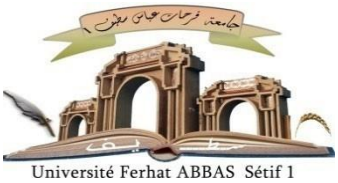
الجمهورية الجزائرية الديمقراطية الشعبية
وزارة التعليم العالي و البحث العلمي

University of Setif 1 Ferhat ABBAS
Faculty of Natural and Life Sciences



جامعة فرحات عباس، سطيف 1
كلية علوم الطبيعة و الحياة

DEPARTMENT OF BIOTECHNOLOGY

N°...../SNV/**2026**

DISSERTATION

Presented by

REBAH Yassamine
BOUZIT Elbatoul
CHEGAR Mounia

To obtain the diploma of

MASTER

Branch of study: Biotechnology

Specialty: Biotechnology and plant improvement

THEME

COMPARATIVE STUDY OF THE EFFECT OF GENOTYPIC VARIATION ON SOME PHYSICO-CHEMICAL PROPERTIES OF SUNFLOWER OIL CULTIVATED IN SETIF

Publicly supported on: **24 /06/ 2026**

DEFENSE JURY

PRESIDENT: DR. BENIDER CHAFIA UFA Setif 1
SUPERVISOR: DR. BELGUET ASSIA UFA Sétif 1
EXAMINER: DR AMOR LOUBNA UFA Sétif 1

Phytotherapy Laboratory Specializing in Chronic Diseases

ACADEMIC YEAR: 2025/2026

لملخص

هدفت هذه الدراسة إلى تقييم تأثير خمسة أصناف من عباد الشمس الزيتي المزروعة في ولاية سطيف، الجزائر (Sirina، Italica، Traveller، ES Bella و ES Savana) على بعض الخصائص الفيزيائية والكيميائية لزيت عباد الشمس المستخلص بطريقة العصر البارد. أظهرت تحاليل الزيوت قيماً لرقم الحموضة تراوحت بين 0.97 و2.01 ملغ/KOH غ، ومحتوى من الأحماض الدهنية الحرة بين 0.48% و1.01%، وهي قيم تقع ضمن الحدود التي يحددها معيار الكودكس(Codex) ، مما يدل على جودة جيدة للزيت وظروف تخزين مناسبة. تباينت قيم التصبن وقيم الإسترات بشكل ملحوظ بين الأنماط الوراثية، مما يعكس اختلافات في تركيب الأحماض الدهنية واحتمال وجود تباين وراثي؛ وفي بعض الحالات، قد تشير القيم المرتفعة إلى نسبة أعلى من الأحماض الدهنية قصيرة السلسلة أو إلى احتمال وجود غش. تراوح معامل الانكسار بين 1.46 و1.56، إلا أن عدداً محدوداً فقط من الأصناف كان متوافقاً مع معايير الكودكس، مما يشير إلى وجود اختلافات تركيبية بين الزيوت. كانت قيم البيروكسيد ومعاملات الامتصاص النوعي للأشعة فوق البنفسجية ضمن الحدود المقبولة بشكل عام، مما يدل على انخفاض مستوى الأكسدة وتمتع الزيوت بثبات جيد؛ ومع ذلك، قد ترتبط بعض الاختلافات الطفيفة بظروف التخزين أو بعمر الزيت.

الكلمات المفتاحية :الجزائر؛ زيت عباد الشمس؛ رقم الحموضة؛ رقم البيروكسيد؛ رقم التصبن؛ معاملات الامتصاص بالأشعة فوق البنفسجية؛ العصر البارد.

Abstract

This study aimed to evaluate the effect of five oilseed sunflower varieties cultivated in Setif, Algeria (Sirina, Italica, Traveller, ES Bella, and ES Savana), on selected physicochemical properties of cold-pressed sunflower oil. The analyzed oils showed acid values ranging from 0.97 to 2.01 mg KOH/g and free fatty acid contents between 0.48% and 1.01%, remaining within Codex limits and indicating good oil quality and appropriate storage conditions. Saponification and ester values varied considerably among genotypes, reflecting differences in fatty acid composition and possible genetic variability; in some cases, elevated values may suggest a higher proportion of short-chain fatty acids or potential adulteration. The refractive index ranged from 1.46 to 1.56, although only a limited number of varieties complied with Codex standards, indicating compositional differences among the oils. Peroxide value and specific extinction coefficients (K232 and K270) were generally within acceptable limits, suggesting low oxidative deterioration and good oil stability; however, slight variations may be associated with storage conditions or oil age.

Keywords: Algeria, Acid value, Peroxide, Saponification, UV extinction coefficients.

Résumé

Cette étude avait pour objectif d'évaluer l'effet de cinq variétés de tournesol oléagineux cultivées à Sétif, en Algérie (Sirina, Italica, Traveller, ES Bella et ES Savana), sur certaines propriétés physicochimiques de l'huile de tournesol extraite par pression à froid. Les huiles analysées ont présenté des indices d'acide compris entre 0,97 et 2,01 mg KOH/g ainsi que des teneurs en acides gras libres variant de 0,48 % à 1,01 %, demeurant dans les limites fixées par le Codex et indiquant une bonne qualité de l'huile ainsi que des conditions de stockage appropriées. Les indices de saponification et les valeurs d'esters ont montré des variations importantes entre les génotypes, reflétant des différences dans la composition en acides gras et une possible variabilité génétique ; dans certains cas, des valeurs élevées peuvent suggérer une proportion plus importante d'acides gras à chaîne courte ou une éventuelle adultération. L'indice de réfraction variait de 1,46 à 1,56, bien qu'un nombre limité de variétés seulement soit conforme aux normes du Codex, ce qui indique des différences de composition entre les huiles. L'indice de peroxyde ainsi que les coefficients d'extinction spécifique (K232 et K270) étaient généralement dans les limites acceptables, suggérant une faible détérioration oxydative et une bonne stabilité des huiles ; toutefois, de légères variations pourraient être associées aux conditions de stockage ou à l'âge de l'huile.

Mots-clés : Algérie ; indice d'acide ; indice de peroxyde ; indice de saponification ; coefficients d'extinction UV.

Acknowledgements	
Dedication	
الملخص	
Abstract	
Résumé	
Table of Contents	
List of Figures	
List of Tables	
List of abbreviations	
I- INTRODUCTION	**1**
II- General Overview of Sunflower	
II-1. Origin and History of Sunflower	**2**
II-2. Classification, genetics and taxonomy	**2**
II-3. Morphological description	**3**
II-4. Growth and development stages	**3**
II-4.1. Germination and emergence	**4**
II-4.2. Vegetative growth	**4**
II-4.3. Bud initiation to start of flowering	**5**
II-4.4. Flowering to physiological maturity	**5**
II-5. Sunflower Production Practices	**7**
II-5.1. Seed Quality	**7**
II-5.2. Soil Fertility and Fertilizer Recommendations	**7**
II-5.3. Water Management in Sunflower	**7**
II-5.4. Weeds and Diseases of Sunflowers	**8**
II-6. Environmental Factors Affecting Sunflower Plant Growth and Development	**8**
II-6.1. Moisture	**8**
II-6.2. Temperature	**9**
II-6.3. Soils	**9**
II-7. Abiotic and Biotic stress tolerance in Sunflower	**10**
II-7.1. Sunflower breeding for resistance to drought	**10**
II-7.2. Sunflower breeding for resistance to salinity	**10**
II-7.3. Pest Management	**11**
III- Compositions and uses of sunflower products	
III-1. Compositions of sunflower products	**13**
III-1.1. Compositions of sunflower seeds	**13**
III-1.2. Compositions of sunflower seeds cake	**13**
III-1.3. Compositions of sunflower seeds oil	**14**
III-1.3.1. Sunflower oilseed consumption in Algeria	**15**
III-1.3.2. Factors affecting oil yield and quality	**16**
A. Environmental factors	**16**
B. Genetic factors	**16**
III-2. Uses of sunflower	**16**
III-2.1. Potential of Sunflower for human health	**16**
III-2.2. Potential of Sunflower as feed	**17**
IV- Materials and methods	
IV-1. Genotypes Collection and Study Design	**18**
IV-2. Extraction and Collection of Oil Samples	**18**
IV-3. Physico-chemical properties of sunflower oil	**19**

IV-3.1. Acids value and Free fatty acids	**19**
IV-3.2. Saponification and Ester Value	**19**
IV-3.3. Refractive index	**21**
IV-3.4. Peroxide value	**21**
IV-3.5. Determination of conjugated-diene (K 232) and conjugated-triene (K270)	**22**
IV-4. Statistical analysis	**23**
V- Results and discussion	
V-1. Acid value (AV) and Free fatty acids (FFA)	**24**
V-2. Saponification and Ester Value	**24**
V-3. Refractive index	**25**
V-4. Peroxide value and UV extinction coefficients (K232 and K270)	**26**
VI- Conclusion	
References	

INTRODUCTION

I- INTRODUCTION

Vegetable oils play an essential role in human nutrition. They contribute significantly to dietary energy intake and serve as an important source of essential fatty acids, particularly linoleic acid (Meziani et al., 2021). Sunflower oil is considered a high-quality edible oil composed mainly of triacylglycerols (98–99%), along with minor constituents including phospholipids, tocopherols, carotenoids, sterols, and waxes. It is characterized by a high content of linoleic acid, followed by oleic acid, providing favorable nutritional and health-related properties (White et al., 2000). Sunflower originated in North America approximately 5,000 years ago and was initially cultivated as a source of flour and oil seeds (Eric, 1997). During the late nineteenth century, sunflower was introduced into the Russian Federation as an oilseed crop, where cultivation practices were considerably improved by local farmers. Since then, sunflower has become one of the major oilseed crops worldwide due to its high yield potential (Putnam et al., 1990). Currently, global sunflower production is dominated by several countries, particularly Ukraine and Russia, followed by Argentina and European producers such as France and Spain. Sunflower oil accounts for approximately 13% of global edible oil production and represents an economically important vegetable oil worldwide (Gabagambi et al., 2010).

In Algeria, sunflower cultivation remains relatively limited. Although preliminary cultivation attempts began in the mid-1970s, development of this crop was constrained mainly by severe losses caused by bird attacks.

Therefore, the present study aims to evaluate the physicochemical characteristics of sunflower oil extracted from five sunflower varieties cultivated in the Sétif region. The assessment was conducted to determine oil quality through the analysis of several quality indicators, including saponification value, peroxide value, specific gravity, and other relevant physicochemical parameters.