**SUMMARY**

Brinjal is one of the most common and popular vegetable crops grown in India and many parts of the world for its immature fruits as vegetable. Brinjal is available throughout the year for large consumption and coupled with generally low price. It is an important supplier of nutrients like any other vegetable. It is a good source of proteins, carbohydrates and nutrients. It also contains minerals like phosphorous, potassium, calcium and magnesium. In addition to its nutritional values, brinjal tissues and extracts are useful in treatment of diabetes, asthma and cholera. Its fruits and leaves are used to lower the blood cholesterol level.

For any successful breeding programme, availability of known source of resistance will be of primary importance. Keeping this view, brinjal seeds were collected from different geographical regions of India. A total of 40 germplasm was collected for the screening. These collections included local cultivars, and national released varieties. The varieties and local cultivars were collected specially from coastal part and interior areas of Orissa and West Bengal, where the bacterial wilt is more prone. These genotypes collected from different geographical regions/ institutions were subjected to screening against *Ralstonia solanacearum* in field under epiphytotic conditions. The level of resistance varied among the lines screened. Among the different geographical collections, coastal Karnataka, West Bengal and Orissa originated lines and farmer’s field collections have been found to have greater resistance to bacterial wilt followed by Assam and Kerala. Among institutional collections, the variety Pusa Purple Cluster (PPC) from
Indian Agricultural research Institute (IARI) and three varieties viz., Arka Neelakatha, Arka Nidhi and Arka Keshava from Indian Institute of Horticulture Research (IIHR) have found good resistant to bacterial wilt. The highest wilt resistance was observed in many genotypes, among them, nineteen collections were categorized as immune and four of them found as resistant. However the left out seventeen germplasm have been categorized as-two collections in moderately resistant group, eight of them as moderately susceptible and seven as susceptible.

Based on the disease reaction to bacterial wilt, six tolerant lines were selected along with two susceptible lines. Among tolerant lines three are local collections from West Bengal (Makra, Bhangar local and Hazari) and Orissa (Tejpur local), two are released varieties from IIHR viz, Arka Keshava and Arka Nidhi. Among two known susceptible lines, one line Arka Kusumakar is from IIHR and another line Green Round is a breeding accession. All the above 8 lines were crossed in diallel style (all possible combinations) without reciprocals. Totally 28 hybrids were obtained from these crosses. All the hybrids along with parents were set to take up trial in two soils. One set was sown and planted in bacterial sick plot to know the resistance level of hybrids and nature of gene actions of parental lines. While another set was planted in normal soil to know the yielding potential of the hybrids to work out heterosis and combining ability studies of the hybrids over parents.

The experiment conducted on bacterial wilt sick plot that hybrids having both the parents resistant (R X R) were stood as resistant/ tolerant.
While other hybrids, where in either of the two parents was susceptible have shown varied level of wilting symptoms to group the hybrids under different susceptible categories. This experiment has shown that the gene action for resistance to bacterial wilt is controlled by recessive gene/s in all the six resistant parental lines, while susceptibility has expressed as major gene.

An appreciable amount of heterosis over mid parent and better parent was noticed from the same set of hybrids trial experiment conducted under normal soil condition. As many as 23 hybrids have expressed positive over the respective best parents for the trait of yield. However the maximum heterosis was noticed from cross Hazari x Green Round and minimum from Makra x Tejpur local. Arka Keshava was regarded as best check among parents for heterobeltosis. Considering the consumer requirements of horticultural traits for north and north eastern states of India, the cross Bhangar local x A. Keshava, Tejpur local x A. Keshava were found promising with respect to fruit shape, size and colour. The other best hybrids were Bhangar local x Makra (green big bhartha size fruit), Makra x Tejpur local (pinkish with green tinge on fruit, medium long). The cross Bhangar local x A.Keshava is one of the best hybrid having high bacterial wilt tolerance and also higher yield, it was followed by Tejpur local x A. Keshava and Hazari x A. Keshava. The highest heterosis over the best parent was noted from Hazari x Green Round followed by Makra x Green Round and Bhangar local x A. Keshava.

Combining ability analysis for yield and its component characters revealed that both additive and non additive effects. However, for the traits
fruit length and bacterial wilt the GCA variance was higher compared to SCA indicating additive gene action. While other studied characters plant height, branches per plant, flowers per inflorescence, fruits per cluster, fruit length, fruit girth, ratio of fruit length to girth, average fruit weight, and yield are predominantly controlled by non additive gene actions.

The GCA effect has indicated that the parents Green round, A. Keshava and Makra are good general combiners. High SCA effect was noted in Hazari x Green Round and Makra x Green Round for yield.

From the 28 hybrids derived for the bacterial wilt study, two F₁ crosses viz, A.Kusumakar x Hazari and A. Keshava x Tejpur local were selfed to get F₂ seeds to study the population under bacterial sick plot. A plant population of 261 and 258 was maintained in the field. Plants stand in the field till the crop end was taken for observations. From the distinct classification of wilted and non wilted plants in two F₂ populations, it was suggested that the ratio between these two sections was not fitting in to any gene actions or gene interactions/ epistasis. Hence it was inferred that the nature of gene action controlling the bacterial wilt as polygenic-recessive in nature.

As India is a primary center of origin of brinjal, there exists large variability of fruit types. Hence a huge variability and preference is seen in the vegetable market. Looking into a different consumer requirement another experiment was conducted where in eight elite lines were selected which represent various shape, size and color from different Indian geographical regions. The eight parental lines were characterized based on
fruit color and shape as purple round (PR), pinkish purple long (PPL), purple variegated- non spiny (PVNS), blackish round (BR), green round (GR), purple variegated spiny (PVSP), green long (GL) and purple long (PL). These eight lines were crossed in diallel crossing pattern (without reciprocals). The 28 hybrids obtained from the crossings were evaluated under normal fields conditions. The analyzed data has shown highly significant and high yield was noticed from the cross combination of PPL X GR followed by PVNS X GR. There were other F₁ hybrids like PR X GR, PPL X GL, which were having good yielding ability and good fruit qualities. PVNS X GR hybrid was having a mix of two colors of green with purple streaks which is very much suitable to Maharashtra and parts of North Karnataka markets. While BR X GR has blackish, round fruit type much preferred in western Maharashtra, Rajasthan and Madhya Pradesh. PPL X GL is having attractive purple with long fruit preferred in eastern states like Chhattisgarh, West Bengal and Assam.

Combining ability studies for quantitative traits have shown high level of additive gene effects for traits like plant height, fruits per clusters, fruit length to fruit girth ratio. And hence progeny selections as a breeding tool can be applied in advanced generations among eight parents GL was found good combiner for traits like branches per plant, fruit length and average fruit weight. GR has a good potential for fruit length and yield, PVNS for flowers per inflorescence. From the estimates of SCA effects PVNS x GR has been found to have a high potential for yield followed by PPL x GR.
It is evident from the experimental results that darker fruit colours are dominant in expression over lighter colours. Black coloured fruit was found dominant over rest of all the fruit colours. Purple colour fruit colour is dominant over pinkish purple and green colour, and pinkish purple is dominant over green coloured fruit. The tendency of colour also holds true for flower colour. Dark purple colour is clearly dominant over light purple and white flower and light purple is dominant over white.

The presence of spines over the leaf and fruit calyx is dominant over non spinyness. Shapes of fruits have intermediate actions where in there was no clear-cut actions between the crosses between long and round types. But the tendency of the hybrid fruit shape was found to be a long type.