INTRODUCTION

Castor (*Ricinus communis* L., 2n = 2x = 20) belongs to family euphorbiaceae is an industrially important non-edible oilseed crop widely cultivated in the arid and semi-arid regions of the world (Govaerts *et al.*, 2000). The genus Ricinus is monotypic and *R. communis* is the only species with the most polymorphic forms known. Several of these forms were designated as species (*R. communis, R. macrocarpus, R. microcarpus*) (Weiss, 2000) but they are inter crossable and fertile and are not true species. All the varieties investigated cytologically are diploids and it is presumed to be a secondary balanced polyploid with a basic number of x = 5 (Singh, 1976). Many of the morphological differences might be due to genic differences, cryptic inversions, duplications, etc., rather than changes in the whole chromosome complement (Perry, 1943).

Castor is believed to have most probably originated in Ethiopian-East African region. There are four centers of diversity for castor *viz.* Ethiopian-Eastern African, North-West, South –West and Arabian Peninsula and Sub-continent of India and China. In India, it is known from very early days and is referred in Susruta Samhita written over 2,000 years ago (Gangaiah, 2005). Its monoecious nature favours cross-pollination and it is up to the extent of 50 per cent. It is essentially a semi-tropical, intermediate perennial plant, but it has naturalized as annual / seasonal crop plant throughout the world in frost free zones. It has an ability to grow under low-rainfall and low-fertility conditions, and hence it is most suitable for dry land farming.

The seed of castor contains more than 45 per cent oil, this oil is rich (80-90%) in an unusual hydroxyl fatty acid, ricinoleic acid. Castor oil is the only oil soluble in alcohol, presenting high viscosity and requiring less heating than other oils during the production of biodiesel. Due to its unique chemical and physical properties, the oil is used as raw material for numerous and varied industrial applications.

Castor originally used as an illuminant, now it is being used as one of the most valuable lubricants. Presently, it is one of the most important indispensable industrial raw materials. Castor cake is also a good source of nitrogen and widely used as manure, but it is unfit for cattle feed due to presence of ricin the highly poisonous substance. Castor leaves are generally used as rearing of silk worms. The stalks are
used as source of pulp for paper industries, card board, news prints and as a fuel in rural areas. Castor oil is different from other vegetable oils in the sense that it does not freeze even under the temperature regime of -12 to -18°C. It is, therefore, considered as the best lubricating agent particularly for high speed engines and aeroplanes. Castor seed oil is tremendous industrial value. The oil is mainly used in production of plastics, nylon, all purpose greases, hydraulic fluids, artificial leather, rubber, printing ink, soaps, fast drying oils, paints, varnishes, recinonyl and medicines.

Castor is grown in tropical, sub-tropical regions of the world. It is cultivated in about 30 countries on commercial scale. Among those, India, Brazil, China, Russia, Thailand and Philippines are the principle castor growing countries. Total world production of castor seed was 19.96 lakh tonne during the year 2014-15, from an area of 14.94 lakh ha with 1336 kg/ha productivity (Anon., 2015). Total area under castor crop in India for the year 2014-15 was 11.07lakh hectares with a production of 17.33 lakh tonne and average yield of 1568 kg/ha (Anon., 2015). The major castor growing states in India are Gujarat, Andhra Pradesh, Rajasthan, Tamilnadu, Karnataka and Orissa. Gujarat is leading castor growing state, where the crop was grown in around 7.15lakh ha with 14.56 lakh tonne production and productivity of 2036 kg/ha during 2014-15 (Anon., 2015). In Gujarat, Banaskantha, Mehsana and Sabarkantha are major castor growing districts. Being the largest producer, India is also largest exporter of castor seed oil and exports 80 per cent of its total castor oil to China, which is the world’s largest importer of castor oil followed by USA, Japan, Thailand and other European countries. India’s export of castor oil and derivatives are estimated to be over Rs. 4000 crores (US $ 800 million) per annum, and the whole world is highly dependent on India for the supply of this oil, which is used in production of some vital chemicals (Anon., 2012).

With the availability of short stature early hybrids, its cultivation in middle Gujarat is increasing year by year. The crop ecological condition of middle Gujarat is different in comparison to semi-arid regions, where soils are fertile with good rainfall, and assured irrigation facilities. The castor crop is an important contingent crop for middle Gujarat under the condition of natural calamity such as excess rainfall or draught as pre-rabi or rabi crop.

The basic rationale in any crop improvement programme is the increase in yield potential of the crop. Seed yield is a complex and polygenic trait, and in order to
study it properly, different factors affecting the seed yield must be considered and evaluated with regard to their contribution to seed yield. For a particular crop, information on the nature and magnitude of variability present in the population due to genetic and non-genetic causes is an important pre-requisite for commencing any systematic breeding programme.

Variability present in the population is the pre-requisite in response to selection for any crop improvement programme. Selection of superior varieties or populations will be possible only when adequate variability exists in the gene pool. Hence, the insight into the magnitude of variability present in a gene pool of a crop species is of utmost importance to plant breeding programme. The coefficient of variation expressed in phenotypic and genotypic levels are used to compare the variability observed among different characters. Hence, knowledge about the variability using parameters like Genotypic coefficient of variation (GCV) and Phenotypic coefficient of variation (PCV) is of paramount importance for an effective breeding programme in crops like castor. It is not possible to identify a genotype with higher performance for all the characters implied that it is advisable to improve the individual trait in the order of economic importance and requirement. The heritability estimates aid in determining the relative amount of heritable portion in variation and thus helps the plant breeder in selecting the elite genotypes from a diverse population. Therefore, the present study was undertaken for assessing the extent of genetic variability, heritability and genetic advance in castor genotypes.

Study of genetic variability of seed yield and its components characters among different genotypes provides a strong basis for selection of desirable genotypes for augmentation of yield and other agronomic characters.

Heritability and genetic advance are also important selection parameters. Heritability estimates along with genetic advance are normally help full in predicting the gain under selection than heritability estimates alone. It will help the plant breeder in selecting the elite genotype from diverse population. Therefore, the present study was undertaken for assessing the extent of genetic advance in castor inbred line. However, it is not necessary that a character showing high heritability will also exhibit high genetic advance.

Yield is a complex character resulting from interplay of various yield contributing characters, which have positive or negative association with yield and
among themselves. To assess the magnitude of correlations for various characters with yield would be immense help in the indirect selection for the improvement of yield.

Different components of seed yield very often exhibit varying degree of associations with seed yield as well as among themselves. In order to accumulate optimum combination of seed yield contributing characters in a single genotype, it is essential to know the relationships among themselves. Further, the seed yield is influenced by its various components directly and/or indirectly via other traits that create a complex situation before a breeder for making desirable selection.

Path analysis is a standardized partial regression analysis, which further permits the partitioning of correlation coefficient into components of direct and indirect effects of independent variable on the dependent variable (Dewey and Lu, 1959). Path coefficient analysis could provide more realistic picture of the interrelationship as it partition the correlation coefficient in direct and indirect effects of the variables thus, characters association and path analysis provide information of yield contributing characters and breeder can practice selection of superior accession for gene bank.

Objectives:

Keeping all these facts in view, the proposed investigation was carried out using 64 genotypes of castor with the following objectives:

- To estimate the nature and magnitude of variability present in castor genotypes with respect to seed yield and its contributing traits.
- To estimate genotypic and phenotypic correlations among seed yield and its component traits.
- To determine direct and indirect influences of various seed yield attributing characters on seed yield through path coefficient analysis.