Some Physical Properties of Gilaburu Seed

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Abstract: In this study, the physical properties of gilaburu (*Viburnum opulus* L.) seed have been investigated. The average length, width, thickness and geometric mean diameter values in 54% of moisture content of gilaburu seed were between 6.56 and 8.44 mm, 6.24 and 8.57 mm, 1.62 and 2.52 mm, 4.19 and 5.31 mm, respectively. Sphericity, surface area, thousand seed mass and terminal velocity values in the same moisture content increased from 0.59 to 0.68, from 55.22 to 88.65 mm^2, from 75.00 to 78.30 kg, from 4.52 to 5.15 m s^{-1}; the bulk density, true density, porosity and angle of repose values changed betweeen 524.82 and 546.81 kg m^{-3}, 981.45 and 1046.15 kg m^{-3}, % 45.46 and 50.14%, 22.60^o and 26.78^o, respectively. The physical properties of gilaburu seed are necessary for the design of equipments for planting, harvesting, seperating, transporting, storage and other processing.

Key Words: Gilaburu seed (*Viburnum opulus* L.), Physical properties.

Gilaburu Tohumunun Bazı Fiziksel Özellikleri

Öz: Bu çalışmada gilaburu (*Viburnum opulus* L.) tohumunun fiziksel özellikleri araştırılmıştır. % 54 nem içeriğindeki gilaburu tohumunun, uzunluk, genişlik, kalınlık ve geometrik ortalama çap değerlerinin sırasıyla 6.56 ile 8.44 mm, 6.24 ile 8.57 mm, 1.62 ile 2.52 mm ve 4.19 ile 5.31 mm arasında olduğu tespit edilmiştir. Küresellik, yüzey alanı, 1000 tane ağırlığı ve kritik hız değerlerinin sırasıyla, 0.59' dan 0.68' e kadar 55.22 mm^2' den 88.65 mm^2'ye, 75.00 kg'dan 78.30 kg 'a kadar ve 4.52 m/s 'den 5.15 m/s 'ye kadar değiştiği, hacim ağırlığı, kütlesel yoğunluk, porozite ve doğal yığılma açısı değerlerinin sırasıyla, 524.82 kg/m^3' den 546.81 kg/m^3' e, 981.45 kg/m^3 'den 1046.15 kg/m^3 'e, % 45.46 'dan % 50.14 'e ve 22.60^o 'den 26.78^o 'ye değiştiği belirlenmiştir. Gilaburu tahumunun fiziksel özellikleri gilaburu tohumunun ekim, hasat, ayırma, taşıma, depolama ve diğer işlemler için gerekli olan ekipmanların dizayn edilmesine yardımcı olmaktadır.

Anahtar Kelimeler: Gilaburu tohumu (*Viburnum opulus* L.), fiziksel özellikler.

Introduction

Gilaburu seed having economical value are used in medical science for curing ilnesses, also painting properties and in the ink industry. They come from the family of *Caprifoliaceae* (honeysuckle) of Discapales group (Rubiales). Gilaburu plant (*Viburnum opulus* L.) is known as Crampark, Guelder Rose, European Cranberrybush.

Gilaburu grows rapidly and has got long life. Its height can reach from 1.3 to 3.5 meters. Plant starts to give fruit after 3 years from planting and can live 300 years owing to deep shoots. At the end of summer the shapes are as spherical and the bunch has got between 30 and 40 fruits. Fruit's productivity per tree is approximately 8.4 kg. Fruit juice productivity is around 43.5%. Gilaburu generally grows hot and dry climatological conditions in summer and snowy conditions in winter, and it is grown as fence plant in Turkistan, Siberia, America, Europe, North Asia and North Africa (Davis 1972). In Turkey, it is grown in especially Kayseri, Bursa, Sakarya, Ankara, Tokat, Sivas, Trabzon, K.Maraş, Kırşehir, Istanbul, İzmit, Erzurum and Samsun cities (Ekici and Velioglu 2003).

The fruit of gilaburu is collected at the end of autumn in Turkey. Then, the fruits are washed and, gilaburu soaked in water during three months. At the end of this process, the fruits of gilaburu ripens. The ripened fruits are pressed to obtain juice and diluted with water (1:4) before drinking and added sugar is to this solation (Soylak *et al*. 2002).

The peels and fruits of gilaburu is widely used pharmacology. İt has been reported that it is used for light asthma, epilepsy, high tension, some heart problems, rheumatism and some nervous problems as

internal, and used for some skin problems such as eczema as external. It is determined that gilaburu liquid has also dissolve sand and stone of kidney. In Anatolia, this plant is used for cure of bile and liver diseases. Besides, main using branches are cramps and menstrual aches. It is expected that component, which provide the muscle relaxation, is 'viopu-dial". Other active components of gilaburu are coumarone and tannin such as hydroquinone, arbutina, methylarbutina, scopoletine and scopoline. One of the other research reported that to take 250 g gilaburu liquid per day has positive effects on human health.

Knowledge of the physical properties of gilaburu seed is essential to facilitate the design of equipment for handling, harvesting, processing, transportation and storing the fruit. Various types of cleaning and seperation equipment are designed on the basis of preserving the physical properties of gilaburu fruit and seeds. However, no published work seems to have been carried out on the physical properties of gilaburu seed.

Materials and Methods

In this study, gilaburu was taken from the local market in Kayseri province. Foreign materials such as ash, parts of arm and leaves were removed from gilaburu seed. The initial moisture content of the seed was determined by using the standard hot air oven method at least three samples at 70 ± 1^0C for 24 hours (Gupta and Das 1997; Brusewitz 1975; Altuntaş *et al. 2005; Özarslan 2002; Coşkun et al. 2005*). The average moisture content was found to be 54% d.b.

Seed dimensions were measured by a micrometer to an accurancy of 0.01 mm. The weight of seeds and thousand seed mass were measured by an electronic balance to an accuracy of 0.001 g. To evaulate thousand seed mass, randomly selected hundred seeds from the bulk were weighed and averaged.

With this determined axis measures, geometric mean diameter (D_g) and sphericity (Ø) values were calculated (Mohsenin 1970; Kabaş and Özmerzi 2006).

$$D_g=(LWT)^{1/3} \qquad (1)$$

where L is the length, W is the width and T is the thickness in mm.

$$\text{Ø} = (LWT)^{1/3} / 3 \qquad (2)$$

The surface area of gilaburu seed was found by analogy with a sphere of the same geometric mean diameter, using the following equation cited by Sacilik et al. (2003), Tunde-Akintunde and Akintunde (2004) and Altuntaş et al.(2005):

$$S = \pi D_g{}^2 \qquad (3)$$

where S is the surface area in mm^2.

The bulk density was determined by filling a circular container of 500 ml in volume with the seed from a height of 150 mm at a constant rate and weighing the contents (Gupta and Das 1997). No seperate manual compaction of seed was done. The bulk density was calculated from the mass of the seeds and the volume of the container. The true density defined as the ratio between the mass of gilaburu seed and the true volume of seed was determined using the toluen (C_7H_8) displacement method. Toluene was used in place of water because it is absorbed by seeds to a lestel extend. The volume of toluene displaced was found by immersing a weight quantity of gilaburu seed in the toluene (Sacilik et al. 2003).

The porosity of gilaburu seed was calculated from bulk and true densities using the relationship given by Mohsenin (1970) as follows:

$$\varepsilon= (1-\rho_b / \rho_t).100 \qquad (4)$$

where ε is the porosity in %, ρ_b is the bulk density in kg m^{-3} and ρ_t is the true density in kg m^{-3}.

To determine the dynamic angle of r epose, θ a plywood box measuring 300 mm × 300 mm × 300 mm, having a removable front panel was used. The box was filled with the seeds at the desired moisture content and the front panel was quickly removed, allowing the seeds to flow to their natural slope. The angle of repose was calculated from measurements of seed free surface depths at the end of the box and midway along the sloped surface and horizontal distance from the end of the box to this midpoint. This method has been used by other researchers (Kaleemullah and Gunasekar 2002, Sacilik et al. 2003 and Karababa 2006). The angle of repose may also be determined from the diameter and height of a heap of seeds on a circular plate (Viswanathan et al. 1996).

$$\theta= \tan^{-1}(2H / D) \qquad (4)$$

where: H is the height of the cone in cm and D is the diameter of cone in cm.

The terminal velocities of gilaburu seed were measured using an air columm device. For each experiment, a sample was dropped into an air stream from the top of the air columm. Then airflow rate was gradually increased until the seed became suspended in the air stream. The air velocity which kept the seed in suspension was measured using a pilot tube in conjuction with a micromanometer. Each sample consisted of 30 seeds selected randomly at the same content of the seed. Three replications were taken for each sample (Sacilik et al. 2003; Gupta and Das 1997).

All the experiments were replicated five times for each gilaburu samples and the average values were reported.

Results and Discussion

The values of all the physical properties measured are summarised in Table 1. The length ranged from 6.56 to 8.44 mm, width ranged from 6.24 to 8.57 mm and thickness ranged from 1.62 to 2.52 mm. The geometric mean diameter increased from 4.19 to 5.31 mm. The surface area ranged from 55.22 to 88.65 mm^2. The sphericity of the seeds varied from 0.59 to 0.68. The seeds have a bulk density of 524.82 to 546.81 kg m^{-3}. The seeds have a true density of 981.45 to 1046.15 kg m^{-3}. The porosity of gilaburu seed ranged from 45.46% to 50.14%. The angle of repose ranged from 22.60^o to 26.78^o. The terminal velocity of gilaburu seeds varied from 4.52 to 5.15 m s^{-1}.

Similar trends have been reported by Sacilik et al.(2003) for hemp seeds, Sirisomboon et al. (2006) for green soybean, Özarslan (2002) for cotton seeds, Aviara et al. (1999) for guna seeds, Konak et al. .(2002) for mahaleb kernels, Altuntaş et al .(2005) for fenugreek seeds, Çetin (2006) for barbunia bean

seeds, Gupta and Das (1997) for sunflower seeds, Kaleemullah and Gunasekar (2002) for arecanut kernels, Coşkun et al. (2005) for sweet corn seeds, Nimkar and Chattopadhyay (2001) for green gram, Gezer et al. (2002) for apricot pit and kertnel and Aydın and Özcan (2002) for terebinth fruit.

Conclusions

The following conclusions are drawn from this investigation into physical properties of gilaburu seeds.

(1) The average length, width and thickness values of gilaburu seed were 7.51, 7.16 and 2.05 mm, respectively.

(2) The average geometric mean diameter of gilaburu seed value was 4.71 mm.

(3) The average thousand seed mass of gilaburu seed value was 76.57 g.

(4) The average surface area of gilaburu seed value was 69.93 mm^2.

(5) The average sphericity of gilaburu seed value was 0.63.

(6) The average bulk density of gilaburu seed value was 536.39 kg m^{-3}.

(7) The average true density of gilaburu seed value was 1011.67 kg m^{-3}.

(8) The average angle of repose of gilaburu seed value was 24.69^o.

(9) The average porosity of gilaburu seed value was 47.11%.

(10) The average terminal velocity of gilaburu seed value was 4.62 m s^{-1}.

Table 1.Some physical properties of gilaburu seed

Physical properties	Number of observations	Mean value	Standart deviation
Length L , mm	100	7.51	0.50
Width W, mm	100	7.16	0.54
Thickness T, mm	100	2.05	0.18
Geometric mean diameter, mm	100	4.71	0.26
Sphericity	100	0.63	0.02
Surface area, mm^2	100	69.93	7.85
Thousand seed mass, g	10	76.57	1.66
Bulk density, kg m^{-3}	10	536.39	10.67
True density, kg m^{-3}	10	1011.67	32.56
Angle of repose, deg.	10	24.69	2.25
Porosity, %	10	47.11	0.02
Terminal velocity, m s^{-1}	30	4.62	0.33

References

Altuntaş, E., E. Özgöz and O. F. Taşer. 2005. Some physical properties of fenugreek (*Trigonella foenum-graceum* L.) seeds. Journal of Food Engineering, 71(1), 37-43.

Aviara, N. A.,M. I. Gwandzang and M. A. Haque. 1999. Physical properties of guna seeds. Journal of Agricultural Engineering Research, 73(2), 105-111.

Aydin, C. and M. Özcan. 2002. Some physico-mechanic properties of terebinth (*Pistacia terebinthus* L.) fruits. Journal of food engineering, 53(1), 97-101.

Brusewitz, G. H. 1975. Density of Rewetted High Mistur Grains. Transactions of the ASAE. 18(5), 935-938.

Coşkun, M. B., I. Yalçın and C. Özarslan. 2005. Physical Properties of sweet corn seed (Zea mays saccharata Strut). Journal of Food Engineering. 74, 523-528.

Çetin, M. 2006. Physical properties of barbunia bean (*Phaseolus vulgaris* L. Cv. 'Barbunia') seed. Journal of Food Engineering. 80. 353-358.

Davis, P. H. 1972. Flora of Turkey and the East Aegean Islands. Volume.4. Edinburg University Press, 544.

Ekici, L. and S. Velioglu. 2003. Gilaburu ve sağlık. www.cine-tarim.com.tr/dergi/arsiv46/ arastirma02.htm. Accesed 25 January 2005.

Gezer, İ., H. Hacıseferoğulları and F. Demir. 2002. Some Physical Properties of Hacıhaliloğlu Apricot pit and Kernel. Journal of Agriculture Engineering Research. 56(1):49-57.

Gupta, R. K., and S. K. Das. 1997. Physical properties of sunflower seeds. Journal of Agricultural Engineering Research. 66 (1), 1-8.

Kabaş, Ö. and A. Özmerzi. 2006. Characteristic of washington orange in water that grown in Antalya Region. Journal of Agricultural Machinery Science. Vol:1, Number:1, 37-42.

Kaleemullah, S. and J. J. Gunasekar. 2002. Moisture-dependent physicial properties of Arecanut Kernels. Biosystems Engineering. 82(3). 331-338.

Karababa, E. 2006. Physical properties of popcorn kernels. Journal of Food Engineering. 72. 100-107.

Konak, M., K. Çarman and C. Aydın. 2002. Physical properties of chick pea seeds. Biosystems Engineering. 82(1). 73-78.

Mohsenin, N. N. 1970. Physical Properties of Plant and Animal Materials. Gordon and Breach Science Publishers, New York

Nimkar, P. M. and P. K. Chattopadhyay. 2001. Some physical properties of green gram. Journal of Agricultural Engineering Research. 80 (2). 183-189.

Özarslan, C. 2002. Some physical properties of cotton seed. Biosystems Engineering, 83(2), 169-174.

Sacilik, K., R. Ozturk, R and R. Keskin. 2003. Some physical properties of hemp seed. Biosystems Engineering. 86(2). 191-198.

Soylak, M., L. Elci, S. Saraçoğlu and U. Divrikli. 2002. Chemical Analysis of Fruit Juice of European Cranberrybush (*Viburnum opulus* L.) from Kayseri-Turkey. Asian Journal of Chemistry. 14(1): 135-138.

Sirisomboon, P., P. Pornchaloempong and T. Romphophak. 2006. Physical properties of green soybean: Criteria for sorting. Journal of Food Engineering.79, 18-22.

Tunde–Akintunde, T. Y. and B. O. Akintunde. 2004. Some physical properties of sesame seed. Biosystems Engineering. 88(1). 127-129.

Viswanathan, P.T., L. Palanisamy and E. Sreenarayanan. 1996. Physical properties of neem nut. Journal of Agricultural Engineering Research. 63, 19-26.

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