SURVEY OF CASTOR SEED PHYSICAL CHARACTERISTICS AND SEEDLING ESTABLISHMENT AT BADEGGI, NIGER STATE, NIGERIA

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ABSTRACT
Castor oil plant (Ricinus communis L.) is one of the most versatile oil crops with high socio-economic values around the world. The crop has been demonstrating its economic potentials by earning notable foreign exchange credits to many countries. However, following the incorporation of castor into national research mandate in Nigeria, poor seedling establishment and low yield have been identified as some of the limitations to its commercial production in the country. Based on this background, 51 local and 48 exotic castor germplasm were surveyed on seed physical characters and evaluated for field seedling establishment at three locations. The collections revealed high divergence in seed colour, seed shape, seed mottle, seed caruncle and seed sizes. Variability observed in 100 seed-weights among the accessions ranged from 8.51g to 65g with average of 26.48g. High significant variability in seedling establishment was observed among the accessions. The highest establishments (87 – 89 %) were recorded in Acc. 002 and Acc.062 across the locations and the least (10 – 17 %) was recorded in Acc.104. Significant genotypic effect and no significant effect of genotype X location were recorded. High broad sense heritability of 88 and 22.51 per cent genetic gain show good expected gain from selection programs.

Keyword: Ricinus communis, Germplasm, Nigeria, Establishment, Characteristics

INTRODUCTION
Castor (Ricinus communis L., 2n = 20) is an oil crop with high economic values (Anjani, 2012). The recent rapid increase in demand of castor seed/oil in local and international markets (Mutlu and Meier, 2010) has aroused the interest of Nigerian farmers to cultivating the crop. Unfortunately, castor is presently receiving little or no active research attention in Nigeria, resulting in lack of improved production technologies for farmers. This has necessitated integrated castor research efforts among Nigerian scientists (Salihu et al., 2014). Therefore, the aim of this research is to survey the NCRI castor germplasm for seed physical characteristics and seedling establishment.

MATERIALS AND METHODS
Seed Physical Characteristics: In 2014, the seeds of all the collections were multiplied and 100 seeds weights were taken from three replicate samples per accession. The seeds were characterized based on the seed shape, seed colour, mottle, caruncle, seed size and seed weight using INDIA Castor Descriptors (2004). The seed colour was determined using Graf Colour Chart (2012).
Seedling Establishment: 99 castor accessions including 51 local and 48 exotic collections were evaluated on experimental fields at three different locations: NCRI Mokwa (Lat. 9º 12'N, Long. 5º 20'E), NCRI Badeggi (Lat. 9°45'N, long. 6°07'E) and Mina (Lat. 9º 36'50"N, Long. 6º 33'25"E) . The treatments were laid out on Alpha Lattice Design with 3 replications. Each plot size was 3m X 1.5m in dimension with inter-row and intra-row of 75cm. Thirty (30) intact seeds, pre-treated for seed-borne diseases, were planted at two seeds per hole in each of the replicate plots, resulting to 90 seeds planted per location and total of 270 seeds across the locations. The planting was done in Mid-June 2015, when rainfall has completely stabilized at the locations. Insecticide (Cypermethrin) was applied at 5, 15, 25 and 35 days after planting to prevent seedling lose due to insect attacks. Seedling establishment was taken (at 40 days after planting) as the number of plant stands expressed in percentage. Descriptive statistics was used to summarize the date. Combined Analysis of Variance was performed across the locations. Genotypic effect, and GXE effect were tested using -2 log-likelihood ratio test procedure of PBtools 1.3. Broad-sense heritability was estimated according to Eckebil et al. (1977). Genetic advance (at 10% selection differential) as described by Johanson et al. (1955) and Genetic gain (%) as genetic advance (GA) expressed in percentage of the population mean were estimated.

RESULTS AND DISCUSSION

Seed physical characters of castor accessions at NCRI, Badeggi

The accessions reveal high divergence in seed colour, seed shape, seed mottle, seed caruncle and seed sizes. Exotic collections comprise of 17 large seeded (diameter > 15mm), 23 medium (diameter, 9mm – 15mm) and 13 small seeded (diameter < 9mm) castor types (Table not included). Variability observed in 100 seed-weight among the accessions ranged from 8.51g to 65g with average 26.48 (Table not included). The result obtained is in conformity with result of 1033 accessions reported by Wang et al., (2010).

Field seedling establishment

High significant variability in seedling establishment was observed among the accessions (Table 2). The highest establishments (87 – 89 %) were recorded in Acc. 002 and Acc.062 across the locations and the least (10 – 17 %) was recorded in Acc.104 (Table 3).

Analysis of variance revealed no effects of blocks and location, and genotype variation has the highest value among the sources of variation (Table 1). Significant genotypic effect and no significant effect of genotype X location were recorded (Table 2). High broad sense heritability of 88.00%, and 22.51 per cent genetic gain show good expected gain from various kinds of selection programs.

Inherent problem of castor seedling establishment caused by poor seed germination is an issue that deserves attention from scientists. Machado et al., (2010) reported seed internal morphology and apparent level of reserved food as two important factors for fast germination and seedling establishment. Low soil temperature is one of the factors that also influence poor germination and seedling establishment in castor.

CONCLUSION

The diversity in seed weight and seedling establishment observed in the germplasm provides good sources of variability upon which selection can be made to generate improved genotypes. Although the results reported here may justify the aim of the research, however there is need for proactive research in seed technology and genetic improvement to enhance the seedling establishment of the present castor cultivars among Nigerian farmers.

Table 1: Combined analysis of variances for seedling establishment of castor at three locations

Sources of Variation	Variances	Std. Deviations
Genotype X Location	**11.686**	**3.419**
Genotype	**158.165**	**12.576**
Rep X Block X Location	**4.013e-13**	**6.335e-07**
Rep X Location	**24.857**	**4.986**
Location	**0.000**	**0.000**
Residual	**42.099**	**2.052**

Table 2: Genotypic and genotype x location effects on seedling establishment of castor at three locations

Genotypic Effect					Genotype X Location Effect						
Df	Sum Sq	Mean Sq	F value	Pr (>F)		AIC	BIC	logLik	Chisq	Df	Pr(>Chisq)
97	158835.5	1637.479	3.9002	0.0000	Model2	6940.53	7422.24	-3368.26			
					Model1	6942.42	7428.85	-3368.21	0.113	1	0.7363

S/N	Treatment	Badeggy	Mokwa	Minna	S/N	Treatment	Badeggi	Mokwa	Minna
1	Acc.001	77.513	77.898	77.720	53	Acc.059	75.042	73.790	74.838
2	Acc.002	88.779	88.623	89.265	54	Acc.060	78.508	78.622	79.536
3	Acc.003	83.270	82.843	83.328	55	Acc.061	83.838	84.764	84.731
4	Acc.004	86.512	87.167	86.322	56	Acc.062	87.307	88.233	87.793
5	Acc.005	72.653	72.091	71.922	57	Acc.063	71.272	71.579	70.522
6	Acc.006	69.710	69.959	70.331	58	Acc.064	87.307	87.692	88.334
7	Acc.007	74.921	74.494	73.919	59	Acc.065	69.811	70.296	69.365
8	Acc.008	73.854	73.292	72.853	60	Acc.066	57.674	58.194	58.190
9	Acc.009	77.053	75.949	76.998	61	Acc.067	71.850	72.535	71.554
10	Acc.010	74.109	74.629	74.595	62	Acc.068	83.178	83.021	83.800
11	Acc.012	65.971	67.302	66.727	63	Acc.069	66.376	67.032	66.592
12	Acc.015	62.383	62.226	62.057	64	Acc.070	82.959	83.298	83.904
13	Acc.016	85.310	85.560	85.797	65	Acc.071	73.584	73.292	73.123
14	Acc.017	38.456	38.224	38.130	66	Acc.072	75.581	75.695	75.391
15	Acc.018	84.650	84.764	83.919	67	Acc.073	75.095	75.377	75.520
16	Acc.019	80.911	81.431	80.991	68	Acc.074	73.766	73.959	73.469
17	Acc.020	25.500	30.598	29.888	69	Acc.075	81.842	82.362	82.463
18	Acc.021	17.147	21.589	15.930	70	Acc.076	81.745	82.265	81.931
19	Acc.022	57.323	55.544	57.133	71	Acc.077	61.816	61.774	62.572
20	Acc.023	20.910	31.411	32.744	72	Acc.078	75.581	75.965	75.120
21	Acc.024	81.707	82.632	82.328	73	Acc.079	84.515	84.088	84.731
22	Acc.026	83.449	82.887	83.665	74	Acc.080	77.188	76.896	75.916
23	Acc.027	80.251	79.959	79.790	75	Acc.081	80.521	79.959	79.520
24	Acc.028	81.046	81.025	81.261	76	Acc.082	45.446	45.019	46.202
25	Acc.029	85.716	85.695	85.255	77	Acc.083	83.043	83.292	83.665
26	Acc.030	28.288	35.658	26.035	78	Acc.084	73.904	73.952	73.783
27	Acc.031	30.892	38.991	32.987	79	Acc.085	66.782	66.896	66.322
28	Acc.032	82.524	82.250	82.333	80	Acc.086	76.782	76.761	76.457
29	Acc.033	26.217	26.467	25.972	81	Acc.087	84.130	83.297	83.857
30	Acc.034	69.033	70.500	70.467	82	Acc.088	79.980	80.635	79.384
31	Acc.035	53.839	54.900	54.595	83	Acc.089	85.581	85.560	85.526
32	Acc.036	81.587	81.296	80.450	84	Acc.090	54.524	54.705	55.423
33	Acc.037	65.987	65.154	65.526	85	Acc.091	76.512	77.167	76.322
34	Acc.038	62.112	62.632	61.922	86	Acc.092	77.385	77.926	77.487
35	Acc.039	74.587	74.863	74.532	87	Acc.093	71.587	71.431	70.315
36	Acc.040	67.307	67.827	68.199	88	Acc.094	73.746	72.305	73.400
37	Acc.041	37.702	38.221	36.952	89	Acc.095	81.920	82.180	82.812
38	Acc.042	39.439	40.094	40.466	90	Acc.096	81.046	81.025	81.262
39	Acc.043	39.455	38.487	38.724	91	Acc.097	86.190	85.976	86.406
40	Acc.044	69.726	68.622	68.318	92	Acc.098	59.726	59.164	57.777
41	Acc.045	48.525	47.692	47.117	93	Acc.099	82.248	81.956	82.463
42	Acc.046	59.757	59.600	59.521	94	Acc.100	62.924	61.821	61.922
43	Acc.047	72.367	72.649	72.447	95	Acc.101	62.175	61.883	61.958
44	Acc.048	80.596	81.228	80.947	96	Acc.102	55.581	56.236	54.850
45	Acc.050	57.984	58.368	56.982	97	Acc.103	65.851	65.289	65.526
46	Acc.052	66.647	66.355	66.998	98	Acc.104	15.087	17.028	10.910
47	Acc.053	80.074	78.627	79.671	**OVERALL MEAN:**				**71.071**
48	Acc.054	77.578	77.962	77.793	**S.E. OF DIFFERENCE**				**10.489**
49	Acc.055	72.637	73.292	74.070	**HERITABILITY (%):**				**88.000**
50	Acc.056	81.317	80.619	81.397	**GENETIC ADVANCE:**				**16.270**
51	Acc.057	80.438	80.590	81.368	**GENETIC GAIN (%):**				**22.513**
52	Acc.058	67.537	66.975	69.117					

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