

Identification of resistance to multiple viruses in lentil germplasm

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Viruses are a major threat to lentil production worldwide with high levels of virus infection regularly found in Australian lentil fields. Losses are likely to increase as lentil cultivation is expanding into environments that are more prone to virus infection than the current production areas.

Cucumber mosaic virus (CMV) is currently the most commonly virus found in Australian lentil crops and its spread is facilitated by high levels of transmission in lentil seed. *Pea seed-borne mosaic virus* (PSbMV) is a major virus in Australian peas, but less so in lentils as, unlike with peas, high levels of PSbMV seed transmission have not been found in commercial seed lots. However, PSbMV strains have been isolated from experimental lentil seed lots that have unique virulences and the capacity to incite severe damage. Spread of these strains into commercial fields will have a major impact on production. *Bean leafroll virus* (BLRV) is particularly dangerous and can cause plant death after early infections. All three viruses are transmitted by aphids and lentils are a preferred host for a number of aphid species.

There is an urgent need to identify genetic sources of resistance to each of these viruses as current Australian lentil varieties are lacking adequate resistance. A program is established to evaluate germplasm using greenhouse (Tamworth Agricultural Institute) and field screening (NSW DPI Liverpool Plains Field Station), the latter being an environment that favours virus and virus vector development. PSbMV greenhouse screening uses mechanical inoculation with highly virulent isolates (lentil seed and pea seed derived strains). CMV screening is done both using mechanical inoculation in the greenhouse and in the field following natural infection. BLRV screening is done in the field using inoculations by viruliferous aphids.

The 2019 trials consisted of 126 germplasm accessions from the Australian Grains Genebank (AGG) with diverse backgrounds from Afghanistan (6), Azerbaijan (4), Chile (3), Ethiopia (9), India (24), Iran (18), Tajikistan (6), Turkey (50), Yemen (4), Italy (1) and Mexico (1) and 6 established lentil varieties. CMV screening is ongoing, but has so far failed to identify high levels of resistance. BLRV screening showed a clear clustering of resistance in germplasm from Iran and Chile; of the 20 accessions that showed less than 10% BLRV symptomatic plants at the first reading on 29 July, 15 originate from Iran and 3 from Chile. Iranian germplasm also performed outstandingly well in the PSbMV screening; of the 96 accessions tested so far, only 16 showed complete immunity to all PSbMV strains used; 14 from Iran, 2 from Turkey and 1 from Chile. Out of these 11 Iranian accessions and 1 Chilean were also among the best performers for BLRV resistance. Two of the Iranian accessions, AGG72116 (PI432028) and AGG71751 (PI431663) and the Chilean accession AGG71289 (PI299198) have been reported of having resistance to *Pea enation mosaic virus* (PEMV). PEMV has not been reported in Australia and is considered a high biosecurity risk.

The identification of accessions with combined resistance to un-related virus species was unexpected and warrants further investigations.