1.5.2 Neshamba, Saul M. (2010). Variability for drought tolerance in finger millet (*Eleusine coracana* (L.) Gaertn.). (Supervisor: Dr. D. M. Lungu).

Finger millet (*Eleusine coracana* (L.) Gaertn.] is an important traditional food security crop in the remote and dry areas of northern Zambia. Its several major uses include porridge, bread, malt, beverages, fodder and popped products. Yields in these areas are severely limited by drought. Drought is expected to occur with increased frequency and intensity in future with climate change. Development of tolerant varieties is a more sustainable way to cope with recurrent drought for small scale growers. Limited research on tolerance to drought in finger millet in Zambia has been done. As a result only a few varieties adapted to the high rainfall region have been developed and promoted. Two hundred and fifteen accessions in the national collection have not been evaluated for the trait. As a result very little is known about their variability in the trait. Assessment of variability is important for effective selection. Variation in 12 putative morphological and agronomic traits of drought tolerance in 203 accessions was studied in a wooden box Randomized Complete Block Design off-season in 2 environments, one with and the other without stress, on an Acrisol in northern Zambia. One sample T-test of differences in attributes of traits showed no significant difference between test environments in grain weight (GW, $p = 0.744$). The test, however, showed significant differences in spike length (SL, $p = 0.027$); highly significant differences in biomass (BW, $p < 0.001$) and chaff weight (CW, $p < 0.001$), days to 50 % flowering (DTF, $p < 0.001$), pest and disease susceptibility (PDS, $p < 0.007$), plant height (PH, $p < 0.001$), number of productive tillers (NPT, $p < 0.001$), spike weight per plot (SY, $p < 0.001$) and stay-green characteristic (SGC, $p < 0.001$). Withholding water for 5 days during flowering reduced SL by 3.4 %, BW by 3.1 %, SGC by, CW by, PDS by 10.5 %, NPT by 40.0 %), and SY by 48.5 % and increased PH and DTF by 3.1 and 4.3 %, respectively. One-way analysis of variance detected significant differences among accessions in SY ($p = 0.032$) under optimal conditions. The same analysis detected significant differences in number of spikes per panicle (SN, $p = 0.014$) and SGC; and highly significant differences in PDS ($p = 0.001$) under stress. Eighty-three accessions outweighed the best check (FMM 165 = 2.500 ± 1.000 kg/plot) in SY under optimal conditions. Accession ZM 3813 had the highest SY (6.450±1.000 kg/plot) and ZM 203 (0.200 ± 1.000 kg/plot) the lowest in the environment. Under stress 92 accessions exceeded the best check (Nyika = 5.923 ± 1.3825 - same and 1.5457 - different block) in SN. ZM 3825 had the largest attribute (8.706 ± 1.3825,1.5457) and ZM 193 the smallest (2.631). In SGC 77 accessions were scored better than the best check, FMM 165. ZM 225 (5.222 ± 0.7643, 0.8545), ZM 245 (5.222 ± 0.7643, 0.8545), and ZM 112 (4.972 ± 0.7643, 0.8545) were scored the best and 37 others the poorest in the trait. And in PDS 31 accessions had better scores than the best check (Senga = 3.000 ±-0.0151, 0.01689). The least susceptible accession was ZM 3860 (Score = 0.406 ± 0.0151,0.01689) and the most susceptible was ZM 3652 (6.031 ± 0.0151, 0.01689). Overall ranking of accessions according to tolerance to stress in 9 traits showed 16 accessions namely, ZM 3825, ZM 3920, ZM 1459, ZM 3906, ZM

3819, ZM 3834, ZM 3834, ZM 203, ZM 40122, ZM 3816, ZM 229, ZM 3685, ZM 154, ZM 153, and ZM 3824, to be more tolerant to stress than the best check, Nyika. These accessions occurred across a wide range of clusters. Six of them were collected from the high, and 5 from the low rainfall region. Five were collected from Kawambwa showing the district to be an important source of tolerance. Nearest neighbour analysis using the dissimilarity coefficient, Euclidean Distance, generated 3 dendrograms depicting relationships among the accessions based on the traits evaluated 1 dendrogram for each of the test environments and 1for the most tolerant accessions. Accessions could be consigned to several clusters. All clusters could be read between Euclidean Distance 0.84 and 1.00. The pattern of clustering in the 2 environments was similar. Under optimal conditions ZM 153 and ZM 3813 were the most divergent. Under stress maximum cluster distance was between the most tolerant accession (ZM 3825) and the recently released mutant variety, FMM 175. Among the most tolerant accessions ZM 3834 and ZM 40 122 were the most closely related, and ZM 154 and ZM 203 the most divergent. There was obvious differentiation at both interc1uster and intracluster levels. In the dendrogram of the most tolerant accessions ZM 3825, ZM 3824, ZM 3819, ZM 3834, ZM 3783 and ZM 3816 collected from Luapula did not occur in the same cluster at short distances indicating wide divergence among the most tolerant accessions. This also showed extensive divergence between the most and less tolerant accessions. The accession may be used to introgress drought tolerance in the mutant variety.