

I. INTRODUCTION

Phaseolus aureus, Roxb (Syn. P. radiatus, L), commonly known as green gram or mung, is an important leguminous crop of India specially of eastern India. According to De Candolle(1886) green gram is under cultivation for more than two thousand years in India. Outside India, green gram is cultivated to some extent throughout the South Eastern Asia and in the central and southern part of Africa. Recently it has been introduced to the new world. There are reasons to believe that green gram originated in India, was brought into cultivation here and spread to other countries. The Hindustan Centre is recognized as the centre of origin of green gram by Vavilov(1951). Prain (1903) is of the opinion that Phaseolus trinervis, (syn.P.sublobatus,Roxb) is the ancestral wild form of the two cultivated Indian legumes, green gram (P.aureus, Roxb)and black gram (P.mungo, L).

The plant is an annual herb. The stem is lightly ridged, and hairy in nature. The leaves are imparipinnate trifoliate compound with stipules and stipels; petioles long and hairy; leaflets ovate, semiacute. The inflorescence is a raceme with a long peduncle bearing flowers at the swollen tip in opposite pairs. The flowers are small, stalked, papilionate, with twisted keel and staminal column. The pods are in clusters, radiating from the apex of the stalk, firm, slender, 7 to 8 cm. long. Seeds are 2.5 - 4.0 mm. long, globose or slightly elliptical; hilum flat and germination is epigeal. Considerable varietal difference with respect to different characters are seen.

The green gram is mostly grown for its protein rich seed and also as a fodder legume. Apart from protein the seeds supply starch, fat, vitamins and minerals. Green gram enriches the soil with nitrogen through the root nodule bacteria and thus plays an important role in crop rotation programmes. Sometimes it is grown as a green manuring crop. Some of the short duration varieties are favoured as a catch crop preceeding or following the major crop like rice or wheat.

In India, green gram is cultivated both as kharif(monsoon) and rabi (winter) crop. A large number of varieties exist, adapted to the different environmental conditions. The kharif varieties of green gram are sown as soon as the land can be prepared after the first monsoon shower generally in early June. As the crop is of short duration and can be harvested in about two and half month's time, it is often possible to take two crops in the kharif season. Green gram can be grown under varied soil and fertility conditions, but it cannot withstand water logging. The rabi varieties are sown in August-September. The seeds are sown either broadcast or in rows, a foot apart in plough furrows with a spacing of 9-12 inches between plants. Most of the varieties are ready for picking in two months and the crop can be harvested in 3 months. The picking of fruits at stages stimulates further production and is done where labour is cheap. Average yield of green gram is 350 - 400 lbs per acre; 1000-1200 lbs. per acre are obtained from improved varieties under good cultivation conditions.

Considering the importance of green gram in Indian agriculture, very little attention has been given to breed better

varieties except selection of suitable types from cultivators mixtures. In course of a breeding project of green gram in this laboratory, some fundamental work on genetics, interspecific hybridisation and induced tetraploidy was taken up and the observations are presented in this thesis.

The genetical part covers the mode of inheritance of all the available contrasting characters found in our large collection of varieties. Except the mode of inheritance of four of these characters practically nothing was known before. Attempt has been made to understand the basis of difference of the contrasting characters mostly through anatomical studies. A photoperiodic experiment has helped to understand the basic difference in the flowering of green gram generally grown in kharif and rabi seasons. It has also helped to develop a technique for forcing flower in off season and expedite genetical and breeding studies.

Interspecific hybridization was attempted with black gram (P.mungo, L) the other commonly cultivated Phaseolus. In appearance and habit green gram resembles black gram very closely. The main differences between the two species are in seed and pod characters. The hilum of the green gram seed is flat or at least not concave, which is always concave in black gram. The green gram pods are long, radiating from a cluster and thin walled thus shattering readily, while black gram pods are smaller, erect and thick walled. Purple pigmentation is less intense and generally restricted in green gram and there ^{is} ~~are~~ a variety where it is absent and even the leaf colour is generally lighter green than that of black gram. As a pulse the green gram is considered superior over the black gram, but the black gram plants ~~is~~

in general grow more vigorously, are less susceptible to diseases and can tolerate drought and rains better than green gram. It was possible to hybridize green gram with black gram and to select types combining the characters of the two species. The observations are presented in the chapter on interspecific hybridization.

As polyploidy is associated with gigas characters in different plant parts and increased protein and vitamin contents, tetraploid breeding was taken up. As the response to tetraploidy of different varieties takes place in different direction and fertility can be improved considerably by selection and hybridization at tetraploid level and selection from later generations, tetraploidy was induced in six varieties to broaden the programme. The observations on induced tetraploidy, selection and hybridization are given in the chapter on induced tetraploidy.