CHAPTER 1

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Nutritional security to the growing population and sustainable crop production are the present national priorities in which pulses play a key role. The importance of pulses has also been realized due to their high protein, better nutritional food, fodder and soil enrichment qualities. However, the availability of pulses is progressively declining which is a matter of great concern to botanist and agriculturists. The target growth rates for pulse crops, even though higher than achieved in past, can be made by bringing more area under pulse crops, increasing irrigation coverage and by introducing high yielding varieties of these crops under cultivation (Bajpayee, 1999).

Among the various pulses grown in India, cowpea (*Vigna unguiculata* L. Walp; syn. *Vigna sinensis* Savi) is an important tropical pulse crop with high protein and other essential nutrients. It is generally used as dry seeds, green seeds, green pods, green fodder, cover crop, green manure crop and leafy vegetable in various parts of the world. In India, cowpea is mostly used as a vegetable in form of green pods or dry seeds and has got potential to solve the protein problems as vegetable meat. It is also a rich source of Ca, P and vitamin A. Cowpea protein could be used as an emulsion, stabilizer in fat and water system, and in meat emulsion system (Ngarmasak, 1989). In South-East Asia, cowpea is used in the preparation of variety
of snack products namely *tako* (steamed cowpea gel with coconut cream); *klong kang klob* (boiled cowpea dough in coconut milk); *knom kloke* (charcoal-baked cowpea flour with sweet batter); *kloy tod* (fried banana coated with cowpea flour batter); *kanom saree* (cowpea sponge cake); and *kai nok kata* (fried cowpea paste).

In Africa, the young leaves of cowpea are eaten as spinach or dried for use in soups. Cowpea is also used as a livestock feed in form of green fodder and preserved as hay and silage. In USA, it is used mostly as a fodder and as a cover crop.

Cowpea is in cultivation from very ancient times in the tropics of Old World. Vavilov (1949) considered India as the main centre of origin of this crop. In India, cowpea is known since the Vedic times. Africa and China is the secondary centre of its origin. Though India constitutes one of the main centres of diversity, the historical as well as archaeological evidences strongly suggested that Africa is most probably the place where the present day cultivated cowpea evolved. Cowpea has been cultivated since very ancient times in the Mediterranean region by the Greeks, Romans and Spaniards.

As an annual herb, cowpea belongs to the family Leguminosae subfamily Fabaceae. Marechal et al. (1978) differentiated the genus *Vigna* from *Phaseolus*. Based on cytological and genetic studies, Verdcourt (1970) recognized three cultivated sub-species of cowpea which are *Vigna unguiculata* sub-sp. *unguiculata* L. Walp. Verdc. (seed type cowpea); *Vigna unguiculata* sub- sp. *cylindrica* L. Eseltino (Fodder type cowpea); and *Vigna unguiculata* sub-sp. *sesquipedalis* L.
Verdic (vegetable type cowpea). However, these species are easily crossable among them and produce fertile hybrids.

Cowpea is a multi-season and multipurpose leguminous crop grown throughout the tropics and subtropics. Africa is the main producer of cowpea with major concentration in Nigeria, Niger, Uganda and West Indies. In Asia, cowpea is grown in Bangladesh, Burma, China, India, Indonesia, Korea, Nepal, Pakistan, Phillipines, Thailand and Sri Lanka. It is also cultivated in lowland and coastal areas of South and Central America, Brazil and Italy. It was recently introduced in Australia. In India, cowpea is mainly cultivated in the states of Gujarat, Madhya Pradesh, Maharashtra, Rajasthan, Haryana, U.P., Bihar, Karnataka, Tamilnadu, Andhra Pradesh, Kerala, West Bengal and Assam. In Madhya Pradesh, cowpea is grown in 29 districts with major coverage of Raigarh, Dhar, Jhabua, Bilaspur, Surguja, Hoshangabad, Chhindwara, Raipur and Balaghat (Fig. 1).

The literature on statistics related to area and production of cowpea are rarely available. Such informations are reported jointly with other minor pulses. It creates difficulty in assessing the status of cowpea in the country as well as in global agriculture. According to latest statistics available, cowpea is grown in about 7.7 million hectares with annual production of about 2.27 million tones throughout the world. In India, this crop is cultivated in about 5 Lac hectares with major concentrations in Central India. Cowpea is cultivated in about 10,348 hectares in Madhya Pradesh. During 1970-71, area of this crop was about 6,300 hectares in the state, which showed an increasing trend with highest coverage of 12,000 hectares.
Cowpea in Madhya Pradesh

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Fig. 1. Area and productivity of cowpea in Madhya Pradesh
during 1995-96 (Fig. 2). Having increasing significance as a multipurpose crop in Indian agriculture and human nutrition, cowpea deserved more attention. However, very limited attention has been paid towards genetic improvement in both seed yield and green pod yield. Hence, the yield of this crop is more or less stagnant at a low level of about 300 kg/ha. Similarly, the productivity of cowpea in Madhya Pradesh was 307 kg/ha during 1997-98. Thus, this crop deserves more attention for its genetic improvement in seed yield as well as green pod yield with systematic breeding programme.

Selection of potential parents is a prerequisite for any effective crop improvement programme. When the aim is to replace the existing varieties to superior-ones, the choice of existing varieties as one of the parents is very logical. Hence, local land races of cowpea namely Sidhi Local (SL 3) and Dindori Local (DL 1) were included in the parental population of present study. Apart from local adaptation, the recently developed biometrical techniques such as $D^2$ analysis, metroglyph analysis, component analysis, regression analysis, triple test cross analysis and diallel cross analysis have been found useful tools in selecting the desirable parents for hybridization. Among them, diallel cross analysis technique has been found one of the best biometrical techniques for the identification of the lines possessing a built-in genetic potential for superior performance in hybrid combinations. These analyses also permit the classification of parental lines in terms of their combining ability in hybrids and throw light on genetic architecture of parents and offsprings for different characters, which is very much essential to
Fig. 2: Trend of cropped area in Madhya Pradesh
formulate a sound breeding programme and for the selection of appropriate breeding methods for the genetic improvement in the traits of economic interest. The practical utility of this technique has not been adequately tested for the genetic improvement in green pod yield of cowpea.

The knowledge of genetic architecture of parents and off-springs in relation to characters governed by polygenes like green pod yield is important for the selection of appropriate breeding methods for genetic improvement. Some attempts have been made to know the genetics of seed yield and its component characters in cowpea (Aryeetey and Laing, 1973; Singh and Dabas, 1986; and Biradar et al., 1993). However, the attempts to determine the gene action governing the green pod yield is very limited (Chattopadhyay et al., 1996). Similarly, the information on combining ability of the cowpea genotypes related to green pod yield are scanty (Umaharan et al., 1997). Being a self-pollinated crop, the scope for exploitation of hybrid vigour looking to the biological feasibility and gene action need to be searched out. So far, very few attempts have been made to know the heterosis and inbreeding depression in cowpea.

Complex polygenic trait like green pod yield is known to be largely influenced by ambient environmental conditions, while physiological yield components governed by relatively less number of genes are known to be less sensitive to environmental fluctuations. Hence, selection based on yield component has better chance of success in comparison to selection for yield itself. The knowledge of associations between green pod yield and their attributing characters
therefore, become most important. The physiological components and their, inter-relationship among themselves help breeders in deciding the selection criteria to be practised in breeding material. Meagre information on these aspects is available in early generations of cowpea.

Keeping these points in view, the present investigation was planned with the following objectives:

1. To know the extent of heterosis and inbreeding depression for green pod yield and its components.

2. To understand the genetic system governing green pod yield and its contributing characters.

3. To determine the relative merits of graphical, component and combining ability analyses in estimating the genetics of quantitative characters.

4. To find out the best combiner for green pod yield and its component characters.

5. To determine the nature of association and relative merits of various component characters in determining the green pod yield in cowpea.