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1 **The use of infrared thermal imaging as a non-destructive screening tool for**
2 **identifying drought-tolerant lentil genotypes**

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8 **Abstract**
9

10 Lentil (*Lens culinaris*, Medik.) is an important legume crop, which often experience drought
11 stress especially at the flowering and grain filling phenological stages. The availability of
12 efficient and robust screening tools based on relevant non-destructive quantifiable traits would
13 facilitate research on crop improvement for drought tolerance. The objective of this study was to
14 evaluate the drought tolerance of 37 lentil genotypes using infrared thermal imaging (IRTI),
15 drought tolerance parameters and multivariate data analysis. Potted plants were kept in a
16 completely randomized design in a growth chamber with five replicates. Plants were subjected to
17 three different drought treatments: 100, 50 and 20 % of field capacity at the onset of reproductive
18 period. The relative drought stress tolerance was determined based on a set of morpho-
19 physiological parameters including non-destructive measures based on IRTI, such as: canopy
20 temperature (Tc), canopy temperature depression (CTD) and crop water stress index (CWSI)
21 during the growing period and destructive measures at harvest, such as: dry root-shoot ratio (RS
22 ratio), relative water content (RWC) and harvest index (HI). The drought tolerance indices used
23 were drought susceptibility index (DSI) and drought tolerance efficiency (DTE). Results showed
24 that drought stress treatments significantly reduced the RWC, HI, CTD and DSI, whereas, the
25 values of Tc, CWSI, RS ratio and DTE significantly increased for all the genotypes. The cluster
26 analysis from morpho-physiological parameters clustered genotypes in three distinctive groups
27 as per the level of drought stress tolerance. The genotypes with higher values of RS ratio, RWC,
28 HI, DTE and CTD and lower values of DSI, Tc and CWSI were identified as drought-tolerant
29 genotypes. Based on this preliminary screening, the genotypes Digger, Cumra, Indianhead, ILL
30 5588, ILL 6002 and ILL 5582 were identified as promising drought-tolerant genotypes. It can be
31 concluded that the IRTI analysis is a a high-throughput constructive screening tool along with
32 RS ratio, RWC, HI and other drought tolerance indices to define the drought stress tolerance
33 variability within lentil plants. These results provide a foundation for future research directed at

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