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CORN SILK (STIGMA MAYDIS) EXTRACT AS A NATURAL SOURCE OF ANTIOXIDANTS

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Relevance of the Study

Oxidative stress, caused by an imbalance between free radicals and antioxidants, is a critical factor in the pathogenesis of numerous chronic diseases, including diabetes, inflammatory disorders, cardiovascular conditions, and cancer. The search for safe, effective, and accessible natural antioxidants to mitigate oxidative stress is a significant priority in modern pharmacology and nutraceutical science. Stigma maydis (corn silk), a traditional medicinal byproduct in Central Asia, particularly Uzbekistan, is widely used in folk medicine for its purported health benefits. However, a quantitative, scientific validation of its antioxidant capacity, specifically for locally grown varieties, is essential to bridge the gap between ethnobotanical use and evidence-based application. This research provides a quantitative assessment of the anti-radical potential of Stigma maydis, offering a scientific basis for its potential development as a natural antioxidant agent.

Keywords: Stigma maydis, Corn Silk, Antioxidant, DPPH, Radical Scavenging, Flavonoids, Phenolic Compounds, Zea mays

ABSTRACT

Introduction: Stigma maydis (corn silk) is a traditional medicinal substance recognized for its rich composition of bioactive compounds, including flavonoids (luteolin, apigenin) and phenolics. While used traditionally to manage various ailments, its antioxidant potential requires quantitative validation. Objective: This study aimed to evaluate the in vitro anti-radical activity of an ethanolic extract of Stigma maydis (corn silk) to ascertain its potential as a natural antioxidant source. Methods: The anti-radical potential was assessed using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) spectrophotometric assay. A 70% ethanolic extract was prepared and tested at concentrations of 0.25, 0.50, 0.75, and 1.0 mg/ml. The radical scavenging activity (ARF%) was monitored kinetically over 30 minutes at 517 nm. Results: The Stigma maydis extract demonstrated significant, concentration-dependent anti-radical activity. The radical scavenging percentage (ARF%) increased directly with higher extract concentrations. The maximum average scavenging activity of 84.7% was achieved at the highest tested concentration of 1.0 mg/ml. The reaction kinetics indicated that the scavenging activity was rapid, reaching a stable equilibrium after approximately 15 minutes of reaction time. Conclusion: The findings confirm that the ethanolic extract of Stigma maydis possesses potent antioxidant properties. This activity is likely attributable to its high content of flavonoids and other phenolic compounds. Stigma maydis represents a promising, accessible, and natural source of antioxidants for potential pharmaceutical or nutraceutical applications.

INTRODUCTION

The human body is continuously exposed to oxidative stress resulting from the excessive production of reactive oxygen species (ROS), commonly known as free radicals. This

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imbalance is implicated in the onset and progression of various chronic and degenerative diseases, including cancer, cardiovascular disorders, and neurodegenerative conditions (Prior et al., 2005). Consequently, there is a growing global interest in identifying natural antioxidants from plant sources, which are often perceived as safer and more sustainable alternatives to synthetic antioxidants.

Zea mays L. (corn) is a globally significant crop, and its silk (Stigma maydis) is a byproduct often discarded during processing. However, in many traditional medicine systems, including those in Uzbekistan and Central Asia, corn silk is highly valued as a therapeutic agent. It is traditionally used as a mild diuretic, a cholagogue (promoting bile flow), a hypoglycemic agent, and a general antioxidant (Dat et al., 1992; Mamatova & Madaminova, 2025).

The therapeutic efficacy of Stigma maydis is attributed to its complex phytochemical composition. It is known to be a rich source of bioactive compounds, particularly flavonoids (such as luteolin and apigenin), phenolic acids, vitamins, and minerals (Bastien, 1982; Alam, 2011). These compounds, especially the phenolics and flavonoids, are recognized for their potent ability to neutralize free radicals and chelate metal ions, thereby reducing oxidative stress (Hu & Deng, 2011).

While the ethnobotanical use of corn silk is widespread, quantitative data on the antioxidant capacity of Stigma maydis grown in the specific agro-climatic conditions of Uzbekistan is limited. Therefore, this study was designed to scientifically validate its traditional use by quantifying the in vitro anti-radical activity of a 70% ethanolic extract of Stigma maydis using the stable 2,2-diphenyl-1-picrylhydrazyl (DPPH) free radical.

MATERIALS AND METHODS

Plant material and extract preparation - Dried Stigma maydis (corn silk), harvested in Uzbekistan, was used as the raw material. An ethanolic extract was prepared using maceration. Ten grams (10 g) of the dried plant material was submerged in 100 ml of 70% (v/v) ethanol. The mixture was allowed to macerate for 24 hours at room temperature, protected from light. Following extraction, the mixture was filtered using standard filter paper. The resulting filtrate was concentrated to obtain the crude extract. From this stock, sample solutions were prepared at final concentrations of 0.25, 0.50, 0.75, and 1.0 mg/ml, using methanol as the solvent.

Chemicals and reagents - The 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical was obtained and prepared as a 0.1 mM stock solution in methanol. All solvents, including 70% ethanol and methanol, were of analytical grade.

DPPH radical scavenging assay - The anti-radical activity (ARF%) of the Stigma maydis extract was determined using the DPPH spectrophotometric method, based on the protocol described by Brand-Williams et al. (1995). The assay measures the reduction of the purple DPPH radical to the yellow-colored diphenylpicrylhydrazine.

An aliquot of the plant extract (at varying concentrations) was mixed with the 0.1 mM methanolic DPPH solution in a test tube. A control sample, containing only the DPPH solution and methanol (in place of the extract), was prepared simultaneously. The absorbance of the control (A_control) was measured at 517 nm (D1 = 0.994). The absorbance of the test samples (A_sample) containing the extract was measured at 0, 5, 10, 15, 20, 25, and 30-minute intervals using a UV-VIS spectrophotometer.

Calculation of anti-radical activity - The percentage of DPPH radical scavenging (anti-radical activity, ARF%) was calculated to quantify the antioxidant efficacy. The calculation was performed using the following standard formula:

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ARF (%) = [(A_control - A_sample) / A_control] × 100

Where: 1) A_control (D1) = The initial absorbance of the 0.1 mM DPPH control solution (0.994). 2) A_sample (Dt) = The absorbance of the reaction mixture (DPPH + extract) at a specific time point.

RESULTS

The ethanolic extract of Stigma maydis demonstrated a potent capacity to scavenge the DPPH free radical. This anti-radical activity was found to be both concentration-dependent and time-dependent.

Concentration-dependent activity: the scavenging effect increased significantly with the concentration of the extract. as shown in table 1, the average anti-radical activity (arf%) over the 30-minute period was lowest at 0.25 mg/ml (76.013%) and highest at 1.0 mg/ml (84.766%). this positive correlation indicates that a higher concentration of the extract provides a greater quantity of antioxidant compounds capable of neutralizing the free radical.

Time-dependent activity (kinetics): the reaction kinetics (table 1) reveal that the radical scavenging process was rapid. a substantial increase in arf% was observed across all concentrations within the first 5 minutes of the reaction. after 15 minutes, the reaction rate slowed significantly, and the arf% values stabilized, indicating that the reaction had reached or was approaching equilibrium. at the 30-minute mark, the average arf% across all concentrations reached 84.86%.

Table 1. Raw absorbance data and calculation of anti-radical activity (ARF%).

Sample / Time	0.25 mg/ml	0.50 mg/ml	0.75 mg/ml	1.0 mg/ml	Average ARF%
D1	0.994	0.994	0.994	0.994	
0 min (Abs)	0.418	0.300	0.290	0.215	
Difference	0.576	0.694	0.704	0.779	
ARF%	**57.948**	**69.819**	**70.825**	**78.370**	**69.240**
5 min (Abs)	0.259	0.145	0.144	0.141	
Difference	0.735	0.849	0.850	0.853	
ARF%	**73.944**	**85.412**	**85.513**	**85.815**	**82.671**
10 min (Abs)	0.226	0.140	0.141	0.141	
Difference	0.768	0.854	0.853	0.853	
ARF%	**77.264**	**85.915**	**85.815**	**85.815**	**83.702**
15 min (Abs)	0.208	0.140	0.141	0.141	
Difference	0.786	0.854	0.853	0.853	
ARF%	**79.074**	**85.915**	**85.815**	**85.815**	**84.155**
20 min (Abs)	0.194	0.140	0.141	0.140	
Difference	0.800	0.854	0.853	0.854	
ARF%	**80.483**	**85.915**	**85.815**	**85.915**	**84.532**
25 min (Abs)	0.184	0.140	0.141	0.141	
Difference	0.810	0.854	0.853	0.853	
ARF%	**81.489**	**85.915**	**85.815**	**85.815**	**84.759**
30 min (Abs)	0.180	0.140	0.141	0.141	

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Difference	0.814	0.854	0.853	0.853	
ARF%	**81.891**	**85.915**	**85.815**	**85.815**	**84.859**
Average	**76.013**	**83.544**	**83.630**	**84.766**	**81.988**

Note: Data derived from the original manuscript's calculations. Abs = Absorbance. D1 = Control Absorbance. Difference = D1 - Abs. ARF% = (Difference / D1) * 100. The final row "Average ARF%" represents the mean ARF% for each concentration over the 30-min period. The final column "Average ARF%" represents the mean ARF% at each time point across all concentrations.

The maximum average scavenging activity (84.766%) was recorded at the 1.0 mg/ml concentration, confirming a robust dose-response relationship.

DISCUSSION

The results of this in vitro study confirm that the 70% ethanolic extract of Stigma maydis is a potent source of natural antioxidants. The high ARF% (reaching a maximum average of 84.8% at 1.0 mg/ml) is indicative of a strong capacity to donate hydrogen atoms or electrons, thereby neutralizing the stable DPPH free radical.

This potent activity is consistent with previous research (Hu & Deng, 2011) and is primarily attributed to the rich phytochemical profile of corn silk. Stigma maydis is known to be abundant in phenolic compounds and flavonoids, such as luteolin and apigenin (Bastien, 1982). These compounds possess ideal structural chemistry for free radical scavenging, and their presence in the extract likely accounts for the high activity observed (Nguyen et al., 2003).

The concentration-dependent response observed in our findings is a hallmark of phenolic-based antioxidants (Prior et al., 2005). The stabilization of the reaction kinetics after 15 minutes suggests a rapid interaction between the extract's primary antioxidants and the DPPH radical, which is a desirable characteristic for a protective agent.

The findings provide a strong scientific validation for the traditional use of Stigma maydis in the folk medicine of Uzbekistan and Central Asia for conditions that may be linked to oxidative stress. The extract's demonstrated ability to mitigate oxidative stress highlights its potential for development as a natural additive in the pharmaceutical or food industries. Natural antioxidants are increasingly sought for the prevention and management of chronic diseases, including inflammatory conditions, diabetes, and cancer (Miguel, 2010; ANTICANCER PROPERTIES..., 2024).

While this in vitro study demonstrates significant anti-radical activity, it serves as a foundational step. Future research is warranted to isolate and identify the specific bioactive components responsible for the observed activity, such as specific phenolic acids or iridoids, which were mentioned as potential targets in the original study's conclusion. Furthermore, in vivo studies are necessary to confirm these antioxidant effects and to correlate them with the extract's established pharmacological applications, such as its diuretic, cholagogue, and hypoglycemic effects (Dat et al., 1992; Mamatova & Madaminova, 2025).

CONCLUSION

This study successfully demonstrated that a 70% ethanolic extract of Stigma maydis (corn silk) grown in Uzbekistan possesses high in vitro anti-radical activity. The efficacy was found to be both concentration- and time-dependent, with a maximum average scavenging activity (ARF%) of 84.8% achieved at a concentration of 1.0 mg/ml. The reaction kinetics were rapid, with activity stabilizing within 15-30 minutes.

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These results underscore the potential of Stigma maydis as a valuable, accessible, and potent source of natural antioxidants. This research provides a scientific basis for its ethnobotanical use and suggests its utility as a supplementary agent for the prevention and management of oxidative stress-related diseases.

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