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MORPHOLOGICAL VARIATION IN CASTOR (*RICINUS COMMUNIS* L)

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ABSTRACT

In India the growth of agriculture is the symbol of production of variability in seed crops. Castor (*Ricinus communis L.*) is cultivated around the world because of the commercial importance of its oil. India is the world's largest producer of castor seed and meets most of the global demand for castor oil. The present investigation undertaken on two varieties (deshi and hybrid castor) of *Ricinus communis L.* growing at Agra and adjoining area revealed the variation in morphological characteristics *viz.* plant shape and size, seed size, length and breadth, mottling, colour and thickness of the seed coat and seed surface. Different sized seeds showed significant differences. The present study also showed that the plant height, leaf size, fruit size and seed size of deshi castor is significantly less than hybrid castor. The present study may conclude that the size and weight of the seed is related to the oil percentage.

INTRODUCTION

Seed morphology has been shown to provide useful characteristics for the analysis of taxonomic relationships in a wide variety of plant families. In addition to gross morphology of seeds, sculpturing details of outer seed coat are quite variable between different species and can be of systematic importance. Exomorphic features of seeds, in addition to vegetative and reproductive characters, have long been employed as important tools in various scientific studies. However, most of the light microscopic features used are concerned with general shape and size rather than details of surface ornamentation.

Seed is the most important part of the plant it is the basic unit for distribution and maintenance of plant populations. It carries the genetic potential of the crop plant, determining the upper limit on yield. Seed is an agent of change plant crops change as seed changes (Gastel *et al.*, 1996).

The seed like many other plant structures cannot be rigidly defined a seed is a fertilized ovule is inadequately because it is applied to fertilized ovules both immature and mature. In angiosperm all the seeds posses an embryo in stage of development. Seeds are commonly called ripe, when they are grown and shed from the mother plant regardless of the stage of development and their embryos seeds have been called technically ripe only when ready to germinate the term seed must remain in morphological use and will commonly be applied to matured ovules that contain an embryo at some stage (Eames, 1961).

The basic structure of the seed is that of the ovule, because the seed develops from the ovule. In the mature seed the following parts can be distinguished. The seed coat commonly called testa, which develops from one or two integuments, endosperm, which may be present in a large or small amount. The embryo constitutes the partially developed young sporophytes. In some seeds the endosperm is completely absent and such seeds as well as those that contain a very small amount of endosperm are termed exalbuminous seeds. Seeds with endosperm or perisperm are termed albuminous seeds. Seeds that contain endosperm formed in the early stages of embryo as it matures. In endosperm less seeds form the seeds may be determined by the presence of a large embryo as in many legumes (Eames, 1961).

Castor bean (*Ricinus communis* L.) is an oil crop cultivated for industrial use and as an ornamental plant. Lately, the interest for this species has increased for being a raw material for the production of biodiesel, an ecological less pollutant fuel *Ricinus communis* L. castor oil plant

is a monotypic genus of Arica. These are tall, glabrous, herbs, sometime shrub or sub-arborous. This generic name is form Latin word *Ricinus* a tick from the resemblance of the seed (Bhattacharjee, 2000). Castor bean (*Ricinus communis* L.) is non-edible oil seed crop with enormous significance.

In the light of these enumerated facts, the present study was carried out on morphological evaluation in *Ricinus communis* L.

MATERIAL AND METHODS

The present investigation was carried out on *Ricinus communis L.* growing at various places of Agra during a period of 2010-2012. The two plant species of castor i.e. Deshi green castor and reddish hybrid castor collected from different agro climatic regions of Agra.

Ten plants of deshi castor (green plants) and reddish castor (hybrid plants) were selected and marked for morphological studies. Morphological data was recorded througho the year. Following morphological characters were recorded: height of mature plant, shape of seed, colour of seeds, seeds surface, seed length, seeds width, caruncle size, seed mottling and 100 seed weight.

RESULTS AND DICUSSION

The present study was conducted on morphological diversity of *R.communis* growing in Agra region. There are two different variety of this plant found in waste land and commonly on the marginal fields as well as cultivated fields of Agra. The plants which were collected showed great diversity in plant morphology and seed morphology and named as deshi castor and hybrid castor.

Table 1: Plant morphological characters of two different species of castor growing at Agra region

S.No	Plant species	Plant height (ft)	Leaf size (cm)	Leaf shape	Stem shape and colour	Fruit type	Fruit surface colour
1.	Desi (green) castor	10-12	15-45	Palmate, toothed	Glabrous, greenish	Smooth capsule	Dark green
2.	Reddish (Hybrid) castor	10-16	16-40	Palmate and spiny	Non glabrous, reddish purple	Spiny capsule	Reddish - light green

Table 2: Seed variability characters of two different species of castor growing at Agra region

S.No.	Plant species	Seed size (cm)	Seed shape	Seed coat colour	Seed coat thickness	Seed mottling	Seed surface	100 seed weight (gm)
1.	Desi (green) castor	12.5x7.6	Bean like	Medium-dark	Medium-thick	Light mix	shinny	30.8
2.	Reddish (hybrid) castor	8.5x5.3	Oval like	Dark	Thick-medium	Dark mix	Dark	26 gm

It is evident from Table 1 that the plant of deshi green castor attains a height up to 10-12 ft with palmately compound, large broad leaves which are coarsely toothed and pointed at the apex. The leaves are 15-45 cm in size and long stalked. The stem is glabrous, frequently glaucous and covered with a waxy bloom. The fruit is greenish, smooth, capsule containing three seeds. However, the significant variation was observed in reddish castor species. The plant grows up to 10-14 feet with reddish purple, round, glabrous stems. The leaves are reddish purple, silky and dark reddish purple at the time of maturity with16-46 cm in size. The fruit is a spiny capsule, reddish purple in colour. Enormous variability was observed in seeds of desi green and reddish castor for the following seed characteristics viz. seed length, seed breadth, seed shape, seed coat colour, seed coat thickness, seed mottling, seed surface and 100 seed weight. Among the seed variability characters the great variation was observed in seed length and seed breadth of both castors. In the present investigation, the seed length of green castor is 12.5 cm and breadth 7.6 cm while, the seed length of reddish castor 8.5 cm and breadth 5.3cm respectively. Similar results were observed by Anjani *et al.* 1993; Duhoon *et al.* 1996 and Anjula Radhamanji 2006.

The plant species under the present investigation showed a wide range of variation for the seed morphological characteristics. The average seed weight about 30 gm/ 100 seeds but the green castor possesses 30 gm/100 seed and reddish castor (16 gm/100 seeds). Table 2 clearly shows that the green castor formed bean like seed with medium-dark seed coat colour while, the reddish castor formed formed oval like seeds with dark seed coat colour. Both castors showed variation in the seed coat thickness i.e. medium thick (green castor) and thick medium (reddish castor). The light mix seed mottling was found in green castor and dark mix mottling was observed in reddish castor respectively. Within the investigated castors maximum variability was observed in

reddish castor representing large medium seeded types, dark mix mottling, dark colour of seed coat etc. this castor was collected from the marginal sides of agricultural field of Agra. Similar study was carried out by Anjula and Radhamani (2006) on variability in seed longevity of castor in relation to seed morphological characters. They showed wide variation in the seed morphological characteristics viz, seed size, length and breadth ratio, caruncle size, mottling, colour and thickness of the seed coat and seed surface. Based on the size, the seeds were classified into three categories viz. small, medium and bold. Different sized seeds showed significant differences in their seed viability and vigour pattern during storage. The desiccated seeds of medium size at 4.0 % moisture on fresh weight basis showed maximum survival of 65-70 percent after storage of five years at ambient temperature.

Kaushik *et al.* (2007) have also observed variability in seed traits and oil contents of 24 accessions of biodiesel plant *Jatropha curcas* belonging to family Euphorbiaceae collected from different agro climatic zone of Harayan, India. There were significant differences in seed size, 100 seed weight and oil content observed on the basis of seed variability.

Castor (*Ricinus communis* L.), which belongs to the Euphorbiaceae family, is perennial in tropical, subtropical, and temperate climates, although it is an annual plant in harsher climates. The seed contains 46.0 to 51.8% oil, 17.1 to 24.4% protein, 18.2 to 26.5% crude fiber and 2.1 to 3.4% ash (Yuldasheva et al., 2002). Castor is an important oilseed crop that produces an oil rich in ricinoleic acid \ an unusual hydroxy fatty acid with conjugated unsaturation.

Castor oil typically contains a high concentration of ricinoleic acid – over 85% – which gives the oil unique technological properties (Alam et al., 2010). Such properties are of great value for a number of applications, such as paints and varnishes, nylon-type synthetic polymers, hydraulic fluids and lubricants, cosmetics and food (Labalette et al., 1996). Knowledge of castor seeds' physical properties and their dependence on moisture content is essential to facilitate and improve the design of processing equipment as well as harvesting and storage procedures and facilities (Mirzaee et al., 2008). During the process of extracting the castor oil and its derivatives, the seeds undergo a series of unit operations. At each step, various types of cleaning, grading, separation and oil-extraction equipment operate on the basis of the seeds' physical properties. Research on physical and engineering properties has been reported for different types of seeds, such as soybeans (*Glycine max* L. Merr.) (Deshpande et al., 1993).

To our knowledge, detailed measurements of castor seeds' principal dimensions and the variation of their physical properties at various moisture levels have not been reported. This study investigated some moisture-dependent physical properties of castor seed: size, sphericity, surface area, one thousand seed mass, bulk density, true density, porosity, angle of repose, terminal velocity and static coefficient of friction in the moisture range of 6.24 to 12.56% d.b. These parameters are important for the design and fabrication of the equipment involved in processes such as oil extraction.

The testa of castor is thin and often brittle, depending to some extent on age and oil content. Seed of some cultivars may have a dormancy period of several months, but freshly harvested seed of their varieties can be made to germinate by removing the caruncle and piercing the testa at this site leaving the endosperm intact. However, the majority of modern dwarf hybrids are not dormant and freshly harvested seed germinates without special treatments. Some factors controlling dormancy have been investigated (Bewley and Downie, 1996).

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