Journal of Applied Biosciences 188: 19823 - 19834
ISSN 1997-5902

Proximate composition, colour of seeds, chemical compounds of seed oils of *Vitex doniana, Ricinodendron heudelotii* and *Cleome gynandra*: Implications for human nutrition and industrial applications

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Submission 16th June 2023. Published online at https://www.m.elewa.org/Journals/ on 31st August 2023. **https://doi.org/10.35759/JABs.188.4**

ABSTRACT

Objective: Vitex doniana (Black plum), Ricinodendron heudelotii (African nut tree) and *Cleome gynandra (Spider plant) are three common wild plant species in Benin. I*n this study, the proximate composition, colour of their seeds and volatile compounds of derived oils were assessed in order to explore their usefulness and possible applications of their oils.

*Methodology and results***:** Proximate composition and colour of the seeds, chemical compounds and quality index of seed oils were analysed using standard methods. Their seeds protein and lipid content ranged respectively from 25.58 g/100 g dw to 33.52 g/100 g and from 22.26 g/100 g dw to 44.39 g/100 g dw. The unsaturated fatty acids found in the oils are petroselinic acid (39.09%) and conjugated linoleic acid (12.57%) for *V. doniana* oil, oleic acid (44.75%) and linoleic acid (15.99%) for *C. gynandra* oil and oleic acid (16.63%) in *R. heudelotii* oil. Additionally, *R. heudelotii* oil contained a high level of β-sitosterol (24.39%).

Conclusion and application of the findings: The above results along with previous research suggest that the oils extracted *from R. heudelotii, V. doniana*, and *C. gynandra* are rich in a variety of bioactive compounds and may have potential applications in cosmetics, food, and pharmaceutical industries. *R. heudelotii, V. doniana* and *C. gynandra* kernels are rich in protein, lipids and fibre. These nutrients are essential for human health and could be used to improve the nutritional value of food products. Particularly, the protein from *R. heudelotii* kernels could be used as a food supplement. *V. doniana and C. gynandra are non-drying oils and* consequently could be used as ingredient in processed food products *and in skincare products. R. heudelotii* kernels oil is a drying oil and then could be used as vehicles in paints, varnishes, and printing inks. *Additionally, R. heudelotii could be used in salad dressing according to its fatty acid composition.*

Keywords: Benin, wild-seed oil, fatty acids, nutrition, industrial applications

INTRODUCTION

Wild seed oils (WSO) have been used for centuries with increased interest these last decades. In sub-Saharan Africa countries, *Ricinodendron heudelotii*, *Vitex doniana*, and *Cleome gynandra* are examples of wild plants that produce seed oils that are rich in bioactive compounds including fatty acids, phytosterols, vitamins, and antioxidants, with potential nutritional and health benefits (Amah and Okogeri, 2019, Kouamé *et al.*, 2015, Yirankinyuki *et al.*, 2018). They occur naturally in West Africa and are listed as of priority for conservation and valorisation in Benin (Hounsou-Dindin *et al.,* 2022). Recent research has highlighted the potential of these WSO as a source of essential fatty acids, minerals and vitamins. For example, the oil obtained from the seeds of *V. doniana* is rich in monounsaturated fatty acids like oleic acid (Amah and Okogeri, 2019). Similarly, the oil obtained from the seeds of *R. heudelotii* contains high levels of a conjugated polyunsaturated fatty acid α-eleostearic acid, which is known to contribute to the reduction of cardiovascular diseases risk (Leudeu *et al.,* 2009). The oil also contains a high level of antioxidants, which are plant-derived steroids that can lower cholesterol levels and improve heart health (Odinga *et al.,* 2016, Olasehinde *et al.*, 2016, Shilla *et al.*, 2019). *R. heudelotii, V. doniana,* and *C. gynandra* are of critical interest because of their wide range of uses and may be natural alternatives to synthetic compounds in the food, cosmetics and pharmaceutical industries in Benin, where these resources occur naturally in abundance. Unfortunately, there is no information on the properties and quality of oils obtained from these wild plants in the Benin context. Yet, the literature informed that the properties of seed oils are significantly associated with the geographical provenance of the wild seeds (Elfeel, 2010) as well as on extraction conditions (Akretche, 2015). Therefore, there is a need to generate updated and contextual evidence on the properties and quality of the seed oils of these three wild plants for possible valorisation. This study aimed to improve knowledge about the proximate composition of seeds and the chemical compounds of derived oils of *V. doniana*, *R. heudelotii*, and *C. gynandra* from Benin. It identified and quantified chemical compounds present in the oils and discussed their potential for human nutrition and other applications.

MATERIALS AND METHODS

Sampling methods: *R. heudelotii* and *V. doniana* fruits were collected in Bassila District, Donga Department of Benin in October and July-August 2021, respectively. *C. gynandra* seeds were collected separately at Lokossa District, Mono Department of Benin in October 2021.

Seeds, kernels and the wild seed oils screening methods: *R. heudelotii*, *C. gynandra,* and *V. doniana* oils were extracted using Soxhlet method and following the processes detailed in Figure 1. *C. gynandra* seeds were ground with a grinder, and the ground samples were used to extract the oil. Fruit pulps of *R. heudelotii* and *V. doniana* were removed and the seeds were sun-dried for 5–7 days, crushed between two stones before grinding.

Photo: Ripened fruits and kernels of *Ricinodendron heudelotii* (a and b), *Vitex doniana* (c and d), and seeds of *Cleome gynandra* (e)

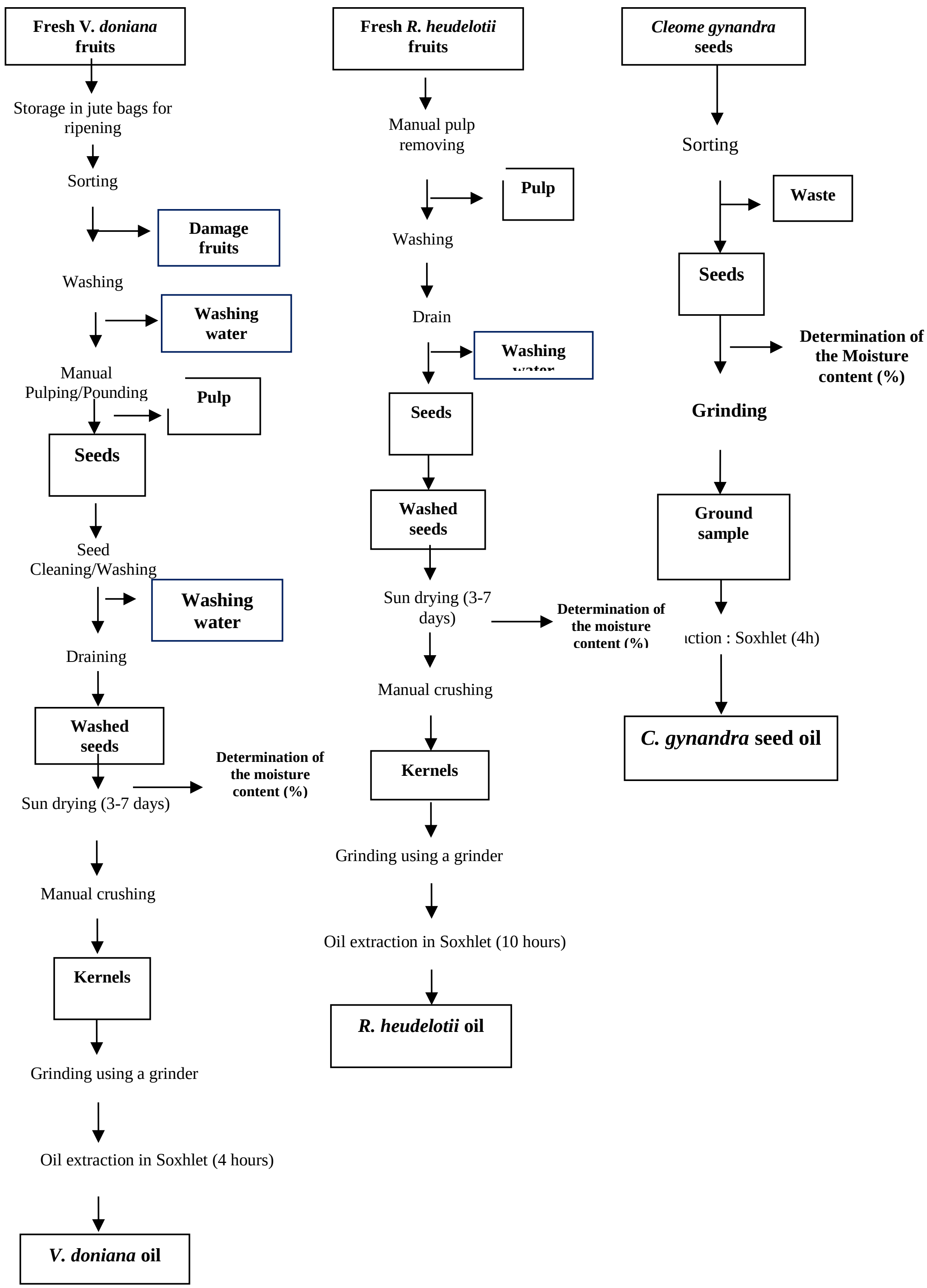

Figure 1: Seed oils extraction methods: *V. doniana* (Amah and Okogeri (2019)), *R. heudelotii (Tchiegang et al. (1997)), and C. gynandra* (Aparadh and Karadge (2010)

Proximate composition and colour analyses of dried seeds and kernels: Dry matter content of the dried kernels of *V. doniana*, *R. heudelotii*, and *C. gynandra* was determined according to the AOAC method – 1984. Total ash content was determined by the AOAC method – 1984 – after incineration at 550 °C for approximately 12 hours. Crude protein content was determined, using the Kjeldahl method (AOAC, 1984). Crude lipid content was determined according to the Soxhlet method (AOAC, 1984) with an extraction temperature between 65 °C and 70 °C for 4 hours for *C. gynandra* seeds *and V. doniana kernels*, and 10 hours for *R. heudelotii* kernels (Tchiegang *et al.*, 1997). Crude fibre content was determined according to the method described by Osborne and Voogt (1978). Colour was determined by colorimetry in the L* (brightness), a* (red saturation), b* (yellow saturation) system, using a calibrated CR-400/410 Chroma Meter (Konica Minolta) with a white ceramic reference (x = 31.71, y = 86.10). Peroxide value, acid value, and iodine value of oils were determined respectively by titration according to the NB ISO 3960 (2001), NB ISO 660 (2006) and NB ISO 3961 (2006) method. Free fatty acid content calculated as the oleic acid percentage was also determined, using NB ISO 660 (2006) method. All chemical analyses were performed in duplicate and normalized to dry weight (dw). The oil composition was determined by Gas Chromatography-Mass Spectroscopy (GC-MS) technique using the method described by Lagha-Benamrouche et al. (2017). The Agilent Masshunter Qualitative Analysis 10.0 and QQQ Quantitative Analysis (Quant-My-Way) version 10.2 data systems were used to purify and analyse the results of the chromatographic analysis of the oils.

Statistical analyses: Analyses of variance using Student's t-test were performed in Minitab to compare physico-chemical characteristics of *C. gynandra*, *R. heudelotii* and *V. doniana* seeds, kernels and oils.

RESULTS

Proximate composition, colour characteristics of the seeds and kernels of *Vitex doniana, Cleome gynandra* and *Ricinodendron heudelotii*: Proximate composition of *R. heudeloti* and *V. doniana kernels*, and *C. gynandra* seeds showed significant difference for moisture, ash, protein, lipid and fibre contents (Table 1). *R. heudelotii* kernels had the lowest moisture content (6.7%) compared to *V. doniana* kernels (8.83%) and *C. gynandra* seeds (10.39%). High lipid content was found in *V. doniana* kernels (44.39 g/100 g dw) compared to *R. heudelotii* kernels (30.99 g/100 g dw) and *C. gynandra* seeds (22.26 g/100 g dw). *R. heudelotii* kernels and *V. doniana* kernels had similar protein content (33.52 g/100 g dw and 32.29 g/100 g dw respectively) while the lowest value was found in *C. gynandra* seeds (25.58 g/100 g dw). Fibre content was higher in *C. gynandra* seeds (25.33 g/100 g dw) compared to *V. doniana* kernels (18.20 g/100 g dw) and *R. heudelotii* kernels (4.54 g/100 g dw). Higher value of ash was in *R. heudelotii* kernels (11.10 g/100 g dw), followed by *V. doniana* kernels (6.29 g/100 g dw), and *C. gynandra* seeds (5.86 g/100 g dw). The brightness (L*), redness (a*), and yellowness (b*) values were higher in *R. heudelotii* kernels (63.41, 1.49, 25.46 respectively) compared to the values found for *V. doniana* kernels (57.28, -0.49, 16.26) and *C. gynandra* seeds (35.15, -1.79, 7.28).

Table 1: Proximate composition and colour characteristics of *V. doniana*, *C. gynandra* and *R. heudelotii kernels*

Parameters	*R. heudelotti* kernels	*V. doniana* kernels	*C. gynandra* seeds
Moisture (%)	6.70 ± 0.55[1a]	8.83 ± 0.31[b]	10.39 ± 0.13[c]
Lipid (g/100 g dw)	30.99 ± 0.32[b]	44.39 ± 0.23[c]	22.26 ± 0.59[a]
Protein (g/100 g dw)	33.52 ± 2.62[c]	32.29 ± 0.36[b]	25.58 ± 0.74[a]
Fibre (g/100 g dw)	4.54 ± 1.75[a]	18.20 ± 1.4[b]	25.33 ± 0.05[c]
Ash (g/100 g dw)	11.10 ± 0.15[c]	6.29 ± 0.09[b]	5.86 ± 0.38[a]
Brightness (L*)	63.41 ± 0.09[c]	57.28 ± 0.74[b]	35.15 ± 0.22[a]
Redness (a*)	1.49 ± 0.08[c]	-0.49 ± 0.08[b]	-1.79 ± 0.01[a]
Yellowness (b*)	25.46 ± 0.13[c]	16.26 ± 0.08[b]	7.28 ± 0.56[a]

[1] Mean ± standard error of mean; means with the same letters in the row are not statistically different at 5% significance level. Statistical analysis revealed significant difference for all colour parameters (L*, b*, a*) among the three wild plants. *R. heudelotii* showed the highest value for all the parameters.

Physicochemical properties and quality of the seed oils of *Vitex doniana, Cleome gynandra* and *Ricinodendron heudelotii*: *Colour and quality index of V. doniana, R. heudelotii, and C. gynandra seed oils.* Brightness (L*= 70.73 ± 0.52) and yellowness (b*=12.47 ± 1.31) values were found to be significantly higher for *R. heudelotii* oil ($p = 0.018$ and $p = 0.027$, respectively) when compared to the values found for *V. doniana* seed oils (67.87 ± 0.14 and 8.37 ± 0.16) and *C. gynandra* seed oils (69.82 ± 0.59 and 10.89 ± 0.63). Acid, peroxide, and iodine values are parameters commonly used for determining the quality of oil. In this study, the acid value of *V. doniana* oil was 8.55 mg KOH/g; its peroxide value was 14.69 mEq O2/kg, and its iodine value was 68.68 gI_2/100 g (Table 3). Acid, iodine, and peroxide values for *R. heudelotii* kernel oil, was 6.87 mg KOH/g, 237.32 gI_2/100 g, and 33.87 mEq O2/kg, respectively (Table 2). The acid value, iodine value, and peroxide value for *C. gynandra* seed oil were 33.45 mg KOH/g, 62.25 gI2/100 g, and 17.56 mEq O2/kg, respectively (Table 2). Comparison of the acid value of *R. heudelotii* kernel oil with that of *V. doniana* kernel oil and *C. gynandra* seed oil revealed significant difference between the values ($p=0.001$). Highest peroxide values were found in *R. heudelotii* kernel oil ($p=0.003$), while *C. gynandra* seed oil had significantly lower iodine values ($p=0.000$) than *R. heudelotii* and *V. doniana* oil, indicating that its fatty acids are relatively more saturated.

Table 2: Colour characteristics and quality index of *V. doniana*, *C. gynandra* and *R. heudelotii* seed oils

Parameters	***R. heudelotti* kernel oil**	***V. doniana* kernel oil**	***C. gynandra* seed oil**
Acid value (mg KOH/g)	6.87 ± 0.971[a]	8.55 ± 0.65[b]	33.45 ± 2.46[c]
Peroxide (mEq O_2/kg)	33.87 ± 2.32[c]	14.69 ± 0.95[a]	17.56 ± 1.75[b]
Iodine (gI_2/100 g)	237.32 ± 8.17[c]	68.68 ± 0.92[b]	62.25 ± 5.43[a]
FFA (% oleic acid)	10.54 ± 0.34[a]	11.48 ± 0.81[b]	30.14 ± 4.68[c]
Brightness (L*)	70.73 ± 0.52[c]	67.87 ± 0.14[a]	69.82 ± 0.59[b]
Redness (a*)	7.32 ± 0.46[a]	6.64 ± 0.02[a]	6.32 ± 0.11[a]
Yellowness (b*)	12.47 ± 1.31[c]	8.37 ± 0.16[a]	10.89 ± 0.63[b]

[1] Mean ± standard error of mean; means with the same letters in the row are not statistically different at 5% significance level

Volatile compounds of *Vitex doniana, Ricinodendron heudelotii* and *Cleome gynandra* seed oils: A total of 23 compounds were identified in the *V. doniana* kernel oil through chemical analysis, while 22 compounds were identified in *R. heudelotii* kernel oil and 20 compounds in *C. gynandra* seed oil (Table 3). The most prevalent group was acids (61.55%, 24.86%, 60.80% respectively in *V. doniana* oil, *R. heudelotii* oil, *C. gynandra* oil). *R. heudelotii and V. doniana* oils were also rich in phytosterols (24.39% and 16.42% respectively). The oils of *C. gynandra* and *V. doniana* were found to contain more than 60% fatty acids. The total of saturated fatty acids (hexadecanoic acid C16:0 or palmitic acid) in *V. doniana* oil was 9.89% and it was the only saturated fatty acid present in this oil. Total unsaturated fatty acids (6-octadecenoic acid C18:1 or petroselinic acid and 9.12-octodecadienoic (Z, Z) acid (C18:2 or alpha-linoleic acid) in *V. doniana* oil, is 51.63% and the predominant acid is petrosilenic acid (39.09%). Two fatty acids were identified in *R. heudelotii* oil: a saturated fatty acid (C5:0 hexanoic acid or caproic acid) and a monounsaturated fatty acid (oleic acid 16.63%). The only saturated fatty acid identified in *C. gynandra* seed oil is myristic acid (or C14:0 tetradecanoic acid) which is found in trace amounts (0.057%). The oil also contains oleic acid (44.75%) and a methyl ester of linoleic acid (15.99%).

Table 3: Volatile compounds in *V. doniana*, *R. heudelotii* and *C. gynandra* seed oil

Compounds	Abundance	RC
***Vitex doniana* kernels oil**		
2- Octenal (E)-	56	0.07
dl — Alanyl-l-phenylalanine	64	0.08
2.4-Decadienal (E, E) —	94	0.37
7-Pentadecyne	91	0.47
Eicosene<1->,	56	13.47
n-Decane	76	0.47
Cycloheptane, methyl-	55	0.18
6- Octadecenoic acid	99	39.09
9.12-Octadecadienoic acid (Z, Z)-	96	12.57
Hexadecanoic acid,	98	9.89
Metaraminol,	68	0.016
Hexadecanol<n->	58	1.26
2- Methyl-Z, Z-3,13-octadecadienol,	90	0.93
Ethanol, 2-phenoxy-,	89	0.05
Pregn-5-en-3-ol, 20-amino-, (3.beta.,20S)-,	64	0.05
Cyclopentadecanone, 2-hydroxy-	90	0.53
alpha.-Amyrin,	90	1.32
delta.-Tocopherol, O-methyl -	95	1.84
Campesterol	96	1.77
Pseudophytol<6Z, 10Z->	80	7.12
Stigmasta-5,24(28)-dien-3-ol, (3.beta.,24Z)-	99	5.69
Stigmasterol,	99	1.13
Stigmastan-3,5-diene	91	0.71
Total		**99.98**
Acids		**61.55**
Phytosterols		**16.42**
Hydrocarbons		**14.59**
Alcohols		**3.21**

Vitamin		**1.84**
Triterpenes hydrocarbons		**1.32**
Ketones		**0.53**
Carbonyls		**0.52**
***Ricinodendron heudelotii* kernel oil**		
Phenylephrine	58	1.75
Propanamide	50	2.92
3- Butenamide	50	0.15
2-Hexanamine	52	0.20
Ala-gly, trimethylsilyl este	52	2.55
Azetidin-2-one 3.3-dimethyl-4- (1-aminoethyl	58	0.14
1— [3.5-Dimethyl-1-adamantanoyl] semicarbazide	52	1.44
2.4-Decadienal (E, E) —	55	0.19
Nonadienal<2E,4E-	94	0.44
Bicyclo [3.2.0] heptane, 2-methylen –	55	15.13
6- Azabicyclo [3.2.1] octane	64	0.74
3- Azabicyclo [3.2.2] nonane	43	0.23
Squalene	95	2.53
Benzeneethanamine, N-methyl	50	0.12
1,4-Benzenedicarboxamide, N,N'— bis [2-hydroxy-1-methyl-2-phenylethyl] —	50	2.76
8-[N-Aziridylethylamino]-2,6-dimethyloctene-2	56	0.23
Oleic acid	86	16.63
Hexanoic acid	72	8.23
Turmerone<ar-	89	0.14
. beta.-tocopherol	76	10.54
dl-. alpha.-Tocopherol	95	6.32
. beta.-sitosterol	94	24.39
Total		**97.77**
Acids		**24.86**
Phytosterols		**24.39**
Hydrocarbons		**18.63**
Vitamin		**16.86**
Carbonyls		**9.78**
Benzenoid hydrocarbons		**3.11**
Ketones		**0.14**
***Cleome gynandra* seeds oil**		
Phenylephrine	52	0.03
Propanamide	50	0.08
1- [3.5-Dimethyl-1-adamantanoyl] semicarbazide	64	0.02
2— Heptanamine, 5-methyl — ,	50	0.05
N-(3,5-Dinitropyridin-2-yl)-L-aspartic acid,	52	0.006
Cycloeicosane	59	13.72
9-Oxabicyclo[6.1.0]nonane	59	1.80
Methyl chavicol,	98	0.05
(5-Methyloctyl) benzene	64	0.04
Benzeneethanamine, 2-fluoro-.beta.,3-dihydroxy-N-methyl – ,	53	0.003
Octadec-9-enoic acid	97	44.75
Tetradecanoic acid,	99	0.057
Methyl linoleate	60	15.99
Z,Z-3,13-C18-dienol	53	10.15
3.3-Dimethyl-4-methylamino-butan-2-one	52	0.03

4,4,6a,6b,8a,11,11,14b-Octamethyl-1,4,4a,5,6,6a,6b,7,8,8a,9,10,11,12,12a,14,14a	0.20	0.20
Vitamin E,	80	3.67
.gamma.-Tocopherol,	93	5.42
Stigmast-4-en-3-one,	81	0.53
Piperazine, 2-methyl – ,	53	0.03
Total		**97.19**
Acids		**60.80**
Hydrocarbons		**15.57**
Alcohols		**10.15**
Vitamin		**9.09**
Phytosterols		**0.53**
Triterpenes hydrocarbons		**0.20**
Carbonyls		**0.186**
Benzenoid hydrocarbons		**0.043**
Ketones		**0.03**
Pyrazines		**0.03**

*RC The relative content of each compound (%)

DISCUSSION

Proximate composition of the seeds and kernels of *V. doniana, C. gynandra* and *R. heudelotii*: The evaluation of the physico-chemical composition of *C. gynandra*, *R. heudelotii*, and *V. doniana* seeds revealed relatively high lipid content in all samples , with values of 22.26 g/100 g dw, 44.39 g/100 g dw, and 30.99 g/100 g dw, respectively for *C. gynandra*, *V. doniana*, and *R. heudelotii* seeds. These values are significantly higher than that commonly found in soybean, cotton and sunflower (18%), (Kouamé *et al.*, 2015). Furthermore, the lipid content of *V. doniana* kernels is comparable to that of groundnut oil (up to 46%), while the lipid content of *C. gynandra* is similar to that found in palm nuts (21–23%) (Karoui *et al.*, 2021, Sbai *et al.*, 2022). These high lipid contents of the samples make them potential sources of fat in oil industry. Additionally, the seeds and kernels of these species had a high protein content (255.8 g/kg dw, 322.9 g/kg, 335.2 g/kg respectively for *C. gynandra*, *V. doniana*. and *R. heudelotii*) compared to legumes (beans, soybeans, peanuts, lentils.) and cereal grains which are in the range of 180–250 g/kg dw and 78–228 g/kg dw, respectively (Oliveira *et al.*, 1999). However, these seeds are not traditionally used as human food, but they can be used in the composition of other food products or animal feed to improve the lipid, protein, and/or fibre contents.

Physicochemical properties of quality of *V. doniana, C. gynandra* and *R. heudelotii* seed oils: The quality of edible oils is determined by their physical, nutritional, and organoleptic properties. The acid value of the oils studied exceeds the standard set by the Codex Alimentarius (1999) (0.6 mg KOH/g in refined oils and 4.0 mg KOH/g in oils obtained by cold pressing and virgin oils. *C. gynandra* oil has the highest free fatty acid content while *R. heudelotii* oil has the lowest free fatty acid content. The peroxide values of *C. gynandra*, *R. heudelotii*, and *V. doniana* oils are above the maximum limit for refined oils for food use (10 mEq O_2/kg), indicating that these oils oxidize easily and cannot be stored for a long period of time (M'baye *et al.*, 2012). Therefore, purification or refining is necessary to neutralize the free fatty acids and improve the shelf life of these oils (Cahuzac-Picaud, 2010, Cossut *et al.*, 2002, Régis *et al.*, 2016). Vegetable oils are classified into three groups based on their iodine value: drying or "siccative oils" with values above 130, semi-drying or semi-siccative oils with values between 115 and 130, and non-drying oils with values below 115 (Yirankinyuki *et al.*, 2018). Based on these classifications, *V. doniana* and *C. gynandra* seed oils are non-drying oils (iodine values: 68.68 ± 0.92 and 62.25 ± 5.43 respectively), while *R. heudelotii* kernel oil is a drying oil (iodine value = 237.32 ± 8.17). Drying oils are those that dry to form flexible films due to reaction taking place through a complex chemical oxidation reaction and transforming the structure of these oils from a liquid state to a solid state. Since they produce films, drying oils are used as paint or varnish binders. According to (Pioch, 2018), oils with iodine value ranging between 90 and 140 and melting temperature below 10 C can be used as seasoning oil, while oils with iodine value less than 110 and linolenic acid content less than 2% can be used as frying oil; when iodine value is around 30 and linolenic acid content is low, this oil can be used in baking and in the production of margarine. According to this classification, *V. doniana* oil can be used as frying oil. Furthermore, *V. doniana* kernels contain a high percentage of unsaturated fatty acids dominated by petroselinic acid, a monounsaturated fatty acid that has a higher melting point than oleic acid and is of interest in the margarine industry for the production of solid unsaturated vegetable oils at room temperature (Ohlrogge, 1994). *V. doniana* kernel oil is rich in 9.12-Octadecadienoic acid (Z, Z) – which is a conjugated linoleic acid (CLA) of the omega-6 fatty acid family, essential for humans. *V. doniana* kernel oil also contains tocopherol, triterpenoids and sterols, mainly delta-tocopherol, O-methyl-, α-amyrin, and stigmasterol respectively. Delta tocopherol is a form of vitamin E with antioxidant properties and stigmasterol is a phytosterol with cholesterol-lowering properties and potential cancer-preventing properties. Free fatty acid composition of *C. gynandra* seed is characterized by the dominance of oleic acid or Omega 9, accounting for 44% of the total composition of the oil, and a methyl ester of linoleic acid in no lesser quantity. Positive effect of monounsaturated fatty acid specifically oleic acid on cardiovascular diseases, regulation of plasma LDL, have found in earlier studies. Like *V. doniana* kernels oil, *C. gynandra* seed oil is a powerful antioxidant as it contains high amounts of the γ-form of tocopherol and vitamin E. *R. heudelotii* kernel oil is rich in oleic acid and in β-sitosterol. Fatty acids of omega-9 families are known for their protective properties in various pathologies, in particular cardiovascular diseases; they intervene in a positive way on the metabolism of cholesterol by favouring its internalization in the cells, with the resulting reduction in plasma levels (Johnson and Bradford, 2014, Farag and Gad, 2022). Beyond their use in the treatment of several diseases, the studied oilseeds of the three species are of importance in cosmetics because of their richness in tocopherol, phytosterols and alpha amyrin (specifically for *V. doniana* oil). These bioactive compounds are natural antioxidants. They reinforce skin hydration; allow the barrier function of the skin and microcirculation use. They exhibit anti-inflammatory activity and are used as anti-aging and against action of UV.

CONCLUSION AND APPLICATION OF RESULTS

This study explored the profile of the oils extracted from *R. heudelotii, V. doniana*, and *C. gynandra* seeds. The high peroxide value *of R. heudelotii* kernel oil indicates a higher level of lipid oxidation. *C. gynandra* seed oil has a lower iodine value and therefore a higher degree of saturation compared to the other two oils. Furthermore, *V. doniana* kernels contain a high percentage of monounsaturated fatty acids. The oil from *R. heudelotii* kernels is rich in vitamins and phytosterols, while *V. doniana* kernel oil is rich in phytosterols. The high levels of unsaturated fatty acids found in *V. doniana* oil may make it particularly suitable for use as a moisturizer or in other skin care products. Similarly, the presence of tocopherols in *R. heudelotii* oil may make it a useful ingredient in dietary supplements or functional foods. *V. doniana* and *C. gynandra* oils may have potential anti-inflammatory or anti-cancer properties. It is important to note that further research is needed to evaluate the safety and efficacy of these compounds when used in various applications.

ACKNOWLEDGMENTS

Financial support from WILD OIL Project/PFCRIII of University of Abomey-Calavi is gratefully acknowledged. The authors are grateful to Dr. Ir. R. Castro Gbedomon for their valuable scientific comments.

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