Characteristics of Guindilla (*Valenzuela trinervis* Bert.) Oil

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Seed of Guindilla (*Valenzuela trinervis* Bert.) and its oil were characterized. On a dry weight basis, the seed consists of 56% hull and seed coat and 44% cotyledon, containing about 67.0% lipids. The main fatty acids are: 62.3% oleic, 12.9% gadoleic, 10.1% linoleic and 9.6% palmitic. Physical properties of oil, expressed by hand press, include: melting point, −6 to −2 C; iodine value, 75.1; saponification value, 192; and unsaponifiable matter, 0.8%.

New oilseed and other oil-bearing crops are under intensive investigation for food and industrial uses (1). Some interesting industrial applications for new oils exist in the manufacture of lubricants, surfactants, insulations, inks, varnishes and adhesives, and as fuels. To be economically attractive these lipids sources must have a high oil content and the ability to survive and thrive in soils and climates regarded unsuitable for agriculture.

The genus *Valenzuela* is comprised of three species which are restricted to Chile and Argentina (2). Guindilla (*Valenzuela trinervis* Bert.) is a small shrub native to the mountains of this area of the world. The plant grows abundantly at altitudes over 1,500 m, and it is usually covered by snow during the winter. The seed has two cotyledons wrapped inside a seedcoat and contained in a round, thick hull 1 to 1.5 cm in diameter.

A recent paper deals with the chemical components of guindilla seeds (3). As in all Sapindaceae, the oil fraction, although abundant, contains toxic cyanolipids (4). The objective of this work was to study the physical and chemical properties of guindilla oil.

EXPERIMENTAL PROCEDURES

Materials. Guindilla seeds were hand-picked in the mountainous areas near Santiago, Chile, between February and April, 1984. A 6-kg sample was used for analyses. Since the shrub grows wild in extensive patches, no estimate of yield per ha. could be made at that time, but about 200-300 g of fruits were obtained from some plants.

Methods. Seeds were fractured and separated by hand into hull, seed coat and cotyledons. Oil was extracted by pressing ground cotyledons in a laboratory press.

Selected physical and chemical properties of the refined oil were determined following AOAC methods (5) as listed in Table 1. The boiling point was determined in a distillation unit (Koehler Instruments Co., Bohemia, New York). The smoke point was obtained in an apparatus also manufactured by Koehler Instruments Co. Surface tension was measured in a Fisher Surface Tensiomat Model 21 (Fisher Scientific Co., Pittsburgh, Pennsylvania). Viscosity was determined in a Brookfield Viscometer Model RTV (Brookfield Engineering Labs, Stoughton, Massachusetts). Color was measured in a Lovibond Tintometer (The Tintometer Co., Williamsburg, Virginia), using an oil column of 5.25 in.

The microstructure of the seeds was studied with an ETEC Autoscan scanning electron microscope at 5 kV. The samples were frozen in liquid nitrogen and fractured. The free surface was treated with chloroform for 10 min to remove some of the oil, and the pieces were mounted on aluminum stubs using silver conductive paint and covered with gold/palladium.

TABLE 1

Properties of Guindilla Oil

Property	Value	Method
Melting point	−6 to −2 C	AOAC 28.009
Boiling point at 750 mm Hg	244 C	
Smoke point	113 C	
Refractive index at 25 C	1.4699	AOAC 28.006
Specific gravity, 25/25 C	0.9149	AOAC 28.006
Viscosity at 25 C (cp)	69	
Surface tension at 20 C (dyne/cm)	46.1	
Peroxide value (meq/kg)	2.27	AOAC 28.022
Iodine value (g/100 g oil)	75.1	AOAC 28.018
Saponification value	192	AOAC 28.025
Unsaponifiable matter (%)	0.8	AOAC 28.035
Free fatty acids (%)	0.06	AOAC 28.029

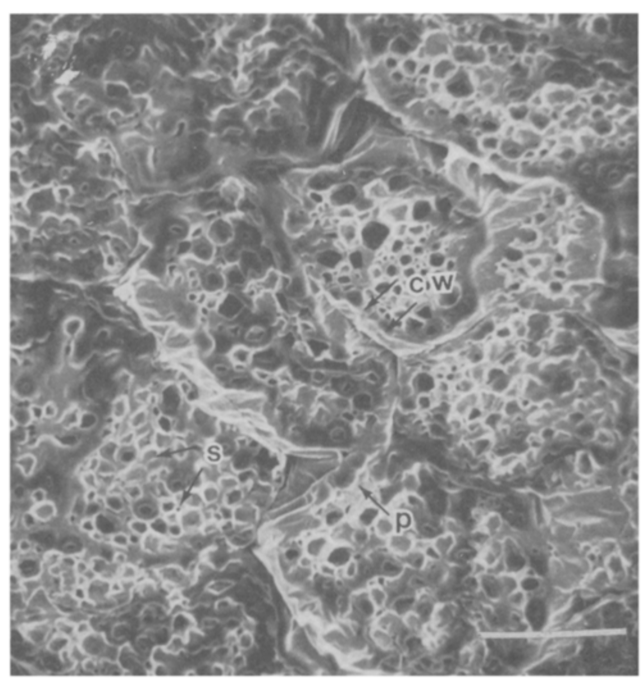

FIG. 1. Scanning electron microscopy of a cross section of a defatted cotyledon from Guindilla. S, spherosomes sites; P, protein bodies; CW, cell wall. Marker 20 μm.

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RESULTS AND DISCUSSION

Cotyledon cells of *Valenzuela trinervis* are parenchymatous, variable in shape and range in size from 10 to 40 μm in diameter. They were filled with oil globules or spherosomes imbedded in an irregular matrix where some structures like protein bodies were apparent (Fig. 1).

Cotyledons comprised 44% of the dry weight of the seed and contained about 67.0% lipids and about 35% protein (oil free basis) (3). This high overall oil content of the fruit is very unusual. The kernel of babassu palm contains 60-70% oil, but constitutes only 10% of the fruit. The main fatty acids were: oleic, 62.3%; gadoleic, 12.9%; linoleic, 10.1%, and palmitic, 9.6% (3). The hull and seed coat, comprising 56% of the fruit, showed no outstanding characteristics.

Sixty six percent of the total oil was extracted with the laboratory press, using a constant load of 227 kg/cm^2 during 30 min. The crude oil had about 5% stearines which precipitated after 15 min at −10 C. The color was light yellow (Lovibond color 30 Y, 3.0 R), but was easily decolored with Fulmont earth to a Lovibond of 2 Y; 0.2 R.

Selected properties of refined Guindilla oil are presented in Table 1. The oil was low in acidity (< 0.01%), peroxide value (2.3 meq/kg) and unsaponifiable matter (0.8%). The saponification value was 192, within the range typical of triglyceride mixtures (6). The iodine value (75.1) indicated that guindilla oil is non-drying.

The melting range was rather low (−6 to −2 C), compatible with the cold environmental conditions where Guindilla grows. The boiling and smoke points were low (244 and 113 C, respectively) when compared to jojoba oil (7). Surface tension (46.1 dyne/cm) was higher than in most vegetable oils, while viscosity at 25 C was in the typical range (6). The refractive index (n), important for identification and grading, correlated well with temperature (T, °C) according to the linear relationship:

$$n = 1.4786 - 0.000362\ T$$

Similarly, the specific gravity (sg) was related to temperature by the following equation:

$$sg = 0.9250 - 0.0005\ T$$

Further studies on the potential of this oil in non-food applications are underway.

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