EVALUATION OF CASSAVA VARIETIES FOR ERI SILKWORM, *SAMIA CYNTHIA RICINI* BOISDUVAL

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ABSTRACT: Seven popular Indian cassava varieties namely CO2, CO3, CO (TP) 4, H165, H226, Mulluvadi (MVD1) and Kunguma Rose were screened for rearing of eri silkworm, *Samia cynthia ricini* Boisduval for effective utilization in eri silk production. The variety MVD1 recorded highest values of essential nutrients *viz.* protein, total carbohydrate, nitrogen, phosphorus, potassium and total minerals which was closely followed by H226 whereas CO2 exhibited least values. With respect to anti- nutrients, highest content of total tannins and HCN were recorded with the variety CO2 and it was least in MVD1. The variety MVD1 registered superior economic traits of eri silkworm followed by H226 while CO2 was noted as poor performer. All the nutrients exhibited positive correlation with economic traits except that of larval period which was decreased with increase in nutritional content of leaves while it was vice versa in case of anti nutrients. The order of merit of cassava varieties suitable for ericulture was recorded as MVD1 > H226 > CO (TP) 4 > CO3 > Kunguma Rose > H165 > CO2.

KEY WORDS: Cassava varieties, biochemical compositions, eri silkworm, *Samia cynthia ricini,* economic traits.

Ericulture is mainly confined to North-east India since the time immemorial as an integral part of the local tribals who traditionally rear the eri silkworms primarily for pupae as food and conventionally weave silk fabric for their family use. The main reason hindered the spread of ericulture from North-eastern region to other states in the country has been the perception that its production would be uneconomical because similar food habits and socio-cultural patterns do not prevail in these areas. In recent past, introduction of advanced machineries for spinning of eri cocoons facilitating production of finer yarns paved the way to commercially attractive designs and products which included blends with other natural silks, cotton, wool, synthetic materials etc. (Somashekar, 2004). As the eri silk gained the market value, there has been increasing demand in production of eri cocoons. This has attracted the non-traditional states and other countries where the food plants of eri silkworm *viz.* castor and cassava are cultivated in large scale as agricultural crops, to go for ericulture as a source of additional income by using a part of foliage without affecting the main produce and primary income from host plant. Eri silk, among all non-mulberry silks, is exploited to the maximum extent accounting for 63% of total non mulberry silk production and 13% of the total silk production in India (Anonymous, 2014).

Castor (*Ricinus communis* L.), the primary host plant of eri silkworm *Samia cynthia ricini* Boisdual is greatly exploited for eri silk production in nontraditional states whereas cassava, the most preferred food plant after castor has also been proved to be suitable for commercial rearing (Sakthivel, 2012). Cassava is cultivated over 2.32 lakh hectare in the country. The southern states *viz.* Kerala, Tamil Nadu and Andhra Pradesh together account for 88.65 % of total cassava cultivation and have great potential to enhance the nation's eri silk production. In this context, the present study was undertaken to find out the feasibility of utilizing different popular cassava varieties for commercial eri silkworm rearing.

MATERIALS AND METHODS

Seven popular cassava varieties namely CO2, CO3, CO (TP) 4, H165, H226, Mulluvadi (MVD1) and Kunguma Rose were selected for the studies. Stems with uniform thickness from 8-10 months old, pest and disease free plants of above varieties were obtained from Tapioca and Castor Research Station, Tamil Nadu Agricultural University, Yethapur, Salem, India. Plantation was raised after preparing sets of 10 cm length from the stems, directly in farmer's field at Karumapuram village, Namakkal district in a randomized block design and replicated five times. Each plot measured 5.4 X 5.4 m with 49 plants in 90 x 90 cm spacing. The crop was raised under irrigated conditions as per recommended package of practices (George et al., 2000).

In order to study the influence of cassava varieties on growth and economic traits of eri silkworm, rearing was conducted 8 months after plantation with standard rearing techniques (Anonymous, 2004). The leaves from each variety were plucked separately and fed to worms in five replicates @ 100 larvae per replication. The top fully opened tender and middle leaves at the rate of one leaf per plant were harvested and used for first two and third instar respectively, whereas the bottom green leaves at the rate of 30% of totally available leaves per plant were used for rearing of 4^{th} and 5^{th} instars. The matured silkworms were collected and transferred to plastic collapsible mountages placed separately in another set of labeled rearing trays as per different treatments. After mounting of worms the trays were covered with perforated news papers to permit aeration and to avoid migration of larvae from the mountages between replications and treatments. The cocoons were harvested five days after mounting.

At each harvest, the composite leaf samples of each variety were retained separately for biochemical analysis. All samples were rinsed with distilled water and shade dried after removing the petioles and was transferred to hot air oven maintained at 70°C until constant weight was obtained. The leaf samples were then powdered, sieved and the biochemical contents *viz.* total carbohydrate (Dubois et al., 1956), crude protein, nitrogen, phosphorus, potassium, total minerals (Jackson, 1973), total tannins (Anonymous, 1984) hydrocyanic acid (Bradbury et al., 1991) were determined as per the standard chemical analytical methods. The economic parameters such as larval period (hrs), weight of mature larvae (g), effective rate of rearing (%), cocoon yield (kg / 100 dfls), shell yield (kg/ 100 dfls), single cocoon weight (g), single shell weight (g), silk ratio (%) were recorded. The pupae were used for grainage to observe fecundity and hatching percentage. The experimental results obtained were evaluated by analysis of variance (ANOVA) at 5% level of significance.

RESULTS AND DISCUSSION

Biochemical constituents of leaf as influenced by cassava varieties

The biochemical constitutions were varied markedly among the leaves of different cassava varieties (Table 1). Highest values of all nutrients studied *viz.* protein (28.18%), total carbohydrate (34.97%), nitrogen (4.83), phosphorus (0.40%, potassium (0.94%) and total minerals13.02%) were recorded with the variety MVD1 which was closely followed by H226 (25.28, 33.51, 4.36, 0.40, 0.93, 12.12 % respectively) whereas CO2 exhibited comparatively least values in all parameters (19.75, 29.47, 3.48, 0.33, 0.78, 8.78 %). With respect to anti- nutrient values, highest content of total tannins (4.15%) and HCN (389 mg/kg) were recorded with the variety CO2 followed by CO4 in tannins (3.35%) and CO3 in HCN (380 mg/kg). However, the varieties MVD1 exhibited least values (2.86% & 329 mg/kg) which was followed by H226 in total tannins (2.96%) and Kunguma Rose (331 mg/kg) in HCN contents respectively.

Influence of cassava varieties on economic traits of eri silkworm

Similarly, the rearing parameters and economic traits of eri silkworm reared on different cassava varieties also varied substantially (Table 2). The larval duration (D: H) did not differ significantly among the varieties (27:22) except that of CO2 where it was a little longer (28:20) whereas MVD1 recorded shorter (26.19) than all varieties. However, MVD1 registered highest values in matured larval weight (6.93 g), effective rate of rearing (97.65%), cocoon yield (79.223 kg/100 dfls), shell yield (12.571 kg / 100 dfls), silk ratio (15.86%), fecundity (349.75) and hatchability (95.86%) which was closely followed by the variety H226 with the respective values (6.86g, 96.33%, 75.766 kg/100 dfls, 11.596 kg/100 dfls, 15.305 %, 347.73 and 95.28%). The varieties CO3 and CO4 recorded on par results and found next best to H226 where as poor performance of the silkworm was recorded (6.28g, 90.90%, 64.924 kg/100 dfls, 8.272 kg/100 dfls, 12.741 %, 312.50 and 85.64% respectively) with CO2 variety.

The present observations are in agreement with the findings of Chandrasekhar et al. (2013) who reported significant variations in nutritive value of leaves in different genotypes of castor, the primary food plant of eri silkworm. Similarly, the influence of variations in nutrient values of mulberry varieties on the silkworm *Bombyx mori* was also documented (Sujathamma & Dandin, 2000). The nutritional status in the leaves of food plants which influences the economic characters of silkworm crop depends upon the level of moisture, total protein, total carbohydrates and total minerals (Bongale et al., 1991). In the present study, the cassava variety MVD1 was found superior in all economic traits followed by H226 while the variety CO2 was noted as poor performer. The relationship between quality parameters of cassava varieties *viz.* crude protein, total carbohydrates, nitrogen, phosphorus, potassium, total minerals exhibited positive correlation with all economic traits except that of larval period which decreased with increase in nutritional content of leaves. The anti nutrients *viz.* total tannins and hydrocyanic acid were had negative impact on the economic traits of eri silkworm irrespective of variety (Tables 3).

The highest nutritional values and lower values of anti-nutrient contents in MVD1 and H226 could be attributed to the superior economic traits including cocoon yield and silk percentage and found most suitable for ericulture compared to the other varieties whereas in CO2 the economic traits and cocoon yield were recorded least which could be due to poor nutrient contents in leaf. Further, the increased level of tannin and HCN in this variety could have caused reduced intake of leaves and digestibility as reported by earlier workers (Reed et al., 1982) in silkworm. The main limiting factor to the use of cassava leaves as animal feed is the presence of cyanogenic glucoside, which gives rise to hydrocyanic acid (HCN) when the plant tissues are broken down during various metabolic processes in the body of animals (Ravindran, 1995). The order of merit of tapioca varieties suitable for ericulture was recorded as MVD1 > H226 > CO (TP) 4 > CO3 > Kunguma Rose > H165 > CO2.

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Table 1. Biochemical composition (%) in different varieties of cassava leaves.

Varieties	Crude Protein (%)	Total Carbo-hydrate (%)	N (%)	P (%)	K (%)	Total Minerals (%)	Total tannins (%)	HCN (mg/kg)
CO2	19.75	29.47	3.48	0.33	0.78	8.78	4.15	389
CO3	22.63	30.15	3.94	0.34	0.86	8.44	3.20	380
CO4	24.54	31.16	4.24	0.35	0.88	9.67	3.35	342
H165	22.47	33.05	3.91	0.31	0.90	8.22	3.23	351
H226	25.28	33.51	4.36	0.40	0.93	12.12	2.96	333
MVD1	28.18	34.97	4.83	0.40	0.94	13.02	2.86	329
KR	21.44	32.37	3.75	0.32	0.79	8.69	3.22	331
CD (5%)	0.135	0.337	0.036	0.048	0.039	0.444	0.318	11.710

Table 2. Influence of feeding leaves of different cassava varieties on economic traits of eri silkworm.

Variety	Larval period D:H	Matured larval weight(g)	ERR %	Cocoon yield (kg/100 dfls)	Shell yield (kg/100 Dfls	SCW (g)	SSW (g)	Silk (%)	Fecundity (no.)	Hatching (%)
CO2	28.20	6.28	90.90	64.924	8.272	2.480	0.316	12.741	312.50	85.64
CO3	27.22	6.59	94.28	71.031	10.019	2.616	0.369	14.105	325.40	89.17
CO4	27.22	6.78	94.89	71.654	10.494	2.622	0.384	14.645	339.19	92.91
H165	27.22	6.76	92.18	65.882	9.079	2.444	0.342	13.993	322.29	90.45
H226	27.03	6.86	96.33	75.766	11.596	2.731	0.418	15.305	347.73	95.28
MVD1	26.19	6.93	97.65	79.223	12.571	2.817	0.447	15.867	349.75	95.86
KR	27.22	6.73	94.00	66.949	8.987	2.473	0.332	13.424	325.25	90.14
CD(5%)	--	0.116	5.668	4.128	0.525	0.161	0.033	0.512	17.445	2.222

Table 3. Correlation co-efficient between biochemical compositions of cassava varieties and economic traits of eri silkworm.

Parameters	Larval period D:H	Matured larval weight (g)	ERR %	Cocoon yield (kg/100 dfls)	Shell yield (kg/100 Dfls	SCW (g)	SSW (g)	Silk (%)	Fecundity (no.)	Hatchin g (%)
Crude protein	-0.908	0.835	0.924	0.947	0.975	0.904	0.975	0.985	0.948	0.941
Total carbohydrate	-0.849	0.872	0.698	0.637	0.698	0.538	0.689	0.760	0.729	0.833
Nitrogen	-0.909	0.833	0.925	0.948	0.975	0.906	0.975	0.984	0.947	0.939
Phosphorus	-0.630	0.545	0.854	0.941	0.922	0.959	0.923	0.852	0.887	0.799
Potassium	-0.774	0.793	0.718	0.782	0.842	0.733	0.859	0.923	0.812	0.856
Total minerals	-0.701	0.622	0.847	0.913	0.911	0.909	0.908	0.856	0.890	0.838
Total tannins	0.917	-0.931	-0.837	-0.727	-0.767	-0.624	-0.754	-0.826	-0.782	-0.852
HCN	0.739	-0.901	-0.709	-0.542	-0.598	-0.430	-0.575	-0.656	-0.749	-0.834