УДК 615.454.2:615.014:615.3 CURATIVE APPROACH OF BEE - HERBAL COMPOUNDS IN THERAPEUTIC USE AND DERMATOLOGY *Tarapata M.O., Kukhtenko O.S., Novosel O.M., Soldatov D.P.* National University of Pharmacy, Kharkiv, Ukraine

Abstract. This research aims to explore the main benefits of plants and bee products using, in phytotherapy, cosmetics and for therapeutic use. To provide evidence-based recommendations for incorporating bee-herbal medicine products into therapeutic complex.

This paper serves as a foundation for understanding the growing significance of combining herbal compounds with bee products urging both continued research and mindful practice in natural product development.

Keywords: Herbal, bee products, honey, propolis, bee pollen, bee bread, royal jelly, beeswax, bee venom.

Introduction. The rising interest in natural and organic products within of medical use and in the fields of cosmetology and dermatology has spurred research into herbal compounds and their synergistic effects with bee products. This paper explores the benefits, applications, and integrating of these natural remedies for medical uses, in skincare and cosmetic formulations.

By examining the pharmacological properties, historical uses, and contemporary innovations, is good to highlight the compelling potential of combining herbal compounds with bee products for creating effective, safe, and sustainable medical and dermatological solutions.

In recent years, consumers have become increasingly aware of the chemical compositions of skincare products. This awareness has led to an upsurge in demand for natural and holistic alternatives, especially those derived from plants and biodiversity. Herbal compounds-obtained from various parts of plants including leaves, roots, flowers, and seeds-have long been used in traditional medicine and cosmetology. Meanwhile, bee products such as honey, propolis, royal jelly, beeswax etc. have garnered attention for their unique therapeutic properties. This paper aims to elucidate the intersection of these two domains-herbal compounds and bee products - and their synergetic efficacy in therapeutic use cosmetology and dermatology.

The aim of the study. The cosmetic and pharmaceutical industries face significant regulatory challenges regarding the use of herbal and bee products. There is a need for standardized quality control protocols to ensure safety, efficacy, and consistency in formulations. Accent is to demonstrate that herbal and bee products are essential for synergistic effects in cosmetics and innovative medical treatments of dermatology, etc.

Further research into the pharmacodynamics and mechanisms of action of herbal and bee product combinations is essential. Clinical studies must be conducted to substantiate the claims associated with these natural ingredients.

Materials and methods. Liquid honey, honey powder, propolis, royal jelly, beeswax, pollen, beebread was used in this study supplied from local apiary, some types of honey, acacia honey, tilia honey, flower honey etc. In combination with herbal extracts and aromatic oils.

The process involves formulation development, sourcing components, quality control. Tests for skin irritation, allergy reactions, microbial contamination, stability, and verifying claimed benefits.

Results and their discussion. Use scientific methods to evaluate performance of research gave the opportunity to develop new formula of skin care products in cosmetics and therapeutic use. The key components of aromatic oils, extracts, powders, lyophilisats, hydrolats present are listed as: *Aloe Vera, Crocus sativus, Calendula officinalis, Lavandula angustifolia, Apis mellifera products.*

In this review, are presented various therapeutic and skin protective effects of bee and herbal products compounds. Herbal compounds boast a plethora of benefits, including:

Antioxidant properties. Many herbs are rich in antioxidants, which help combat oxidative stress and prevent skin aging. Example: Basil, Cinnamon, Turmeric, Ginger, Oregano, Rosemary, Saffron.

Crocus sativus L. (Iridaceae), known as saffron, contains components like anthocyanins, flavonoids and terpenoids. Saffron has been shown to be of benefit for treating skin diseases as a result of its anti-oxidant, anti-microbial, depigmenting, repairing activities and regeneration. Therefore, it is used for formulating various lotions, creams, and cosmetics emulsions, namely sunscreens, moisturizers, and anti-spot and anti-aging products.

Anti-inflammatory effects. Numerous herbal extracts, like chamomile (Matricaria chamomilla), calendula (Calendula officinalis Pic. 1.), yarrow (Achillea millefolium) is known for their soothing properties.

These concentrated oils are rich in anti-inflammatory and antimicrobial properties that allow rejuvenation and restoration of skin issues. Marigold flowers contain high amounts of carotenoids and flavonoids that are both antioxidants [3, p. 4]. Thus its application can combat inflammation and concerned skin problems. Regular application of calendula oil on skin can control acne breakouts and inflammatory issues.



Pic. 1. Ethnopharmacological activities of Calendula Calendula officinalis. Antibacterial and antifungal activity. Ingredients such as tea tree (Melaleuca alternifolia) and oregano (Oríganum vulgáre) oil have shown efficacy against various pathogens. Oregano oil has the most powerful anti-bacterial and antifungal compounds, namely carvacrol and thymol. Scientists indicate that the antimicrobial properties of oregano oil may inhibit Cutibacterium acnes (formerly Propionibacterium acnes) and Staphylococcus epidermidis, two types of bacteria associated with acne.

Skin regeneration. Herbal extracts like lavender (Lavandula angustifolia), aloe Vera (Aloe Vera) promote wound healing and skin cell regeneration. In case of a burn, cut, scrape, or another wound, lavender oil may help speed up the wound-healing process. Lavender oil promotes the healing of skin tissue.

Some popular herbal compounds used in dermatological practices include Aloe Vera. Renowned for its hydrating and wound-healing properties. Aloe contains active compounds that may reduce pain and inflammation and stimulate skin growth and repair [2, p. 59].

Chamomile (Matricaria chamomilla). Valued for its anti-inflammatory and soothing effects on irritated skin. Chamomile extract is effective in neutralizing free radicals and therefore presents an interesting potential in medical cosmetic formulations for this purpose.

Green tea (Camellia sinensis) extract. Known for its high levels of polyphenols, which provide antioxidant protection. Topical application of this extract reduces the scaling of the skin and improves its elasticity and hydration. It can be used as an anti-cellulite agent due to its caffeine content. This extract is used as a conditioning agent, emollient, humectant, and astringent in personal care products. As well as reducing redness and supporting skin's natural renewal process [1, p. 18].

Honey, propolis, bee pollen, bee bread, royal jelly, beeswax and bee venom are natural products which have been used in medicine since ancient times Pic. 2.

Honey exhibits antibacterial properties and serves as a natural humectant.

Honey hydrates and deeply moisturizes the skin. Because of its inherent humectant qualities, honey works well as a moisturizer. Honey's enzyme activity allows it to hydrate the deeper layers of the skin by penetrating there. Consequently, the skin becomes softer, plumper, and more luminous.

Honey reduces the significance of early aging. The skin absorbs moisture from the air thanks to honey's ability to bind it. This additional hydration offers the skin a vibrant, youthful shine and suppleness, reducing the visibility of fine lines and wrinkles. Honey is a gentle exfoliator and effective pore cleanser. Have antimicrobial and exfoliating properties by nature. Due to these characteristics, it is a powerful natural pore cleaner for eliminating deeply ingrained dirt and debris that might block pores and cause skin problems. Honey lightens hyperpigmentation and scars. A very small quantity of hydrogen peroxide is present in honey. This offers modest whitening effects that, with time, aid in fading hyperpigmentation and acne scars. These same qualities also make honey a good option for bringing out the color of drab skin. Honey reduces breakouts and acne. Honey's anti-bacterial and anti-inflammatory properties can significantly reduce acne and outbreaks. These characteristics lessen the bacterial growth resulting in white, black, and acne. They also aid in treating the irritation and redness brought on by breakouts.

Propolis contains flavonoids with anti-inflammatory and antibacterial properties. By chemical composition, propolis is a very diverse product. At present, more 300 active compounds have been identified in it. Phenolic aromatic acids

(caffeic, ferulic, chlorogenic, p-coumaric, trans-cinnamic acid), phenolic aldehyde (vanillin), benzoic acid, cinnamic acid and flavonoids (pinocembrin, kaempferol, pinobanksin, and apigenin) are the most important bioactive compounds etc.

Among flavonoids, we can enumerate chrysin, luteolin, apigenin, galangin, kaempherol, quercetin, pinostrobin, pinocembrin, and terpene compounds, whose content is 0.5% (bisabolol), and alcohols (cetyl, myricyl, mannitol and inositol) Propolis contains also minerals (calcium, magnesium, manganese, zinc, copper, iron, cobalt and selenium), vitamins (B1, B2, B6, C and E) and enzymes (succinate dehydrogenase, glucose-6-phosphatase, adenosine triphosphatase, acid phosphatase).

Of particular importance is the ability of propolis to inhibit the activity of various enzymes (lipoxygenase, acetylcholinesterase, α -glucosidase, xanthine oxidase, hyaluronidase), which makes it an important ingredient of dietary supplements and cosmeceuticals, and in the future, a promising source of new active compounds used in the therapies of skin disorders, and neurodegenerative diseases.

Bee pollen comprises around 200 bioactive substances. About 22.7% of bee pollen composition constitutes proteins, essential amino acids 10.4% including: methionine, lysine, threonine, histidine, leucine, isoleucine, valine, phenylalanine, and tryptophan [5, p. 17].

Complex carbohydrates which constitute digestible carbohydrates constitute 30.8%, while the percentage of reducing sugars is 25.7%. Among the fatty acids present in bee pollen, can list acids such as arachidonic acid, gamma-linolenic acid, and linoleic acid (0.4%). Additionally, nucleic acids and nucleosides are valuable components of bee pollen. It contains also vitamins (B1, B2, B3, B5, B6, C, H, E). Iron (Fe), zinc (Zn), copper (Cu), calcium (Ca), phosphorus (P), potassium (K) and manganese (Mn) are also microelements and minerals present in large quantities in bee pollen [4, p. 155-162]. In cosmetic, bee pollen is used in a form of lyophilized, aqueous, and lipid extracts. Bioactive substances can be extracted with dissolvants as water, propylene glycols, glycerin and oils. Bee pollen extracts are used in cosmetic in concentrations 0.3–7%. Dried grains of bee pollen -micronized can be added in natural cosmetics.

Bee bread. Pollen for winter supplies, which is deposited in the honeycomb cells, undergoes lactic fermentation and produces bee bread. Protein content in bee bread is 12% lower than its content in bee pollen [6, p. 8]. The content of reducing sugars increases by 40–50%, whereas the content of lactic acid rises to 3.1-3.5%. Bee bread contains vitamin K and enzymes which cannot be found in bee pollen. Bee bread is also a good source of phenolic components, p-coumaric acid, ferulic acid, caffeic acid, kaempherol, isorhamnetin, naringenin and quercetin. Bee bread contains high amounts of enzymes, of which amylase, invertase, phosphatases, transferases, and glucose oxidase are the most important. Invertase and glucose oxidase are mainly produced in the hypopharyngeal glands, and are added by the bees to complete the honey maturation process. However, some enzymes, such as catalase and phosphatase, originate from nectar, honeydew, or pollen. Enzyme cofactors, such as biotin, glutathione, and nicotinamide adenine dinucleotide, have also been found in bee bread. These enzymes can transform high molecular weight compounds into other low molecular weight molecules, such as polysaccharides and proteins. This makes bee bread more digestible than bee pollen [7, p. 1-10].

Bee bread contains enzymes and probiotics that can aid digestion and promote a healthy gut and skin flora. Bee bread is rich in antioxidants and flavonoids that can protect the skin from oxidative stress and inflammation, and improve its elasticity and appearance. Also bee bread and bee pollen are bactericidal and bacteriostatic agents.

Royal jelly. Nutrient-rich and known for promoting skin regeneration and hydration. Royal jelly contains peptides: jelleines I, II, III, IV, proteins, aminoacids, carbohydrates, lipids, vitamins and minerals. Among proteins we can list royalisin and enzymes: amylase, invertase, catalase, acid phosphatase, and lysozyme. Proteins of royal jelly are rich in exogenous amino acids. The carbohydrates in royal jelly are mainly monosaccharides: fructose, glucose and oligosaccharides. Lipids play an important role in royal jelly composition. 10-hydroxy-trans-2-decenoic acid (10H2DA) is the main and specific lipid component of this product, also 3-hydroxydodecanoic acid, and 11-oxododecanoic acid. 10H2DA is used as a marker validate the quality of royal jelly. 3-hydroxydodecanoic acid, to and 11-oxododecanoic acid can be volatile compounds such as phenol, guaiacol and methyl salicylate contains in royal jelly. Also present trace amounts of such bio-elements as potassium, sodium, magnesium, phosphorus, sulfur, calcium, zinc, iron, and copper. Vitamins from group B: thiamine, riboflavin, pyridoxine, pantothenic acid, nicotinic acid and biotin and it is also contains phenolic compounds: ferulic acid, quercetin, kaempherol, galangin and fisetin, pinocembrin, naringin and hesperidin, apigenin, acacetin, and chrysin. Royal jelly can most frequently be found in cosmetics in a lyophilized form, and the higher percentage content of lyophilized royal jelly is, the less viscous cream becomes. Preparations with a higher content of royal jelly are well absorbed, and do not leave greasy film.

Beeswax is a naturally occurring product secreted from worker bees that has varied uses in modern day. Wax obtained from honeycombs constitutes a valuable ingredient used in pharmacy, cosmetology and industry. In skincare, its function ranges from its role as an occlusive, helping to create a semi-occlusive skin barrier that minimizes transepidermal water loss; as a humectant, locking in hydration; and an emollient to soften and soothe the skin. As a natural substance, its use has been shown to help alleviate symptoms associated with common cutaneous conditions like dermatitis, psoriasis, and overgrowth of normal skin flora. Beeswax acts as a natural emulsifier and barrier, providing hydration and protecting the skin.

Apitoxin or bee venom produced by honeybee. It contains a complex mixture of different peptides and mast cell degranulating peptide, which therapeutic and cosmetic properties are used in many areas. Peptides are main components of bee venom including melittin, apamine, adolapin, sekapin, prokamin and mast cell degranulating peptide.

Among peptides especially melittin plays important role in inducing reactions associated with bee stings. Melittin induces membrane permeabilization and lyses cells. It possesses also biologically active amines like histamine, epinephrine, dopamine, norepinephrine and enzymes like phospholipase A2, hyaluronidase, acid phosphomonoesterase, lysophospholipase. Bee venom has other components than peptides including lipids, carbohydrates and free amino acids.

Apitoxin are defined as yellow light powder obtained by collecting a large amount of bee venom by electric stunning with using a bee venom collector without

harming the honey bee. Then bee venom has to be purified under strict laboratory conditions. In next step purified bee venom is diluted in water, centrifuged, lyophilized and refrigerated for use as cosmetic ingredient. It is used as cosmetic ingredients which possess antiaging, anti-inflammatory and antibacterial, antifungal and antiviral effects. Bee venom is used to produce antiphotoaging and anti-acne products. Bee venom is used in treatment of dermal diseases as psoriasis, alopecia and atopic dermatitis. Bee venom shows inhibitory effects on Cutibacterium acnes, exhibit antibacterial and anti-inflammatory effects, it can be used as an ingredient of anti-acne vulgaris products. Cosmetics containing bee venom can avert apparition of acne vulgaris. Purified bee venom reduced number of Cutibacterium acnesat (main factor inducing the inflammation in acne) concentration from 0.5 mg. Through melittin bee venom possesses bactericidal and bacteriostatic effects, prevents and destroys the growth of bacterias. It has remarkable antibacterial effect against Staphylococcus pyrogenes, Staph. epidermidis and Staph. aureus. Melittin is toxic and acts as a non-specific lytic peptide with a broad-spectrum activity against eukaryotic cells, which causes breaking up of the bacterial cell wall.

The antifungal effect of bee venom against Trichophyton mentagrophytes, Trichophyton rubrum, Candida albicans and Malassezia furfur was proved. It can be used in fungi and viral skin infections. Also contains chemicals that are antimicrobial and stimulate the immune system to counteract viral load on herpes simplex virus and other viral diseases connected with RNA viruses.



Pic. 2. Bioactive compounds of bee products.

Conclusion. Synergistic effects of herbal and bee products enhanced therapeutic outcomes. The combination of herbal compounds and bee products can produce complementary effects. Research suggests that herbal compounds can enhance the antimicrobial and anti-inflammatory properties of bee products, while bee products can improve the absorption and efficacy of herbal extracts.

Formulation considerations. When developing cosmetic and dermatological preparations featuring these natural ingredients, specific factors must be considered:

Stability, both herbal compounds and bee products can have varied stability; proper formulation techniques are necessary.

Compatibility, certain herbal compounds might interact negatively with bee products, demanding thorough analysis and testing.

The integration of herbal compounds with bee products presents a promising frontier in cosmetology and dermatology, offering potent therapeutic options devoid of harsh synthetic chemicals. As consumers increasingly gravitate towards natural solutions, further exploration and scientific validation of these combinations will be crucial in advancing skincare and cosmetic formulations. The potential benefits and applications of this synergy could redefine contemporary skincare approaches, fostering a return to nature in the pursuit of healthier skin.

The value of honeybee products is strictly related to the plants that attract honeybees. Medicinal plants contribute greatly to increase the beneficial properties of bee products e.g., honey, pollen, royal jelly, and propolis, and have the potential to produce bee products with higher bioactivity. Therapeutic properties of bee products have been discovered for many types of diseases even against various cancers, COVID-19 and scientists are continuing their research to discover other secrets behind the therapeutic properties of bee products and their bioactives. In addition, can accentuate that bee products are proven to be one of the most valuable medicines offered by nature that in combinations with herbal bioactives showing a great synergetic effect.

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