# USE OF WILD GERMPLASM IN BREEDING FOR DISEASE RESISTANCE

V.K. Rajalakshmy

The cheapest and most effective method of combating diseases and pests is the use of resistant varieties. Provided that inherited resistance is not associated with low yield and poor quality, it is as cheap for a farmer to grow a resistant variety as one which is susceptible. It is not necessary or desirable to breed for a high level of resistance. Incomplete resistance has often given an adequate level of control in the field, particularly when such resistance has been supported by other control measures.

If resistant breeding material is not available a wide range of breeding lines and indigenous varieties may be examined for worthwhile levels of resistance. The resistance may also be sought in exotic varieties or in related interfertile species. It is always better to use resistance from indigenous material because these will already be adapted to local conditions. This will facilitate production of resistant varieties for local use. It is important that while breeding for resistance to one pest or disease, resistance to other parasites or agronomically important characters should not be neglected. As a general rule, a resistant variety may be as good as other varieties in nearly all respects in the absence of the disease. If this is not the case, that variety is unlikely to be grown on a large scale, no matter how good its resistance to a particular pest or disease.

Wild germplasm has been widely used in breeding for disease resistance. The often long process of domestication differentiates crops in many ways from their wild ancestors. Non ancestral wild relatives will be yet more different from crops.

The increasing awareness of genetic vulnerability to major crops has encouraged collection and conservation of a multitude

of germ plasm samples as a resource for future breeding. Three main sources of germ plasm are available to the plant breeder, viz., (1) commercial varieties (2) land races or traditional varieties (old established local stocks) and (3) a range of wild ancestral species and their wild relatives. Most samples in larger collections are land races. Apparent need of breeders for additional characters and increased accessibility to traits from wild species have led to wide recommendations for the increased collection, conservation and use of wild germ plasm.

## The need for using germ plasm in breeding for disease resistance

There was a general tendency in breeding programmes towards rapid elimination of variability and strictly uniform population was the universal ideal. Unfortunately, as uniform varieties were grown over wider areas, their vulnerability to disease epidemics increased. Southern corn blight epidemic in maize in 1970 in United States is a very good example. Browning (1998) argued that it is a man made eqidemic caused by excessive homogenity of the U.S.A's tremendous maize hectarage. Genetic vulnerability is regarded as potentially dangerous.

Thus the need to broaden the genetic base of crops has been widely appreciated. The variation immediately available to the breeder may be called the genetic base and it is upon this, the plant breeder depends. The responsibility of the plant breeder in managing variation to combat genetic vulnerability is now paramount.

## Collection and maintenance of germplasm

Wild germplasm is collected with two main objectives viz., (1) to censerve diversity (2) to collect material for specific practical uses of agricultural improvement. When wild germ plasm is used as a source of disease resistance, this must be the main justification for collection. At all stages of collection and maintenance there are problems. The collection mission should involve pathologists so that at the collection site, the biology of the host species and the biology and ecology of the pathogen should be studied. Multiple visits for collection aid documentation of diseases overtime. Maintenance can be done as seed, tissue culture, field collections. Problems of ex-situ maintenance can be avoided by in situ conservation.

## Evaluation of germ plasm

Evaluation is a prerequisite for use of wild germ plasm. In situ evaluation of wild germ plasm in the field is considered the most effective method. Large collections should first be evaluated in field trials, under high pathogen pressure and against as varied a range of pathogen races as possible before controlled evaluations. Screening in the centres of diversity of major pathogens, disease hot spots and in the sites where the wild germ plasm will be used will enhance this objective. In situ evaluation followed by targeted collection of resistant germ plasm is more efficient strategy than ex-situ evaluation of larger collections. High cost involved in evaluating in ex-situ would be reduced by in situ evaluation.

## International movement of germ plasm

Germ plasm movement is vital for successful crop improvement programmes. But the process poses serious hazards for crop production world wide through dissemination of pathogens, especially through seed. Viruses are considered the greates t risk through symptomless colonization. Fortunately, most of the seed borne diseases are fungal. Though tissue culture may be adopted as a method, the technique has to be evolved for many species.

## Appraisal of the value of wild germ plasm for disease resistance.

Use of wild germ plasm for crop improvement has been very successful for a few crops but disappointing for numerous others. Although many successful transfers of single gene resistance have been achieved but only rarely there is the actual release of a new cultivar and its use by farmers.

The greatest impact of the use of wild germplasm in food crop is in wheat, potato and tomato because of the ease in the use of their wild relatives in breeding programmes, presence of polyploid species among wild germ plasm, and extensive background research of these crops, wild germ plasm and the pathogen.

## Value of wild germplasm for disease resistance

The presence of a wide spectrum of genetic resistance mechanisms in wild germplasm of potential value in crop improvement has been proved beyond doubt. Lack of information on the frequency of occurrence of an genetic control of race - nonspecific resistance in wild germ plasm, difficulties in extracting it from wild sources and reluctance of breeders to use such resistance have resulted in the use of wild germplasm almost exclusively as sources of race specific resistance. There is no proof that race specific resistance from wild germplasm will be more durable than resistance from crop germ plasm. Many pathogens have overcome race specific resistance including that from wild species. Wild species have been used to salvage a crop and prevent its failure commercially. Wild germplasm resources have not provided a miracle to combat disease. While the identification of usable resistance in wild germ plasm will broaden the genetic base available to breeder, it will not solve the problem unless used *intelligently*. Browning (1998) stated that "Diversity is the only defense against the unknown, as against a future disease threat".

## Hevea germplasm

The para rubber tree cultivated in South East Asia belong to the original collection of Sir. Henry Wickham in 1876 from an area, near the Tapajos river in Brazil. The number of Wickham seedlings contributed to the original plantation stock is believed to be very small, although around 2000 seedlings have been sent to Sri Lanka, Singapore, Perak and Java and this has been referred to as Wickham base (Simmonds, 1989). It is from this narrow base that spectacular increase of about 10 times has been achieved. Clonal propagation, ortet selection and cyclical assortive breeding systems are factors which further led to the decrease in genetic diversity. In Malaysia most of the clones can be traced back to 7 early clones. viz., Tjir 1, Pil A 44, Pil B 84, PB 24, PB 49, PB 56 and PB 86. In India this can be traced to 20 clones viz., PB 24, 25, 28, 49, 56, 86 and 186, Tjir 1, Gl 1, PR 107, Mil 3/2, Hil 28, Avros 255, Lun N, Pil A 44, RRIC 52, BD 5, BD 10, Pil B 50, and Pil B 84. The same is the situation in other countries in Asia and Africa.

The early selections recorded substantial yield increase over the Wickham material. Later on a slowing down of genetic advance was noticed. So a few introductions of new Hevea germplasm were made at different periods by Indonesia, Malaysia, Nigeria, SriLanka and India.

Recognizing the need to enrich the available genetic variability of Hevea in the orient, IRRDB organized a major collection expedition to the Amazon rain forests in 1981. This expedition has been considered the most significant in the history of rubber germplasm collection. The joint expedition of IRRDB and the Brazilian government collected a total of 64736 seeds from states of Acre, Rondonia and Matto Grosso. The materials collected were sent to Manaus, Brazil. After stringent phytosanitary measures 50% was retained in Manaus, Brazil. The rest was distributed in Malaysia (35%) and Ivory coast (15%) for conservation, evaluation and further re-distribution.

The ultimate objective of Hevea breeding is to synthezize ideal clones with high production potential combined with desirable secondary characters. Resistance to major diseases like South American leaf blight is an important criterion. None of the oriental clones is found to have resistance to *Oidium* and *Gloeosporium*. At present the *Corynespora* disease previously considered as a minor one, has developed to serious proportions in Sri Lanka, Indonesia, Malaysia and in India (Southern Karnataka). So these diseases also deserve special attention. Each country should therefore conserve indigenous, exotic and wild genetic sources. At present centres of conservation of germplasm include Indonesia, Malaysia, Thailand, China, India, Sri Lanka, Liberia, Nigeria, Zaire, Ivory Coast Cameroons, Philippines and Burma. According to diseases problems efforts are being made by different rubber producing countries with varying degrees of sucess and it is revealed that the genotypes display high variability. Early selection techniques for all the important diseases are to be developed. The disease resistance in *Hevea* is polygenically controlled and is not understood well.

Conservation of genetic resources of *Hevea* is an urgent need of the time. The base collection should include all known variants. Other related genera which yield latex may also be collected and conserved. Non availability of sufficient area for field evaluation and the long life-span of the crop limit the scope for detailed evaluations of all the collections.

In utilization of Hevea germplasm for disease resistance, the following priority areas are identified in general,

1) Identification and evalution of field resistance to SALB and other leaf diseases.

2) Promising parents may be selected on the basis of early selection criteria.

## References

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