Original Research Article

Morphological evaluation of locally available cultivated taro (*Colocasia esculenta*) cultivars of Kokrajhar district for growth and yield attributes

Comment [a1]: Better to include the country

ABSTRACT

Aims:Taro probably is one of the world's oldest crop and important crop species in the district but its cultivation and consumption still lie within the less privileged farmers of the rural areas. It is cultivated for its tubers, tender leaves and inflorescence. It is also observed that their nutritional value is very high and is nutritionally superior to other root and tuber crops in protein, mineral and vitamin contents. However, documentation of its genetic diversity and differentiation in the district is very weak. Several morphological types are found in upland and hilly slopes of the district, but their identification and morphological studies are not very clear, and their agronomic potentiality further needs to be exploited.

Comment [a2]: No need to indicate titles as Aims, Study design..etc.

Comment [a3]: Name of the area and country should mention.

Comment [a4]: Objectives of the study is not clearly mention

Study design:The trial was laid out in a randomized complete block design with three replications.

Place of study:In this context a field investigation was undertaken by collecting 4 local cultivars namely Abor, Pehle, Daomasar and Duradema from Debitola and Kachugaon blocks of Kokrajhar district.

Methodology:The diversity was evaluated based on growth and yield traits of plant, leaves, corm and yield against well-known variety Panchamukhi grown in the district.

Results:The results indicated significant differences for all the characteristics studied. 'Panchmukhi' recorded highest value for plant height (134.4cm), leaf size (2244.0 cm2), corm breadth (8.10cm), average corm weight (2036.00g) and average yield (2248.33g/plant). Petiole length was recorded highest in Cv. Deraduma (95.23 cm). Cv. Daomasar was recorded with maximum plant spread of 144.5 cm and numbers of side shoots (5.67 nos.). Highest corm length (20.23cm), cormel length (13.24cm) and cormel weight (98.25g) was recorded maximum in Cv. Abor.

Conclusion:All these local cultivars have nutritional importance therefore, various developmental programmes are need to be undertaken for popularizing it to every corner of the state and country

Comment [a5]: Need to rewrite with the actual findings.

Key words: Taro, Local cultivars, Growth and yield traits, Morphological evaluation

INTRODUCTION

Taro (*Colocasia esculenta* L. Schott.),commonly known as Arvi, Arbi and Eddoe, is one of the oldest and important crops of tropical and sub-tropical regions belonging to the family Araceae, originated in the Indo-Malayan region of Asia, but ethno-botanical evidence favours India as its place of origin (Plucknett, 1979) from where it spread to the Pacific and Mediterranean regions and later to Africa. It is also called 'potato of the tropics'. It is believed that the origin of domesticated taro can be traced to the wild type *C. esculenta* var. aquatilis, either in North East India or South East Asia (Matthews, 1991).

The starch-rich tubers are the main product, but the young leaves are also eaten as a leafy vegetable (Aregheore and Perera, 2003) and some members of the genus are cultivated as ornamental plants. It is a staple food in many developing nations of Asia, Africa and the Pacific. In India both roots and leaves are eaten as curry, fried and boiled. The Northeast India comprising of Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura are one of the mega biodiversity hot spots in the world. It occupies 7.7 per cent of total geographic area in India which accounts for 50 per cent of the biodiversity of the country (Deka *et al*., 2012).Although the crop is regarded as less important crop and its cultivation and consumption still lie within the less privileged farmers. It has been observed that their nutritional value is very high. Apart from the low-fat content, the crop is nutritionally superior to other root and tuber crops in protein, mineral and vitamin contents (Onwueme, 1978). Investigations have shown that it contains digestible starch, protein of good quality, vitamin C, thiamine, riboflavin, niacin and high scores of proteins and essential amino acids (Onayemi and Nwigwe, 1987). The leaves are rich in protein. The high protein content of the leaves favourably complements the high carbohydrate content of the tubers. It is also have been reported to be rich in nutrients, including minerals such as calcium, phosphorus, iron, and vitamins like vitamin C, thiamine, riboflavin and niacin (Baruah, 2002).

Comment [a6]: New references?

Comment [a7]: Need to use recent references than this.

This crop also has many medicinal values and is included in many Ayurvedic preparations. Pharmacologically, the plant is antimicrobial, antihepatotoxic, antidiabetic, anti-lipid peroxidative, antimetastatic, antifungal and anti-inflammatory (Pawar et al, 2018). There are also many pharmaceutical applications for the plant. Taro root and tuber phytochemicals have demonstrated anticancer effects in several types of carcinoma cell lines and animal models (Huang et al, 2004). Additionally, taro has traditionally been used as a medicine for curative purposes by the Bodo people. They consume its tender stems, tender leaves, rhizomes with dry fishes combining various types of spices to get relief from various common diseases like-cough, flu, cold, anaemia, typhoid, gastric, some stomach ailments, burning of urine and to increase mother's breast milk etc. The flower of the colocasia is also an important wild medicinal vegetable against cancer disease.The North-Eastern region of India is known for a diversity of flora and fauna. Wide variability can be seen among colocasia cultivars grown in the region.But little work has been done on evaluation and documentation ofthelocally available cultivars of the district. Therefore, the present investigation was undertaken to evaluate and study the comparative performance of the cultivar.

MATERIALS AND METHODS

Five popular cultivars of the district were taken up for the experiment in the farmers field during the year 2019-20 and 2020-21 under rainfed condition. The trial was laid out in a randomized complete block design with three replications. Uniform package of practices was followed throughout the experiment. Observations on morphological parameters like Plant spread (cm), plant height (cm), leaf size (cm^2), number of side shoots, petiole length (cm), number of petioles, leaf blight incidence (percentage), corm length and breadth (mm), average corm weight (g), cormel length and breadth (mm), average cormel weight (g), yield per plant (g), total yield (t/ha) and number of cormels per plant were recorded.Observations on growth, yield and yield attributing characters were recorded and subjected to statistical analysis as per Panse and Sukhatme (1978).

Comment [a8]: Analysis method not mention, statistical package..etc

RESULTS AND DISCUSSION

The observations among five cultivars shows wide variations in morphological traits for both growth and yield characters. According to several authors, temperature is the most important factor affecting taro growth and yield. The species requires an average daily temperature above

21°C for normal production (Onwueme, 1999) and cannot tolerate frosty conditions. Highest yields for taro are obtained under full intensity sunlight (Miyasaka et al., 2003). The evaluated data presented in Table 1 revealed that the plant spread of cultivar Daomasar was highest of 144.5 cm among the grown cultivars followed by Panchamukhi (135.67cm) and Abor (85.40cm) and the lowest plant spread was noted in cultivar Pehle of 66.22 cm.Plant height was also recorded highest in Cv. Panchamukhi of 134.4 cm closely followed by Daomasar (133.5cm). Cultivar locally known as Pehle was found to be of shortest height (74.80cm) among the grown cultivars. The variation in plant height among varieties might be attributed to differences in their genetic expression or response under a given environment. A similar variation in plant height among taro genotypes was also reported by Singh et al. (2006), Gerrano et al.(2018) and Angami et al.(2015).

Table 1: Performance of taro cultivars with regards to growth parameters

Cultivar	**Plant spread**	**Plant height (cm)**	**No. of side shoots (nos.)**	**Petiole length (cm)**	**Leaf size (cm^2)**
Pehle	66.22	74.80	3.22	54.65	1190.0
Abor	85.40	100.23	4.33	72.33	1840.5
Daomasar	144.5	133.5	5.67	94.67	1845.0
Deraduma	82.33	131.33	3.17	95.23	1827.0
Panchamukhi	135.67	134.4	5.50	94.83	2244.0
Basor	95.93	146.4		82.40	
Mean	102.82	114.85	4.38	82.34	1789.30
SE_d	0.51	0.58	0.15	0.30	21.80
CD (5%)	1.09	1.25	0.33	0.65	46.75
Coefficient Variation	0.60%	0.62%	4.29%	0.45%	1.49%

Comment [a9]: Unit?

Comment [a10]: Leaf area or what? How did you measure?

The data recorded for numbers of shoots revealed Daomasar produced highest number of side shoots (5.67) followed by Panchamukhi (5.50), Abor (4.33), Pehle (3.22) and Deraduma (3.17).Petiole length was recorded highest Deraduma in (95.23 cm), followed by Panchamukhi (94.83cm) and Daomasar (94.67cm), Abor (74.22cm) and the lowest was recorded in Pehle (54.65 cm).Leaves size of 2244.0 cm^2 was notedhighest in Panchamukhi, whereas lowest leaf size was recorded in cultivar Pehle (1190.0cm^2).

All of the four cultivars recorded tohave peltate leaf base shape, erect leaves with apex down position of leaf lamina, whereas for leaf blade margin all the cultivars fall into three categories entire, sinuateand undulate (Table 1 (a). The results are in line with this, Dagne, 2007, who identified accessions with undulate leaf blade margin in southern Ethiopia. Two dominant leaf blade margin colour were observed among the cultivars i.e., yellow and green with vein pattern ranging from V and Y type of vein pattern. All of the cultivars were also found to be flowering typeand the Spathe shape at male anthesis found to be hooded except for all the cultivar other than Abor.A variation among taro cultivars based on petiole was also observed. The study found that, cultivars of expressed purple and yellow petiole colour at top third whereas purple and green petiole colour was observed at middle third and basal third portion of petiole. Variation in petiole juncture colour and petiole colour were also observed in all the cultivars demonstrated. All the cultivars showed small and medium petiole junction patternindicating wide range of variation in different traits of Colocasia esculenta in the district. Therefore, there is need to consideration effort for conservation and research on taro. All the cultivars recorded with closed type cross section of lower part of petiole.

Table 1 (a): Performance of taro cultivars with regards to growth parameters

Cultivar	Leaf base shape	Predominant position of leaf lamina surface	Leaf blade margin	Leaf blade margin colour	Vein pattern	Flower formation	Spathe shape at male anthesis	Petiole colour of top third	Petiole colour of middle third	Petiole colour of basal third	Petiole junction pattern	Crosssection of lower part of petiole	Corm shape	Corm el shape
Pehle	Peltate	Erect-apex down	Entire	Green	V pattern	Flowering	Hooded	Purple	Purple	Purple	Medium	Closed	Conical	Elliptical
Abor	Peltate	Erect-apex down	Undulate	Green	Y pattern	Flowering	Flat	Purple	Purple	Purple	Small	Closed	Conical	Conical
Daomasar	Peltate	Erect-apex down	Undulate	Green	V pattern	Flowering	Hooded	Yellow	Green	Green	Medium	Closed	Round	Round
Deradum a	Peltate	Erect-apex down	Sinuate	Yellow	V pattern	Flowering	Hooded	Yellow	Green	Green	Small	Closed	Elliptical	Conical
Panchamukhi	Peltate	Erect-apex down	Undulate	Yellow	V pattern	Flowering	Hooded	Yellow	Green	Green	Medium	Closed	Round	Round

Yield and yield attributing characters

The cultivars were recorded with conical, round and Elliptical corm and cormel shape (Table 2). Which is in line with works of (Asfaw, 2006.) who reported wide range of variability of tubers among Dioscorea and Colocasia species in Ethiopia. Furthermore, similar result was reported byNebiyu, 2003 in cassava, Dagne, 2007 in taro and in *Plectranthus edulis*. (Garedew, 2006.)

Data presented on Table 2 on yield and yield attributing characters revealed significant difference among cultivars. Highest corm length (20.23cm) was seen in 'Abor', followed by 'Pehle' (13.26cm); while, the lowest (8.56 cm) was observed in 'Deraduma'. Daomasar and Panchamukhi was recorded with corm length of 10.77cm and 9.90cm respectively. This result is in agreement with the findings of Angami et al.(2015) where they reported significant variation among taro varieties in terms of corm length. This variation could be attributed to the inherent variation of taro cultivars in response to specific environmental conditions.

Table 2: Mean performance of taro cultivars with regards to yield and yield attributing characters

Cultivar	Corm size (cm)		Avg. wt. (g)	Cormel size (cm)		Avg. Cormel wt. (g)	Yield/ plant (g)
	Length	Diameter		Length	Diameter		
Pehle	13.26	6.42	95.96	8.16	3.10	18.05	980.2
Abor	20.23	6.51	274.50	13.24	4.60	98.25	864.6
Daomasar	10.77	7.82	1401.11	7.63	5.44	36.27	2173.0
Dera duma	8.56	6.23	155.96	6.50	3.52	13.51	677.05
Panchamukhi	9.90	8.10	2036.12	7.125	5.12	38.12	2248.33
Mean	12.54	7.02	792.73	8.53	4.36	40.84	1388.64
SE_d	0.16	0.06	0.44	0.04	0.04	0.21	0.13
CD (5%)	0.35	0.13	0.95	0.09	0.09	0.44	0.28
Coefficient Variation	1.58%	1.02%	0.07%	0.60%	1.16%	0.62%	0.01%

Data furnished for corm diameter varied significantly among cultivars. Highest corm diameter of 8.10cm was found in Panchamukhi, followed by 'Daomasar, Abor and Pehlewith 7.82cm,6.51 cm and 6.42cm respectively; whereas, the lowest (6.23cm) was recorded in Deraduma. This variation in corm diameter among cultivars could be due to differences in the genetic make-up of the cultivars. Angami et al.(2015) also found a significant variation on the average corm diameter of taro due to variety.Highest average corm weight (2036.00g) was observed in cv. Panchmukhi, followed by 'Daomasar (1401.00g), while, the lowest (95.96g) was found in cv. Pehle, followed by 'Deraduma' (155.96g). which might be due to the contribution of different

sizes of the corms and environmental condition towards its adaptability and translocation of greater quantity of dry matter to the corm, combined with a higher rate of yield-attributing charactersthroughout growth. Similar results were reported by Parthasarthy et al (1989)in taro.The highest average corm weight per plant was found in the type of planting material from corms rather than that from tillers (Tsedalu et al. 2014). Significant variation in cormel length among cultivars was recorded. Maximum cormel length (13.24cm) was recorded in Cv. Abor and the lowest (6.50cm) was recorded in Deraduma. In case of cormeldiameter Cultivar. Daomasar recorded maximum value (5.44cm), followed by Panchamukhi (5.12cm) and Abor (4.60cm); while, Pehle recorded the lowest (3.10cm) cormel diameter, followed by Deraduma (3.52cm).

Data presented on average cormel weight, evidently shows a significant difference among cultivars. Maximum average cormel weight (98.25g) was recorded in Abor followed by Panchamukhi (38.12g). The lowest average weight (13.51g) was recorded in 'Deraduma'. Data on yield per show significant differences among cultivars. Highest yield (2248.33) was recorded in 'Panchamukhi, closely followed by Daomasar (2173.0g). The lowest yield per plant (677.0g) was recorded in Deraduma. Singh et al. (1995) indicated that the yield of taro was affected significantly by genotype, location, and interaction of genotype by location.

CONCLUSION

The local Taro cultivars posseses good amount of nutritional values and this might be the firm reason due to which these varieties are still consumed by the local people and thus has a great demand in the local and nearby markets. Also, the varieties could be tested further and included in the various breeding programmes for development of new varieties.

Comment [a11]: This section should rewrite according to the objectives. Research is about "Morphological evaluation of locally available cultivated taro.." Not about nutritional value.

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Comment [a12]: Better to use recent references.

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