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Unlocking Radiance: A New Botanical Active Ingredient for Skin Luminosity

Stéphanie Brédif [1*], Virginie Pécher [1], Aline Gilbert [1], Georges Olivier Maillet [1], Nolwenn Lemarie [1], Chloé Bordron [1], Sophie Zozine [1], Florence Cassin [1], Daphné Gautier[1], Albane Guiberteau [1] and Virginie Fera[1]

[1] Groupe Rocher, Scientific Direction, Issy-les-Moulineaux, France

1. Introduction

The quest for radiant skin is a universal concern, transcending age. At the cellular level, skin luminosity is influenced by mechanisms such as cellular energy and metabolism, oxygenation, barrier reinforcement, and protection against external stresses. Addressing these key mechanisms, a novel botanical active ingredient derived from *Phacelia tanacetifolia*, cultivated using agro-ecological practices, has been developed and its efficacy demonstrated both *in vitro* and clinically.

This innovative ingredient, derived using a patented eco-extraction process, represents a novel approach to enhancing skin radiance. Derived from the honey-bearing plant *Phacelia tanacetifolia*, this active ingredient is rich in sugars, polyphenols, amino acids, and vitamins, conferring potent biological activities. These studies reveal the extract's significant impact on improving skin tone, texture, and overall radiance.

2. Materials and Methods

2.1. In Vitro Studies

The biological activity of the *Phacelia tanacetifolia* extract was evaluated using various *in vitro* models.

Angiogenesis was assessed using real-time imaging of transduced endothelial cells co-cultured with dermal fibroblasts, analyzing network length, area, and branch points.

Epidermal keratinocyte metabolic activity was measured using Seahorse technology.

The extract's anti-inflammatory activity was determined by measuring IL-8 and TNFα release via ELISA following PMA (Phorbol-Myristate-Acetate) stimulation of keratinocytes.

Antioxidant activity was assessed by measuring ROS levels under H_2O_2-induced oxidative stress using the DCFDA-probe assay.

Barrier reinforcement was analyzed by thin-layer chromatography to quantify epidermal lipids production in keratinocytes and by immunostaining to assess filaggrin expression in Episcreen micro-epidermis models.

2.2. Clinical Study

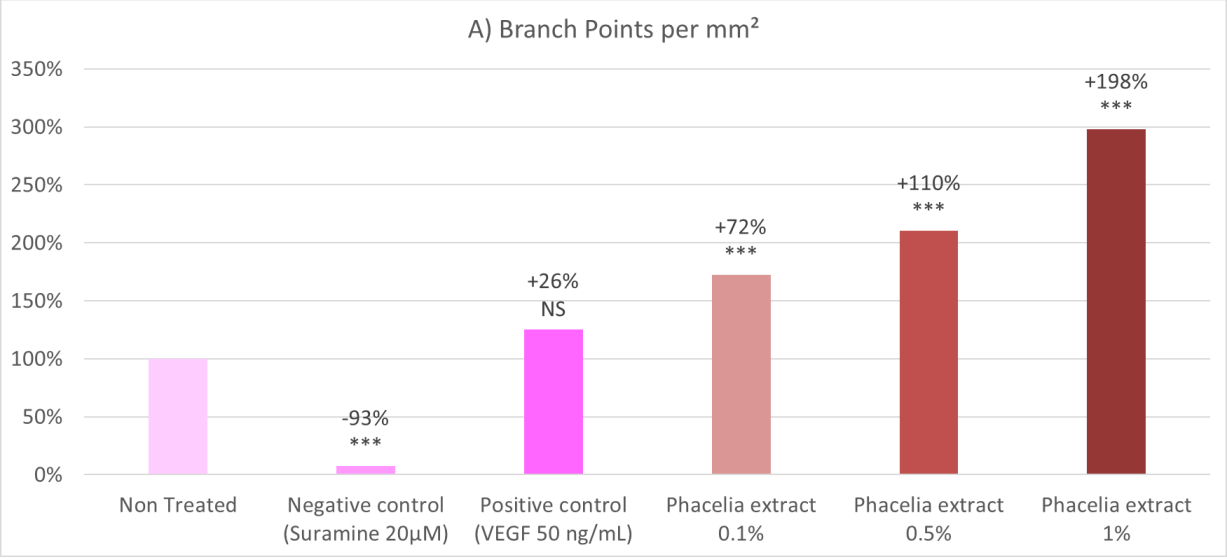
A double-blind, placebo-controlled clinical study was conducted on 20 volunteers. Participants applied a formulation containing the *Phacelia tanacetifolia* extract or a placebo daily for 28 days. Skin luminosity was evaluated using chromametric measurements, specifically analyzing ITA and L* parameters. The extract's efficacy was compared to that of Inositol, evaluated at 0.4% or 2% in the same conditions.

3. Results

3.1. In Vitro mechanisms of action

In vitro studies demonstrated the Phacelia extract's multi-faceted efficacy:

The **Phacelia extract stimulated angiogenesis** as observed by the significant stimulation of the 3 analyzed parameters : the number of branch points (Figure 1A), the area (Figure 1B) and length (Figure 1B) of the network formed by endothelial cells after 72h.



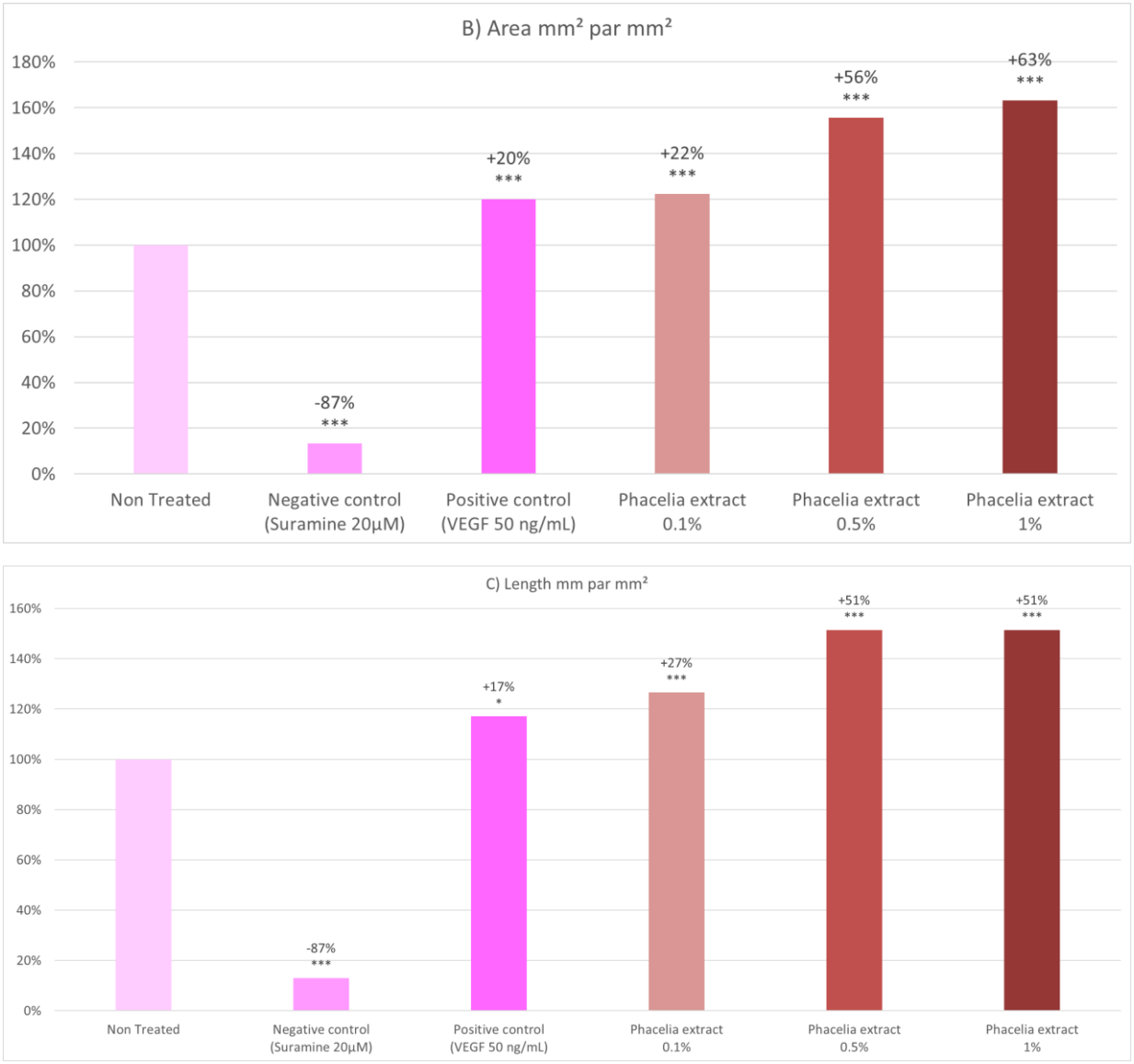


Figure 1. Evaluation of endothelial network formation by image analysis of a NHDF/GFP-Huvec co-culture after 72h of incubation of Phacelia extract or the negative and positive controls (respectively Suramine 20µM and VEGF 50 ng/ml). Evaluation of three parameters representative of network formation: number of branch points (A), area (B), length (C). *Statistical analysis: One-Way ANOVA followed by Dunnet's test: *p<0.05, **p<0.01, ***p<0.001*.

Seahorse technology, used to evaluate cell mitochondrial metabolism, demonstrated that the **Phacelia extract stimulated the general metabolism of keratinocytes and their ATP production**.

As shown in Figure 2 and Table 1, the extract induced basal mitochondrial oxygen consumption (basal respiration) according to a dose effect compared with the untreated control (up to +174%). It also stimulated maximum respiratory capacity, suggesting an increase in mitochondrial biogenesis and/or the overall activity of the mitochondrial chain, as well as ATP production (up to +189%).

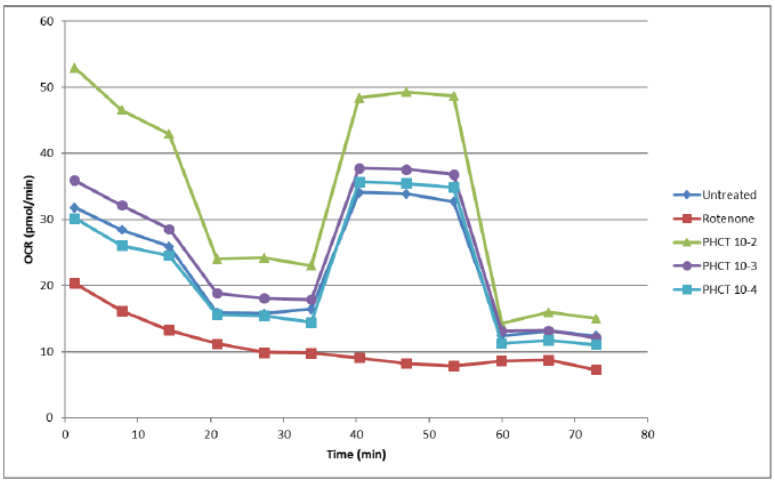


Figure 2. Oxygen Consumption Rate (OCR) measurement using Seahorse technology. OCR is an indicator of mitochondrial respiration, its profile analysis unables to evaluate basal respiration, maximal respiration, spare respiratory capacity and ATP-linked respiration. PHCT = Phacelia extract at 10^{-2}M, 10^{-3}M, 10^{-4}M.

Table 1. Basal respiration and ATP production analysis after OCR measurement by Seahorse.

	Basal Respiration	ATP Production
Untreated	100%	100%
Rotenone	0%	0%
Phacelia extract 0.0001%	100%	112%
Phacelia extract 0.001%	131%	129%
Phacelia extract 0.01%	274%	289%

The **Phacelia extract showed a significant anti-inflammatory potency** as demonstrated by the inhibition of the release of inflammatory mediators Interleukin-8 (Figure 3) and Tumor Necrosis Factor alpha (Figure 4) in keratinocytes stimulated by PMA.

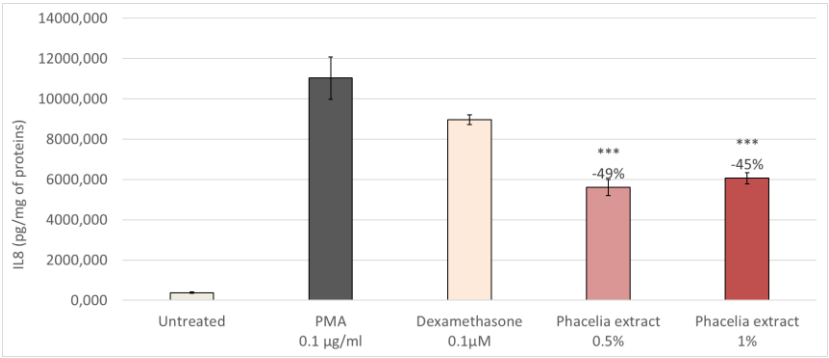


Figure 2. IL8 release in NHEK stimulated by PMA. *Statistical analysis: One-Way ANOVA followed by Dunnet's test: *p<0.05, **p<0.01, ***p<0.001*.

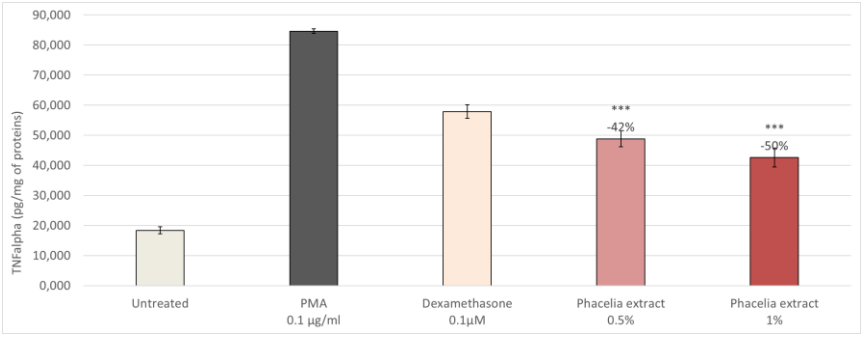


Figure 3. TNFα release in NHEK stimulated by PMA. *Statistical analysis: One-Way ANOVA followed by Dunnet's test: ***p<0.001*.

Reactive Oxygen Species production induced by H202 stress in keratinocytes was highly and dose-dependtly decreased by the **Phacelia extract, showing a strong anti-oxidant activity** (Figure 4).

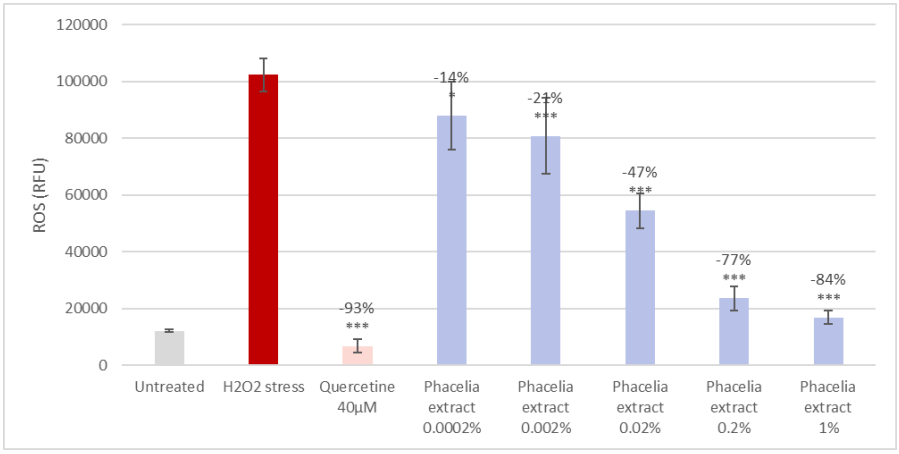


Figure 4. ROS production in NHEK stimulated by H2O2. *Statistical analysis: One-Way ANOVA followed by Dunnet's test: *p<0.05; ***p<0.001*.

Finally, the **Phacelia extract was able to stimulate epidermal barrier**. This has been evidenced by the significant stimulation of filaggrin expression in micro-epidermis (Figure 5). The extract also displayed a stimulating effect of polar ceramides and cerebosides neosynthesis (+167% at 0.004%, Figure 6), key epidermal barrier lipids.

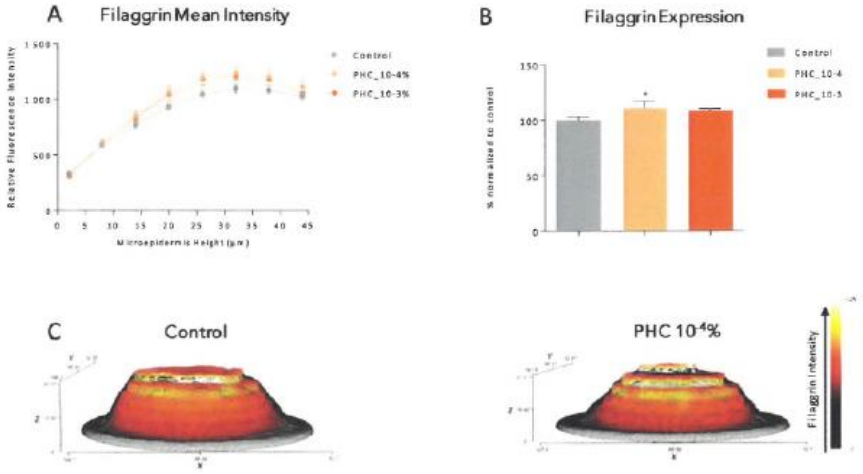


Figure 5. Evaluation of Filaggrin expression in micro-epidermis. PHC = Phacelia extract. A) Filaggrin intensity through micro-epidermis layers; B) Filaggrin expression normalized to Control; C) 3D reconstructed micro-epidermis with Filaggrin expression and distribution represented with a heatmap color scale.

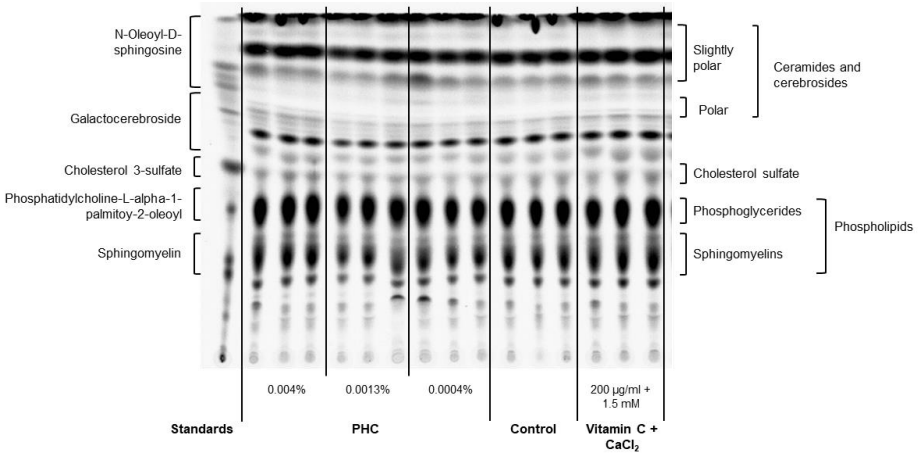


Figure 6. Evaluation of epidermal lipids neosynthesis in keratinocytes by thin layer chromatography. PHC = Phacelia extract.

3.2. Clinical improvement of skin radiance and luminosity

Clinical application of 1% *Phacelia tanacetifolia* extract for 4 weeks resulted in a significant improvement in skin radiance, as measured by an increase in ITA angle (Figure 7), exceeding the efficacy observed with 0.4% Inositol. Furthermore, skin brightness, assessed by the L* parameter (Figure 8), was also significantly enhanced, demonstrating comparable efficacy to 2% Inositol.

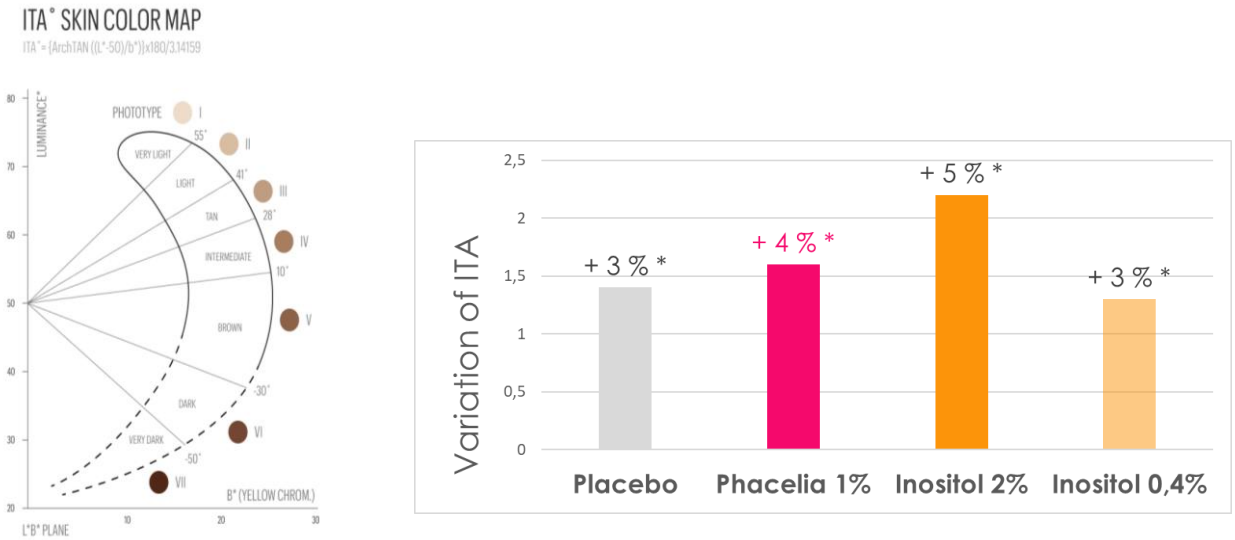


Figure 7. Skin radiance evaluation by measurement of ITA° angle

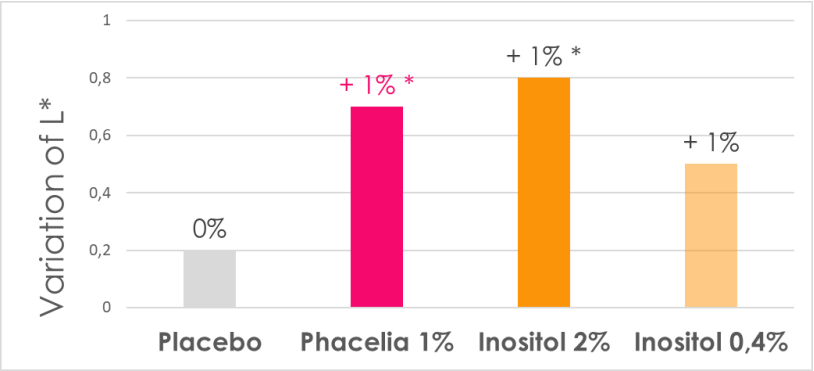


Figure 8. Brightness evaluation by measurement of L* parameter

4. Discussion

Skin radiance is a complex interplay of factors, including healthy microcirculation, efficient cellular turnover, and a robust skin barrier. These interconnected processes contribute to a more even skin tone and texture, minimizing dullness and enhancing light reflection.

The *Phacelia tanacetifolia* extract investigated in this study demonstrates a multifaceted approach to enhancing skin luminosity by targeting these key mechanisms. By stimulating angiogenesis, the extract supports nutrient and oxygen delivery to the skin, promoting a healthy, vibrant complexion. Its positive impact on keratinocyte metabolism encourages efficient skin renewal, while its soothing and antioxidant properties protect against environmental stressors that contribute to dullness. Reinforcement of the skin barrier further enhances radiance by maintaining optimal hydration and protecting against external aggressors.

This *in vitro* demonstrated multi-targeted action translates into tangible clinical benefits, as demonstrated by the significant improvement in skin radiance and brightness following topical application of the extract. The observed increase in ITA angle and L* parameter, exceeding the efficacy of Inositol in certain aspects, underscores the extract's potential as a novel cosmetic ingredient for promoting skin luminosity.

Together, these findings highlight the extract’s holistic action, addressing intrinsic and extrinsic factors critical for skin radiance and positions the *Phacelia tanacetifolia* extract as a promising ingredient for achieving a brighter, more luminous complexion.

5. Conclusion

The *Phacelia tanacetifolia* extract, obtained through a patented eco-extraction process, presents a promising new approach to enhancing skin luminosity. Its multi-targeted mechanism of action, encompassing angiogenesis stimulation, metabolic enhancement, anti-inflammatory and antioxidant properties, and barrier reinforcement, contributes to a holistic improvement in skin radiance. The *in vitro* and clinical findings presented here support the potential of this novel botanical active ingredient as a valuable addition to cosmetic formulations aimed at achieving a healthy, radiant complexion.