

and together contribute 87 per cent in area and 72 per cent in production. There are over 29,500 accessions of sunflower available worldwide (FAO, 1996); 3 per cent of these are of wild species, 4 per cent land races or old cultivars, 54 per cent are advanced cultivars or breeding lines and 39 per cent are others. USDA has maintained over 3608 accessions of *H. annuus* which consist of 1445 cultivated *H. annuus*, 2092 accessions of wild annual species and 71 accessions of perennial *Helianthus* species. There are 750 accessions of sunflower germplasm conserved at -20° C in National Genebank at NBPGR, New Delhi. Cultivated sunflower is an annual and conspicuously different from the wild and weedy forms in having a single unbranched stem, large capitulum and medium to large seeds. The cultivated forms vary greatly from one another in height, stem girth, leaf number and size, duration of maturity, test weight and oil content. The stem may show different degrees of branching, ranging from mono stem nature with single head to highly branched forms with several heads. The stem is supported by a strong, deep central root system with well developed lateral roots reaching a soil depth of 1.5 m to 2.0 m. The leaves vary in number and are produced in opposite pairs at the lower portion of the stem and in alternate phyllotaxy in whorled form at the above. Sunflower germplasm, which includes, wild species, land races, local and improved varieties, CMS lines, Maintainer and Restorer lines, inbreds,

hybrids and breeding lines have been introduced from over 33 countries during 1948 to 2000.

A total of 205 accessions of *Helianthus annuus* were grown during *rabi* season of 2003 at NBPGR Experimental Farm, Issapur, New Delhi. The accessions were sown in an augmented block design at spacing of 50 x 15 cm and 3 m row length with five checks. The recommended agronomic practices were followed to raise a good crop. The observations were recorded on days to 50 percent flowering, days to mean maturity, plant height, stem thickness, number of leaves, leaf length, leaf width, head diameter and oil content.

Wide range of variability was observed in plant height (44.6-318.4 cm), stem thickness (0.8-4.3 cm), number of leaves (8.0-40.0) and leaf length (6.4-30.4 cm), leaf width (4.9-22.4), head diameter (4.0-22.4 cm) and oil content (32.51-51.38 percent). Promising accessions identified for short plant height were EC 512703, EC 512727, EC 512732, EC 512733, EC 512735, EC 512770, EC 512771 and EC 512772; for broad head size and short plant height were EC 494422; EC 494380 for early flowering and EC 512679, EC 494385, EC 494400, EC 494415, EC 494422, EC 494444, EC 512750, EC 512751 for broad head size. The accessions found promising in the present study may be utilized for developing varieties through direct selection or through breeding programmes.

Risk of Seed-transmitted Viruses Associated with Exchange of Soybean Germplasm and the South Asian Scenario

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Soybean (*Glycine max* (L.) Merr.) is an important legume and oilseed crop of immense commercial value to South Asia. Given its nutritional and health related benefits, soybean has been gaining more prominence the world over with the advent of transgenic crops. South Asia accounts for 4 percent of soybean production in the world, of which, within the region, India's share was 99.52 percent during 2003. Soybean diseases, especially of viral origin, severely affect the yield. The crop is infected by 44 viruses, out of which 24 are seed-

transmitted. The yield-loss due to seed-transmitted soybean viruses ranges from 10 to 100 percent. The seed-transmitted viruses reported to be present worldwide include *Alfalfa mosaic virus* (AMV), *Arabis mosaic virus*, *Bean common mosaic virus* (BCMV)-*Black eye cowpea mosaic virus* strain, *Bean pod mottle virus*, *Cowpea aphid-borne mosaic virus* (CABMV), *Cacao necrosis virus*, *Cherry leaf roll virus*, *Cowpea mild mottle virus*, *Cucumber mosaic virus* (CMV), *Grapevine fanleaf virus*, *Mulberry ringspot virus*, *Peanut stripe virus*,

Peanut stunt virus, Raspberry ring spot virus, Southern bean mosaic virus (SBMV), Soybean mild mottle virus, Soybean mosaic virus (SMV), Soybean stunt virus, Soybean stunt mottle virus, Tobacco black ring virus, Tobacco ring spot virus (TRSV), Tomato ring spot virus and Tobacco streak virus. Out of 24, majority are not reported from Bangladesh (21), Nepal (21), Sri Lanka (19), Pakistan (18) and India (17). However, none are reported from Bhutan and Maldives. Seventeen are not reported from any of the South Asian countries. Most of these viruses have wide host range and are transmitted by insect vectors and South Asian countries need to be careful about these viruses. Even a low rate of virus transmission through seeds can be disastrous to the crop and yield losses may be as high as 100 percent if the insect vectors in the field also play an active role in spreading the disease. Quarantine regulatory measures will help in preventing the introduction of these viruses into the region.

As per the Plant Quarantine (Regulation of Import into India) Order, 2003 of the Destructive Insects and Pests Act (1914), the imported germplasm including transgenics are subject to quarantine processing at the National Bureau of Plant Genetic Resources, New Delhi. The Order requires additional declaration to be included in Phytosanitary Certificate for soybean seeds to be free from viruses viz., mosaic, dwarf, crinkle, chlorotic mottle, cucumber mosaic, stunt, poty, tobacco ring spot, tobacco streak and tobacco black ring viruses, to restrict the entry of these viruses/ their strains into India. About 5,364 accessions of soybean germplasm including transgenics were processed for associated viruses under quarantine during 1986-2004. Techniques used to detect seed-transmitted viruses include visual inspection, grow-out test, infectivity test, electron microscopy, double antibody sandwich-enzyme linked immunosorbent assay and dot immunobinding assay. Seven seed-transmitted viruses viz., AMV, BCMV, CABMV, CMV, SBMV, SMV and TRSV were intercepted in the imported germplasm. Transgenic soybean imported from USA was found infected with SMV.

BCMV, CABMV, SBMV and are not known to occur on soybean in India and were intercepted for the first time. AMV, CMV, SMV and TRSV having wide host range are known to be present in India. However, there are reports of worldwide distribution of different virulent strains of these viruses. Therefore, interception of these viruses and incineration of infected plants eliminated the introduction of exotic viruses and their strains into the country. Finally by eliminating shriveled, discoloured and deformed seeds during visual inspection and later uprooting the plants with suspected viral symptoms, possible introduction of viruses other than those detected were also eliminated. Harvest from virus-free plants was released to the indenters. The findings thus highlight the importance of plant quarantine in minimizing/ eliminating the risk of introducing destructive exotic viruses and their strains, along with germplasm.

Strict regulatory measures together with growing new introductions under containment or isolation and collection of seeds from only virus-free plants must be followed to eliminate the risk of introducing seed-transmitted viruses/ their strains if any, into South Asian region. Database on all soybean viruses, including information on host range, geographical distribution, strains, etc. is being prepared for its use as a ready reckoner by the quarantine personnel. The region should take note of technical guidelines for the safe movement of legume germplasm including soybean prepared by International Plant Genetic Resources Institute, Rome. The findings also highlight the importance of having antisera for all the 24 seed-transmitted viruses, especially for those not reported in South Asia, in the quarantine laboratories of the region to facilitate the interception of exotic viruses and their strains. A regional working group of experts for detection of soybean viruses thus needs to be formed to explore future cooperation in terms of sharing of expertise and facilities. This would help in avoiding the introduction of viruses not known in the region and also the movement of viruses within the region, while facilitating the safe exchange of germplasm.