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Performance of different castor /*Ricinus communis*/ genotypes and their effect on eri-silkworms */Samia cynthia*/

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Castor (*Ricinus communis* L.) is the primary feed plant for eri- silkworms /*Samia cynthia* /.The studies were conducted in field and laboratory conditions with the objectives to evaluate the agronomic and their rearing performance of different genotypes of castor on eri- silkworms. About 6 genotypes of castor namely, Acc 105524, Acc 208624, Hiruy, Acc 106509, Abaro and Local were evaluated in the field and laboratory. The treatments were arranged with RCBD in the field and CRD for laboratory experiments in three replications. Significant differences were observed in agronomic and rearing performances of genotypes of castor. In field, maximum number of leaf per plant (28 and 27) and dry leaf weight (167g and 169 g) were recorded from Abaro and Hiruy, respectively. However, the local genotype gave minimum leaf weight (205g). In addition, there were significant differences in rearing performances of eri-silkworms fed on different genotypes of castor. Among different genotypes, eri-silkworms fed on leaf of Abaro gave better results such as larval weight (8.20 g), effective rate of rearing (78 %), cocoon weight (3.30 g), shell weight (0.479 g), silk ratio (14.5 %), fecundity (372) and hatchability (84.17 %) as compared to other genotypes. In general, Abaro and Hiruy showed better results in agronomic performances; however Abaro also gave better results in rearing performance of eri-silkworms for improving silk production as compared to other genotypes

Key words: Castor genotypes, eri –silkworm, Samiacynthia, agronomic and rearing performance

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INTRODUCTION

Castor (*Ricinus communis*) is the primary feed plant, which is known for high production of good quality cocoon. However, cassava (*Manihotutilissima)*, Kesseru (*Heteropanaxfragrance),* Papaya (*Carico papaya*), Jatropha (*Jatrophacurcas*), Barpat (*Ailanthus grandis*) and Payam (*Evodiafraxinifolia)* are secondary and tertiary host plants during unfavorable seasons *(Hajarika et al., 2003).*

Sakthivel 2004, also reported the superiority of castor over other hosts including cassava for larval and cocoon traits.It also been observed that the growth and development of silkworms and quality of silk cocoon produced are directly influenced by the variety and quality of leaves fed to the worms (Krishnaswami *et al.,* 1970). Morphological characters of leaves contribute to acceptability by silkworms (Krishnaswami *et al.,* 1970).

Gogoi and Goswami (1998), studied castor genotypes and observed variation in leaf yield in different genotypes. Therefore, selection of castor genotypes is an important criterion for better growth and development of eri-silkworm for proper nourishment to obtain better fecundity and higher cocoon productivity (Joshi and Misra, 1982). However, very little information is available on the different castor genotypes and its performance on eri-silkworms in Ethiopia. Therefore, the objective of this study was to evaluate the agronomic and their rearing performance of different genotypes of castoroneri-silkworms.

MATERIAL AND METHODS

Experiment conducted on field and laboratory, across differentAgricultural Research Center (Melkassa, Jimma, Wondogenet, Hawassa) and Alage ATVET College.

All genotypes were collected from different parts of the country mainly from institute of Biodiversity conservation (IBC), Essential Oil Research Center and the surrounding areas. About 6 genotypes of castor namely, Acc 105524, Acc 208624, Hiruy, Acc 106509, Abaro and Local were used as a treatment and evaluated under fieldand laboratory conditions. The study was carried out under rain fed condition with supplemental irrigation during dry periods. The castor genotypes were sown with a spacing of 75 cm* 75 cm between plants and rows on a plot size of 6m * 4.5 m. The treatments were arranged with RCBD in three replications in the field.

For laboratory eri-silkworm was reared on the 6 castor genotypes. The silk worm rearing room and equipment's were cleaned, washed and disinfected with 2 % formalin solution at the rate of 800ml per 10m^2 before the commencement of the experiment (Dayashankar, 1982). This silk worm was reared following cellular techniques starting from brushing till silkworms at larval stage was fed four times a day with tender leaves until III instars and mature leaves until V instars. The grown up worms were picked and left on the mountages for spinning. On the sixth-eighth day of spinning, the cocoons were harvested, counted and weighed (Singh and Benchamin, 2002). The experiment was arranged in Completely Randomized Design (CRD) in three replications. In each replication, 50 worms/tray were used and allowed to complete the larval period to cocoon spinning on the six genotypes.

Data collection

Agronomic parameters like, plant height, number of leaves per plant, number of primary and secondary branches, fresh and dry leaf weight *etc.,* were recorded. For the laboratory, rearing variables like larval duration (hr), larval body weight (g), hatchability (%), effective rate of rearing (%), cocoon traits like (cocoon and shell weight in grams and silk ratio in percent) and fecundity (number of eggs per female in number) were recorded. The following formulae adopted by Singh and Benchamin (2002) were used:-

$$\text{Hatchability (\%)} = \frac{No. of\ \ normal\ eggs - number\ of\ nonhatched\ eggs}{No. of\ normal\ eggs} x\ 100$$

$$\text{Silk ratio} = \frac{weight\ of\ shell}{Weight\ of\ cocoon} x\ 100$$

$$\text{Effective rate of rearibg (ERR)} = \frac{No. of\ larvae\ spinning\ cocoon}{No. of\ larvae\ brushed} x\ 100$$

Data analysis: The data were subjected to analysis of variance (ANOVA) using Statistical Analysis Software (Gomez and Gomez, 1984)(version 9.00, SAS, Institute Inc., Cary, NC, USA). Treatment means were separated using Duncan multiple ratio.

RESULTS AND DISCUSSION

Evaluation of castor genotypes in field and its rearing performance was carried out. Eri- silkworms fed with the leaves of different genotypes of castor and their response was evaluated.

Results showed that in all locations displayed significant (P<0.05) differences for a number of agronomic and yield characters for different castor accessions as compared to local check. There were significant differences (P<0.05) in number of leaf production, fresh and dry leaf weight among treatments in different locations. However, in Jimma treatments comparable results on the mean number of leaf production were obtained. Maximum fresh leaf weight (748g) and dry leaf weight (169g) were recorded from Hiruy at Melkassa site. However, the least fresh (205g) and dry leaf weight (31g) was recorded in local and208624accessionfrom Alage site, respectively (Table 3).

Among all treatments, Abaroand Hiruy gave significantly (P<0.05) higher yield as compared to local check and other treatments. They gave better and similar results in most of the measured parameters. Except Jimma and Alagesites, significant difference in plant height was not recorded (Table 1).The difference between the highest and the lowest in leaf production was 39 and 7.7 (Table 3). at Jimma and Alage locations, respectively.

Gemechu (2012) stated that when genotypes perform consistently across locations, breeders shouldable to

Table 1. Means for plant height (cm) and number of leaf per plant at harvesting stage of castor accessions grown across locations

Treatment	Plant height and number of leaf per plant at harvest respectively									
	Melkassa		**Jimma**		**Wondogenet**		**Hawassa**		**Alage**	
	PH	NL	PH	NL	PH	NL	PH	NL	PH	NL
105524	193a	18bc	188bc	32a	144a	20b	135b	20b	184a	10bc
208624	188a	16c	197abc	39a	150a	22ab	161ab	22ab	214a	7.7c
HIRUY	234a	24ab	224abc	25a	155a	27a	133b	24ab	205a	14a
106509	190a	17c	255ab	34a	150a	23ab	172a	20b	216a	10bc
Abaro	220a	28a	266a	23a	125a	19b	152ab	26a	165a	14a
Local	184a	20bc	180c	23a	100a	20b	162ab	20b	148a	12ab
CV	17	16.8	18	38	25	16	17.5	14.7	22	17
LSD	62.7	6.2	71	20.6	62	6.6	31.6	6	76	3.5

Means within the same column with a common letter are not significantly different (P<0.05), PH= plant height (cm), NL= Number of leaves per plant

Table 2. Means for Primary and Secondary branches per plant during harvesting stage of castor accessions grown across location

Treatment	Primary and Secondary branches									
	Melkassa		**Jimma**		**Wondogenet**		**Hawassa**		**Alage**	
	1ry	2ry	1ry	2ry	1ry	2ry	1ry	2ry	1ry	2ry
105524	5ab	1.7ab	9a	3.7a	7bc	1.7ab	6a	0.3b	9a	2a
208624	4bc	2ab	8a	4a	7bc	1b	6a	1.3ab	9a	1.2a
HIRUY	6a	2ab	9a	3a	10a	2.7a	5a	2a	11a	1.6a
106509	2.7c	1b	7a	3.7a	5c	2ab	6a	2.7a	9a	1.4a
Abaro	5.7a	2.7a	6.7a	3a	9ab	2ab	5a	2a	7a	0.8a
Local	5ab	2ab	7a	2a	8ab	1.7ab	4a	1.3ab	8a	1a
CV	19	44.7	32	46	17	33	27	46.5	30	60
LSD	1.6	1.5	4.7	2.7	2.4	1	2.6	1.4	5	1.4

Means within the same column with a common letter are not significantly different (P<0.05).

Table 3: Means for fresh and dry leaf weight (g) per plant at harvesting stage of castor accessions grown across locations

Treatment	Fresh and dry leaf weight (g) per plant at harvesting stage, respectively									
	Melkassa		**Jimma**		**Wondogenet**		**Hawassa**		**Alage**	
	FLW	**DLW**	**FLW**	**DLW**	**FLW**	**DLW**	**FLW**	**DLW**	**FLW**	**DLW**
105524	508cd	128ab	435c	105bc	288b	67b	471c	120a	292b	51b
208624	362d	89b	457c	107bc	287b	74b	492bc	148a	280b	31b
HIRUY	748a	169a	698a	149ab	419ab	101ab	637ab	160a	475a	119a
106509	563bc	132ab	544bc	123abc	338ab	72.7b	475c	156a	284b	34b
Abaro	703ab	167a	668ab	153a	459a	116a	659a	163a	408a	101a
Local	587bc	153a	423c	95c	313b	68b	438c	141a	205b	47b
CV	14	18	15	20	22	25	15	26	17	31
LSD	151	46	149	45	139	38	146	70.5	99	36

Means within the same column with a common letter are not significantly different (P<0.05), FLW= Freash leaf weight, DLW= dry leaf weight

effectively evaluate germplasm with a minimum cost in a few locations for ultimate use of the resulting varieties across wider geographic areas. However, with high genotype by location interaction effects, genotypes selected for superior performance under defined environmental conditions (Ceccareelli, 1997). Therefore, it could be implicated that selection of better performing genotypes at one location may not enable the identification of genotypes that can repeat nearly the same performances at another location.

Table 4: - Rearing performance of eri silkworm fed on different castor genotypes

Treatment	HaP	LaD	Larw	CoW	Shw	SiR	Fecun	ERR
Abaro	84.17^{b}	584.17^{b}	8.29^{ba}	3.3^{a}	0.479^{a}	14.5^{a}	372^{cb}	78^{a}
Acc105524	95.3333^{a}	584.17^{b}	8.05^{bc}	3.149^{e}	0.453^{e}	14.395^{c}	409.000^{a}	69.32^{c}
Acc106509	81.50^{d}	588.17^{b}	8.05^{bc}	3.131^{e}	0.447^{f}	14.281^{d}	337.667^{e}	73.38^{a}
Acc208624	87.00^{b}	588.17^{b}	8.05^{bc}	3.307^{b}	0.477^{b}	14.424^{bc}	374.000^{cb}	73.18^{a}
Hiruy	93.83^{a}	592.17^{b}	8.02^{c}	3.205^{dc}	0.458^{d}	14.305^{d}	388.667^{b}	69.92^{bc}
Local	84.8333^{c}	588.17^{b}	7.60^{d}	3.144^{e}	0.443^{g}	14.073^{e}	353.000^{ed}	65.36^{d}
SE	0.61	3.75	0.04	0.01	0.001	0.02	5.3	1.2
CV (%)	1.21	1.1	0.96	0.47	0.51	0.21	2.47	2.45

B: Hap= hatching percentage, LaD= larval duration (HR), Larw =larval weight, CoW= cocoon weight, Shw =shell weight, SiR= silk ratio, fecund= fecundity, ERR =effective rate of rearing; Means with the same column with a common letter are not significantly different at Pr< 0.05.

Studies on nutritional ecology of an insect are very important for its commercial exploitation (Slansky and Scriber, 1985). The suitability of host is determined through estimation of rate of ingestion, digestibility, conversion efficiency of food and growth rate of the animal (Englemann, 1966).The results indicated that castor genotypes of Acc 105524, Acc 208624, Hiruy, Acc 106509, Abaro and Local check resulted significant variation in rearing performances of the worms. Insects do vary in efficiency of conversion of digested food due to the varied level of nutrients intake, quality of the food and total biochemical components of the leaf supplied to the insects (Krishnaswami *et al.,* 1970). Among different genotypes of castor, eri-silkworms fed on leaf of Abaro gave better results such as larval weight (8.29 g), effective rate of rearing (78 %), cocoon weight (3.30 g), shell weight (0.479 g) and silk ratio (14.5 %) as compared to local check and other treatments (Table 4). The study by Rajesh *et al.,*(2010) on the increase of larval weight, cocoon and pupal weight and silk ratio exhibited by eri silkworm fed on castor leaf was explained due to the higher rate of food ingestion, food assimilation and respiratory activity. The involvement of these factors in increasing the larval body substance has been reported by Stockner (1971). In general, Abaro and Hiruy showed better results in agronomic performances in the field; however, Abaro also gave better results in rearing performance of eri-silkworms in the laboratory.

CONCLUSION

The study revealed that Abaro and Hiruy performed best results in most important agronomic parameters in the field conditions as compared to other accessions. However, Abaro also recorded better results in the laboratory. Therefore, Abaro is potentially useful source of feed plant for eri-silkworms. However, in the absence or next to Abaro, Hiruy also important source of feed plants for better production of cocoon.

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