorganism benefits by using substances produced by the human body, without causing harm (Muntean, 2017). The survival of microorganisms on the skin is affected by several factors: temperature, humidity, O_2, and CO_2 concentration, pH, light, nutrient accessibility, host defense system. The low humidity level and the high osmotic pressure of the fluids act in favor of the survival of the bacteria (Muntean, 2017). Obviously, the organisms that occupy the skin will have many characteristics suitable for that environment and they will be different from those found in the throat or colon. It is not uncommon to find that certain people can harbor organisms considered pathogenic. The organisms that make up the normal flora are not a clearly defined list, but large-scale human studies have provided a nucleus of commonly isolated organisms. The distribution list varies according to the location of the body (Hardy, 2003).

The main roles of the microbiome are protection against pathogens and enhancing host immunity. Improvement of immunity is achieved by fighting with pathogenic microorganisms for resources and space, by secreting substances with antimicrobial properties that will prevent growth and pathogen development. A conclusive example for this role is *Staphylococcus epidermidis*, one of the most common microorganisms found on our skin, which inhibits the development of the biofilm formed by *Staphylococcus aureus* and *Streptococcus pyogenes* by secreting proteases (Sanford and Gallo, 2013).

3. The pathogenic microbiota of the skin

The state of resistance to infections is the expression of a long process by which the body adapts and gains resistance, throughout life, as a result of meeting with various infectious agents (Voiculescu, 1989). The infection is conceived as an interaction between a microorganism and the host organism, influenced by environmental factors. Infection means the penetration of microorganisms into the host organism, followed by their multiplication in its tissues (Voiculescu, 1989).

Bacteria belonging to the genus *Staphylococcus* are Gram-positive, immobile, non-sporogenic and facultative anaerobic cocci. Raised on solid media, they form colonies with a diameter of 2-3 mm, with a smooth and glossy surface. Staphylococci are resistant to dry conditions and high salt concentration. They can survive for a long time outside their favorite habitat, which is the skin and upper respiratory tract. *Staphylococcus aureus* is the most important pathogen of this genus (Muntean, 2017; Madigan et al., 2015).

Staphylococcus aureus can cause various infections easier or more serious, both in humans and animals. It is characterized by the ability to coagulate blood plasma using the coagulase it synthesizes (Muntean, 2017).

The pathogenesis and symptoms of *S. aureus* infection are very varied, ranging from minor infections of the skin to serious infections of the internal organs or food poisoning:

- local infections characterized by purulence: boils, infections of the wounds, sinusitis, otitis of the middle ear, etc.
- food poisoning resulting from ingestion of food contaminated with toxins;
- serious diseases: meningitis, pneumonia, septicemia, etc (Muntean, 2017).

This bacterium possesses a large number of virulence factors associated with the cell or extracellular, with the help of which the bacterium can fight the host's defense system (Muntean, 2017).

To ensure the innate immune response and for the cellular defense against *Staphylococcus aureus*, neutrophilic leukocytes play an important role. A process involving the mobilization of neutrophils, from peripheral blood, is being carried out in response to several virulent factors (Muntean, 2017).

Staphylococcus aureus, a Gram-positive bacterium, is a leading cause of human infection capable of invading most tissues of the human body. Superficial skin is a major site of infection for *S. aureus*, which is normally found in 10-20% of healthy people. *S. aureus* causes skin infections from resident bacteria that colonize skin surfaces (Nakagawa et al., 2017; Creech et al., 2015).

S. aureus is one of the many pathogenic species of *Staphylococcus* that especially cause skin infections such as impetigo, abscesses, wounds, and septicemia. The scope *of S. aureus*-mediated diseases is wide and can usually cause skin disorders by infecting skin ruptures/wounds leading to diseases such as impetigo, secondary infections of inflammatory skin diseases, abscesses, cellulite, arthritis, osteomyelitis, and infections. systems, such as endocarditis and pneumonia (Griffiths et al., 2016; Du Vivier, 2013).

The pathogenic capacity of a *S. aureus* strain is the combined effect of extracellular factors and toxins, along with invasive properties of the strain. At one end of the disease spectrum is staphylococcal food poisoning, which can only be attributed to the ingestion of preformed enterotoxin; at the other end are the abscesses disseminated in all organs. The prototype of a staphylococcal lesion is the boil or localized abscess (Greenwood et al., 2007). A large number of staphylococci are spread through pus and exudates from infected wounds, burns, but also skin lesions. Direct contact is the most important way to spread, but it can also occur through the air (Greenwood et al., 2007).

Escherichia coli is a Gram-negative, short, round-headed, non-sporulated, non-encapsulated, generally mobile (with perilous eyelids) bacillus. It is aerobic, anaerobically optional. It is part of the normal flora of the intestine in humans and animals, accounting for approximately 80% of the resident, aerobic flora of the colon. *E. coli* strains are not usually pathogenic to humans. However, several strains of *E. coli* can cause disease in different locations, including the renal system, gastrointestinal tract, and central nervous system. The most important other *E. coli* infections are cholecystitis, appendicitis, peritonitis, postoperative wound infections (Kayser et al., 2005). *E. coli* strains that are resistant to different antibiotics are of particular importance for global health, so they are the most common uropathogenic and enteropathogenic bacteria (Alharbi et al., 2019).

Klebsiella pneumoniae is a Gram-negative bacterium that can cause serious infections – pneumonia, septicemia, and meningitis. It is the important etiological agent of some nosocomial infections (surgical wound overgrowth, urinary infections, septicemia). *Klebsiella* is also transmitted orally through the respiratory tract, colonizing the mucous membranes of the tissues, resisting the host's immune response (Wooley and Byers, 2017).

Nosocomial infections due to the bacterium *Klebsiella pneumoniae* are a major cause of morbidity and mortality among burn patients. It is an important pathogen that accounts for 15.2% of all infections caused by Gram-negative bacteria (Chadha et al., 2017).

Candida albicans is almost always found on the surface of the skin; rarely penetrate deeper layers of skin. *C. albicans* develops on warm, moist, intertriginous areas (that is, between folds or adjacent surfaces) of the body. The eruption is red, with well-defined borders. Itching and burning usually accompany the infection. Candidosis (moniliasis) is a fungal infection caused by *C. albicans*. Skin problems result from the release of irritating toxins on the skin surface. *C. albicans* is almost always found on the surface of the skin; rarely penetrate deeper layers of the skin (Porth, 2011).

Candida albicans is the most widespread species involved in both muco-dermal and disseminated infections, however, the incidence of candidiasis due to *Candida non-albicans* (NAC) is increasing. Therefore, it can be stated that *Candida non-albicans* species have emerged as an important cause of infections (Deorukhkar et al., 2014).

Bacterial injury to host tissues depends on the ability of the bacteria to adhere to the host cells, invade the tissues, or release toxins. Pathogenic bacteria possess virulence genes that encode proteins that confer these properties. A small number of virulence genes can determine whether or not a bacterium is pathogenic (Kumar et al., 2015).

Fungal infections are of several types and range from superficial infections with *Tinea* or *Candida spp*, to serious infections with *Aspergillus spp*. Fungal infections can be superficial (with interest in the stratum corneum, hair, and nails) or deep (at the level of the dermis or subcutaneous tissue) or systemic. Superficial infections with *Candida* frequently produce lesions that mimic psoriasis (Kumar et al., 2015).

Fungal organisms can infect any location of the body and infections are named based on the infected area (Hall and Hall, 2009).

The wounds are enlarged lesions (1 cm), often formed by the fusion of papules. Skin lesions may appear as primary lesions in previously formed normal skin or may develop as secondary lesions resulting from other conditions. The lesions can vary in size from a fraction of a millimeter to many centimeters.

These can be white, red, hemorrhagic or purple (containing blood) or pigmented (colored) (Porth, 2011).

The wounds break down the skin's protective barrier and provide a gate through which microorganisms can penetrate the circulatory system and into the deep tissues of the body. Microorganisms on the surface of the skin can easily penetrate the wound, and as a result, many wound infections are caused by opportunistic pathogens. To prevent bacterial penetration into the wound, the target area is usually covered to protect against contamination. *S. aureus* is the most common agent in wound infections. The risk of surgical wound infection is higher (Wooley and Byers, 2017; Atlas, 1984).

The infection due to the surgical incision, which appears at the incision level up to 30 days after the intervention, affects the skin and subcutaneous cellular tissue, with purulent secretion and / or microorganism isolated by culture from the wound secretion. Deep surgical wound infection occurs at the site of the surgery within 30 days after it; the infectious process affects the deep tissues (Berceanu Văduva, 2019).

Abscess-Pus is an acute or chronic localized inflammation associated with the pooling of the pus and damaged tissue in one place. These are typical of staphylococcal infection and can be formed in any organ or structure of the body. The pus, produced in bacterial infections, represents fibrinous exudate, with a dense, viscous liquid consistency, with different colors (yellow, whitish or green), depending on the etiological agent involved. Sometimes it can be bloody, smelly, containing leukocytes, cell debris, plasma, protein, and other organic residues. Excess accumulation may cause complications: abscesses, fistulas or even peritonitis and septicemia. From one place, organisms can spread through the lymphatic vessels and blood to other parts of the body (Jawetz et al., 2007; Berceanu Văduva, 2019). The abscesses that appear on the skin may appear from the dermis, subcutaneous fat, muscles or several deeper structures (Fig. 2). Skin abscesses include the spread of bacteria through the circulatory and lymphatic systems (Wiles et al., 2011).

Fig. 2. Skin abscess (Ford, 2010)

Abscesses are formed when the pus begins to build up in the tissues. These can be superficial or deep, associated with an organ. Antibiotics do not penetrate well into the abscess and the infection is therefore difficult to treat. Drainage from the abscess is often a preliminary step for successful treatment (Ford, 2010; Tortora et al., 2013).

4. Anti-infectious treatment

In some cases, appropriate anti-infective treatment is sufficient, but in other cases, oral antibiotics are required. Rarely, resistant cases and complicated skin infections require intravenous antibiotics (Hall and Hall, 2009).

Most people shelter staphylococci on the skin, nose or throat. Even if the skin can be released by staphylococci (for example, in eczema), droplet re-infection will occur almost immediately (Jawetz et al., 2007).

Multiple severe skin infections (acne, furunculosis) occur more frequently in adolescents. Similar skin infections occur in patients treated with prolonged corticosteroids. In acne, staphylococcal lipases and corynebacteria release fatty acids from lipids and thus cause tissue irritation. Tetracyclines are used for long-term treatment. *Abscesses* and other closed suppurative lesions are treated by drainage, which is essential, and with the help of antimicrobial therapy. However, it is difficult to remove pathogenic staphylococci from infected individuals, as organisms rapidly develop resistance to many antimicrobial drugs and the drugs cannot act in the central necrotic part of a suppurative lesion (Jawetz et al., 2007).

S. epidermidis infections are difficult to cure because they occur in prosthetic devices where bacteria can be isolated in a biofilm. *S. epidermidis* is more resistant to antimicrobial drugs than *S. aureus*; about 75% of *S. epidermidis* strains are resistant to naphthylline (Jawetz et al., 2007).

Due to the frequency of drug-resistant strains, significant staphylococcal isolates should be tested for antimicrobial susceptibility to assist in the choice of systemic drugs. The drug resistance of the erythromycin group tends to occur so rapidly that these drugs should not be used alone for the treatment of chronic infections. Drug resistance (to penicillins, tetracyclines, aminoglycosides, erythromycins, etc.) caused by plasmids can be transmitted among staphylococci by transduction or conjugation (Jawetz et al., 2007).

Newer antimicrobial agents, such as linezolid, daptomycin and quinupristin/dalfopristin, are generally reserved for patients with severe staphylococcal or enterococcal infections resistant to more traditionally clinically unsuccessful or highly allergic agents (Ford, 2010). Although cleanliness, hygiene and aseptic management of lesions may control the spread of staphylococcus lesions, there are few methods available to prevent widespread dissemination of staphylococcus from carriers. Aerosols (eg glycols) and ultraviolet irradiation of the air have a reduced effect (Ford, 2010).

If hand hygiene is performed correctly then it is the single most important and effective method to prevent the spread of microorganisms from the environment or from one patient to another. Hand hygiene refers to two main methods: hand washing and applying disinfectant containing alcohol. These methods involve reducing the number of potential pests on the skin surface (Ford, 2010). To reduce the transmission in hospitals, patients at high risk are frequently asked about previous infections. Medical staff must strictly adhere to infection control policies, wearing gloves and washing hands before and after contact with the patient (Ford, 2010).

Infectious chemoprophylaxis involves the administration of antimicrobial drugs to prevent infection. In a broader sense, it also includes the use of antimicrobial drugs shortly after the acquisition of pathogenic microorganisms, but before the signs of infection appear. Useful chemoprophylaxis is limited to the action of a specific drug on a specific organism. An effort to prevent any type of microorganisms in the environment is by selecting the most drug-resistant organisms as the cause of a subsequent infection (Jawetz et al., 2007).

The wounds do not have to be sterile to heal. The wounds may continue to heal in the presence of clinical infection, denying the use of current antibiotics for common skin infections (Cefalu et al., 2017).

Conclusions

The skin is the largest organ of our body. It performs many functions, including protection against UV radiation, regulates pH, prevents water from being eliminated from the body and regulates body temperature. Numerous microorganisms live on the surface of the skin, most of them being beneficial to the human body, they make up the microbiome.

The microbiome has the role of increasing immunity and protecting the body against pathogens, by fighting for space and nutrients. The structure of the microbiome is determined by sex, occupation, cosmetic products and used clothing, geographical area, diet and so on. Disorders in the host's interactions with the microbiota lead to diseases such as acne, seborrheic and atopic dermatitis, rosacea.

Rezumat. Pielea este organul cel mai mare din corpul uman. Îndeplineşte numeroase roluri: împiedică eliminarea apei din organism, reglează temperatura corpului, protejează împotriva radiaţiilor UV, reglează pH-ul. Pe suprafaţa pielii trăiesc numeroase microorganisme, majoritatea dintre ele fiind benefice pentru corpul uman, ele alcătuind microbiomul pielii a cărui structură este determinată de sex, ocupaţie, produsele cosmetice şi obiectele vestimentare utilizate, zonă geografică, dietă etc. Această lucrare are ca scop descrierea microbiotei indigene a pielii, dar şi a principalilor agenţi infecţioşi şi implicit a bolilor ce le produc.

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