Screening of Castor Genotypes for Early Maturity

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Castor is an important oil crop and its oil is used in many industrial products as well as lubricant. Since Ethiopia is center of origin, there is a high diversity of the crop present in this country. This study was undertaken to identify the castor genotypes which can mature earlier to overcome moisture stress at dry areas of the country. There is a wide range of variability in the characterized genotypes and there is also correlation both positively and negatively affected days to maturity which is the main objective of this research. The result from this experiment showed promising results as there are several early maturing and high yielding genotypes was identified. Therefore, further selection should be continued to get best and early maturing as well as high yielder varieties.

Keywords: castor, diversity, early mature, genotypes, late mature

INTRODUCTION

Castor bean (*Ricinus communis* L.) belongs to the family Euphorbiaceae and is the sole species of the genus Ricinus. Both Ethiopia and East Africa are mentioned as castor bean’s center of origin (Moshkin, 1986). Now the plant is well distributed in tropical and warm temperate regions throughout the world. It grows wildly over a wide range of geographical regions and different climatic conditions (Anastasi *et al*., 2015). The castor seed contain about 45–60% oil containing approximately 90% ricinoleic acid (Ogunniyi, 2006). The oil is unique because of its high ricinoleic acid content and the hydroxyl functionality of the ricinoleic acid gives the oil good oxidation stability, shelf life, and a point of reaction for various chemical reactions (Mubofu, 2016).

The main product of castor bean is the oil present in its seeds, which has numerous applications including medicinal and cosmetic use, plastic and lubricant manufacturing and fiber optic production. Currently, global castor seed annual production is around 1.5 million metric tons with four countries (India, China, Brazil, and Mozambique) accounting for 96% of total production. Although the main producing regions are in the tropics, this crop has been grown commercially on large areas in temperate countries such as the United States and the former USSR (Russia and Ukraine). Castor is still being considered for cultivation in regions that experience cool temperatures (10 to 20 °C) that prevail in temperate climates and high elevations during the phase of seed filling (Moshkin, 1986; Severino *et al*., 2012).

In Ethiopia, castor does well under dry land or moisture stress areas in the rift valley, Eastern and North West Ethiopia. There is high diversity of castor genotype in the country since it is center of origin for this crop. Castor germplasm collected within Ethiopia is deposited in Institute of Biodiversity Conservation, Addis Ababa. Castor breeding and variety development is entirely dependent on this germplasm, although exotic germplasm is also necessary for varietal improvement and heterosis breeding. Castor germplasm collected and conserved at this institute were used to select and identify varieties for early and late set type at Wondo genet research center.

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MATERIALS AND METHODS

Ninety (90) castor genotypes advanced from preliminary nursery observation including two standard checks were planted at Wondo genet for one season during 2016/2017. The experiment was laid down in non-replicated seven blocks. A plot had five rows and five plants per row. A respective spacing between rows and plants were 80 and 75 cm., respectively. A distance of 1.3m and 2m was maintained between plots and blocks, respectively. All plots were cultivated once and weeded twice and no fertilizer or pesticide was applied. Days to first flowering was recorded as the number of days from emergence to anthesis of the main raceme. Days to second flowering was recorded as the number of days from emergence to anthesis of the racemes on the secondary branch. Days to first maturity was recorded as the number of days from emergence to maturity of the main raceme. Days to second maturity was recorded as the number of days from emergence to maturity of the secondary raceme. Plant height was recorded as the length from the ground to the tip of the main raceme. Number of inflorescences was counted as the total number of racemes on one plant while the length was measured in cm. The total number of nodes was counted on a plant and was recorded as an average of five plants. Number of branches per plant was recorded as the total number of primary and secondary branches. Number of capsules per plant was recorded by counting all capsules on a plant. Seed weight per 100 seeds was measured by counting 100 seeds and recording the weight in g. The number capsules per plant was analyzed using Ms-excel and SAS soft ware. Pierson simple correlation analysis was used to taste the correlation between different traits.

Table 1: Accessions used for evaluation

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RESULTS AND DISCUSSION

The ranges and means for 13 characters of castor genotypes studied are presented in Table 2. The result showed that there was wide range of variation for almost all of the traits. In general, the range and mean in this study revealed the existence of considerable amount of variability in the material studied for the 13 characters, indicating the potentiality of studied germplasm for castor improvement program in the future. Days of maturity was one the major objective to screen castor genotypes for early (< =150 DM) and late (> =150 DM). Based on the criteria set, 26 castor genotypes were early maturing (range from 148 to 150 DM) and remaining 64 genotypes were late maturing (ranges from 151 to 196 DM) (Table 1). A very wide range in values of agronomic traits was also observed (Table 2). The range for plant height, seeds per raceme, seed yield per plant, seed yield per plot and seed yield per hectare were very high. The range for days to flower and maturity, 100 seeds weight, length of main raceme and number of branches was wider.
The values of individual genotype for characters studied show that accessions had more capsules, branches, seeds per plant and heavier seeds were generally late in days to flowering and maturity. The mean and range values reported in this study are much higher than those reported by Goodarzi et al (2012), Wang et al (2013), Anjani et al (2014) and Lu et al (2010). Wang et al (2011) reported the range of 100 seed weight in the entire USDA castor collection from 10.1 to 73.3, while it was from 22.78 to 84.39 g in our study site. The wide range of days to flower and maturity observed in this study is indicative of the possibility of developing early genotypes through selection. In addition, the variation in plant height and branches per plant indicated that selection of genotypes containing few or single inflorescence with short plant stature can be realized. The coefficient of variability for number of raceme, 100 seed weight, seed yield per plant, seed yield per plot, seed yield per hectare and number of branches were high. Wide range of means providing an ample scope for selecting desirable types. High values of coefficient of variations indicated the existence of substantial variability, ensuring ample scope for their improvement through selection (Shimeles et al., 2016).

**Correlation**

The present study showed that, the existence of significant and positive associations of day to maturity with selected parameters. The correlation between plant height (r=0.45***) and number of internodes (r=0.39***) is positive and highly correlated with days to maturity. This indicated that early flowering and fruiting cultivars produced high yields due to high rates of early flower initiation and fruit development unlike late flowering of vigorous tall plants which need a long growing period for fruiting which later produced the lowest yield. But most of the parameters are negatively correlated with days to maturity, number of raceme and seed yield per plant was negatively and significantly correlated with days to maturity (Table 3).

**Table 3:** correlation analysis of some traits of castor

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<tr>
<th>DF</th>
<th>DM</th>
<th>HSW</th>
<th>PH</th>
<th>NR</th>
<th>LMR</th>
<th>SYPR</th>
<th>SYPP</th>
<th>NB</th>
<th>NI</th>
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DF=Days to flowering, DM= Days to maturity, HSW= Hundred seed weight, PH= plant height, NR= number of raceme, LMR= length of main raceme, NCPR= Number of capsule per raceme, SYPP= Seed yield per plant, NB= Number of branch, NI= Number of internodes

**Table 2.** Range and mean of quantitative characters for the 90 castor accessions studied

<table>
<thead>
<tr>
<th>SN</th>
<th>Characters</th>
<th>Mean ± SD</th>
<th>Maximum value</th>
<th>Minimum value</th>
<th>Range Unit</th>
<th>CV (%)</th>
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<tr>
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<td>Days to flowering</td>
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<td>Days to maturity</td>
<td>167.90±15.95</td>
<td>196.00</td>
<td>146.00</td>
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<td>100 seed weight (g)</td>
<td>44.18±15.00</td>
<td>84.39</td>
<td>22.78</td>
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<td>Plant height(cm)</td>
<td>291.30±70.59</td>
<td>509.00</td>
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<td>Length of main raceme</td>
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Table 2. Range and mean of quantitative characters for the 90 castor accessions studied
CONCLUSIONS
As Ethiopia is rich in castor germplasm, improvements in different traits is possible especially for development of early genotypes with higher yield potential. Research activities concerning castor breeding is under way and there is promises to get good performing dwarf and mono stem varieties suitable for rain fed environment. Plant characters and yield components were evaluated from five randomly selected plants of each accession and analyzed accordingly. As result showed the genotypes have wide range of variability in different traits which give an opportunity for further characterization. The traits have positive and negative correlations with days to maturity which is the main objective of this work. In general further screening is required to come with comprehensive recommendation and variety selection for breeding program.

REFERENCES

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