Introduction

Rapeseed and mustard occupy second place in area and production amongst the major oilseeds grown in India. The area under cultivation is 7.66 m ha and production amounts to 7.6 m tonnes (Economic Survey, 2006-2007). The major *Brassica* species grown in the country are *Brassica campestris* L. vars yellow sarson, brown sarson and toria, and *Brassica juncea* Czern and Coss. *Brassica juncea* is locally known as rai and accounts for 90% of area and production.

The above oleiferous brassicae probably had a common progenitor with chromosome number 5 and through the process of autosyndesis and natural selection gave varied forms adapted to tropical, subtropical and temperate regions (Hemingway, 1976). Amphidiploids are of subsequent origin. *Brassica juncea*, an amphidiploid, is primarily cultivated parallel to Himalayas in winter season from October to March in the Indian sub-continent.

Owing to past history of selection, survival under varied moisture conditions and photo-thermo sensitivity has brought several changes in the genetic make-up of the crop. The present day genotypes require 45-50 days for initial biological build up and reproductive cycle continues for 55 days which quickly terminates due to photo-thermo sensitivity resulting in improper seed setting in late formed siliqueae. However, among other types grown, mustard (*Brassica juncea*) has the advantage of higher productivity and greater tolerance to biotic and abiotic stresses. Due to wider adaptation, it is being introduced even as a replacement crop in the western prairies (Woods et al., 1991, Wu et al., 2004).

The complex process of double pathway i.e. photophosphorylation and subsequent synthesis of fatty acids and proteins coupled with above situations has led to non-linear relationship between biological yield and seed yield (Setia et al., 1989) that can be seen in the following table:
<table>
<thead>
<tr>
<th>Types</th>
<th>Biomass (kg/ha)</th>
<th>Harvest index (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Brassica campestris</em> L.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(i) var. <em>toria</em></td>
<td>2500-3000</td>
<td>25-30</td>
</tr>
<tr>
<td>(ii) var. yellow <em>sarson</em></td>
<td>6000-8000</td>
<td>20</td>
</tr>
<tr>
<td>(iii) var. brown <em>sarson</em></td>
<td>7000-9500</td>
<td>18</td>
</tr>
<tr>
<td><em>Brassica juncea</em></td>
<td>10000-12000</td>
<td>16-18</td>
</tr>
</tbody>
</table>

Besides above, seed yield is also affected by a number of ancillary characters and their relationships. It is evident from the above table that brassica group shows poor conversion ratio and exhibits non-linear relationship. It is one of the major reasons for poor yield recorded among oleiferous *Brassicaceae* under Indian conditions.

White rust, caused by *Albugo candida*, is a very serious disease in crucifers that damages photosynthetic area of leaves and deforms inflorescence (Singh et al., 1999). In Indian mustard (*Brassica juncea*), it can cause a yield loss to the extent of 89.9% (Varshney et al. 2004, Saharan et al. 1993). There is a paucity of literature pertaining to resistance breeding in *Brassica juncea* against white rust. Hence, it is essential to identify suitable genotypes with better genetic background which could be an efficient converter of biomass with high degree of harvest index and fair resistance to diseases and insect-pests. This may help to generate desired relationships among yield contributing characters.

It is necessary to identify genotypes with desirable combining ability for realization of improved yield potential. The determination of nature of gene action in the study material will help formation of effective breeding programmes. The determination of nature of resistance against white rust (*Albugo candida*) will be helpful in developing selection procedures for developing resistance to the disease under consideration.
Breeding for heterosis is emerging as an innovative approach in this economically important oil seed crop. Assessment of heterosis and combining ability too is of vital importance in selection of parents and understanding the nature of gene action involved in the inheritance of these traits. Identification of parental types for realization of better parent heterosis will be useful as good combiner for yield attributes viz. days to maturity, days to 50% flowering, plant height, number of siliquae, seed yield, biological yield and seed free from disease may generate suitable genotypes that may add to the stability of the crop production. Besides the above stated advantage, the best combiner can be employed in future for hybrid development in *Brassica juncea* L. Czern and Coss.

**Objectives**

In view of the aforesaid scenario, the objectives of the present study entitled “Genetical analysis of yield and its components and studies on white rust (*Albugo candida*) resistance in Indian mustard (*Brassica juncea* L. Czern and Coss)” are as follows:

- To evaluate the parents and their crosses for potential of yield and yield contributing traits.
- To estimate the general combining ability and specific combining ability effects of parents for traits of economic importance and breeding value.
- To determine the association among seed yield and yield contributing characters.
- To determine heterobeltiosis for parental combination.
- To study the nature of gene action.
- To study the nature of resistance for white rust.