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RESEARCH ARTICLE

SYSTEMATIC SIGNIFICANCE OF FOLIAR CHARACTERS IN THE DELIMITATION OF PASSIFLORA L. (PASSIFLORACEAE) AT THE LOWER TAXONOMIC LEVELS.

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Abstract

Passiflora L. (Passifloraceae), commonly known as sour passion fruit, yellow passion fruit or granadilla belongs to the family Passifloraceae and consists of approximately 465 species distributed all over the world except in Arctic and Antarctic regions. The present investigation focused on the foliar morphological diversity of the widely variant genus, *Passiflora*, at the inter and intra specific levels, with a view to understand the significance of foliar features in the systematics of the genus. The study was undertaken in 27 accessions including 8 species, 5 varieties and 2 hybrids of *Passiflora*, for analyzing both the qualitative and quantitative characteristics of leaves and trichomes. The investigation revealed the significance of foliar characters in the delimitation of the taxa at the inter specific and intra specific levels in the genus. Diversity at species level was noticed in characters like shape and size of leaf margin, pattern of leaf lobing, size and shape of stipules, number of umbilical glands, length of petiole, type of stomata, and glandular and non glandular trichomes. However, intra specific diversity was evident from the nature of leaf lobing, and in the distribution of glandular and non glandular trichomes. A taxonomic key based on the foliar features was constructed in support of the systematics of *Passiflora*.

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Introduction:-

Passiflora L., the largest genus of the family Passifloraceae consists of about 465 species under 24 subgenera [1-2]. According to Feuillet and McDougal [3], *Passiflora* is a monophyletic group distributed in the subtropical and tropical regions of the world. The genus is distinguished by the herbaceous or woody climbers with characteristic three to five angled stem. Majority of the species possesses nectar secreting foliar and bracteole glands. Moreover, a wide range of diversity was observed in the foliar features of the genus.

Review of related literature revealed that the studies undertaken focused mainly on genetic diversity analysis [4-5] and cytological characterization [6]. Morphological and molecular variability in the wild species of *Passiflora* was

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reported by Viana et al. [7]. Krosnick [8] suggested the role of floral morphology in discriminating the species of *Passiflora*. However, investigations on the foliar characteristics is sparse except that of Tangarife et al. [9] who reported foliar variations in a few species of *Passiflora* from Columbia. The significance of leaf morphological and epidermal characters in plant systematics has been proved in *Alternanthera* Frpsk.(Amaranthaceae)[10], *Cassia sensu* (Cesalpineaceae) [11], *Senna* (Fabaceae) [12] and *Cassiinae* (Leguminosae) and in *Hybanthus* (Violaceae) [13]. The present investigation makes use of foliar features to evaluate the role of those characters in the delimitation of the genus at the inter and intra specific levels.

Materials and Methods:-

Leaf morphological and trichome characteristics of 27 taxa of *Passiflora* belonging to eight species, five varieties and two hybrids collected from different parts of the states of Kerala and Tamil Nadu were analysed for the study. The plants were maintained in the Botanical Garden, Department of Botany, University of Kerala for the investigation. Details of the accessions and the places of collection are provided in Table 1. Both the qualitative (28) and quantitative (11) characters were analyzed and each character state had been scored (Table 2). Fifth leaf of the flowering branch was examined for the study to ensure uniform treatment, and the mean value of 10 observations were analysed. The data were subjected to Analysis of Variance (ANOVA) at the level of significance $p < 0.05$, and was used to test the significant differences among the taxa. Discriminant function analyses such as cluster analysis and scatter plot were carried out to check out the character differences among the taxa. Morphology of foliar trichomes and glands were examined with the help of Stereo microscopic (Olympus SZ) observations and a taxonomic key was prepared based on the findings.

Result and Analysis:-

Details of the qualitative characters analysed in the 27 taxa of eight species are given in Table 3. Foliar variations at the inter specific and intra specific levels were evident from the qualitative data analyzed (Table 3 & Fig 1). Analysis of Variance performed on quantitative traits (Table 2) showed significant variations ($P < 0.05$) at the inter and intra specific levels. Mean standard deviation, range, and coefficient of variation and F values of the quantitative traits were also undertaken (Table 3). A range of values were found as the average means of lamina length (6.03cm to 6.63cm), lamina width (4.88cm to 5.38cm), petiole length (2.23cm to 2.88cm), frequency of stomata in the upper and lower epidermis (74.92 μ m to 78.70 μ m and 33.76 μ m to 36.44 μ m), length and width of stomatal complex (16.97 μ m to 17.82 μ m & 13.42 μ m to 13.68 μ m), length and width of guard cells (18.14 μ m - 18.56 μ m & 5.09 μ m - 5.55 μ m), length and width of stoma (9.77 μ m - 9.97 μ m & 3.21 μ m - 3.98 μ m). Among these, laminar width (LMW) showed maximum coefficient of variation (38.3372%), whereas F value (155.274) and width of guard cell (WGD) had minimum coefficient of variation (16.12%) and F value (14.773).

The Principal Component Analysis (PCA) revealed that the characters were distributed among three principal axes (Fig 2) which accounted for approximately 99.672% of the total variance. The first principal component with Eigen value 17.432 explained 64.563% variance (Table 4). It was found that leaf lobing, leaf arrangement, petiole groove, leaf texture, leaf size, leaf shape, leaf margin, marginal sheath spacing, order of marginal sheath, lob tip gland, leaf color, tooth apex, sinus shape, leaf tip, leaf base, nature of hair, venation, stomata, and leaf pubescence were the highest loaded traits and had positive values. The second component accounted for 13% of the variability with dominance of characters like leaf lobing, leaf arrangement, petiole groove, leaf texture, leaf size, leaf color, leaf shape, leaf margin, order of margin sheath, marginal sheath spacing, tooth apex, sinus shape, leaf tip, leaf base, lob tip gland, nature of hair, and venation. The third principal component accounted for 6% of the variability with dominance of characters like leaf lobing, leaf color, leaf shape, leaf margin, order of margin sheath, leaf tip, leaf trichome and lobe tip gland. The most loaded characters that accounted for more variability in PC1, PC2 and PC3 included leaf lobing, leaf color, leaf shape, leaf margin, marginal sheath spacing, order of margin sheath, sinus shape, leaf tip, leaf trichome, lob tip gland and leaf pubescence, which distinguished the different taxa of the genus *Passiflora* at the inter and intra specific levels.

UPGMA dendrogram based on morphological differentiation of the accessions (Fig 3) revealed two principal clusters at an Euclidian distance 1.40. The first principal cluster consisted of *P.coccinia*, *P.vitifolia*, *P.trifaciata* and *P.subpeltata* along with two accessions of *P.edulis* var. *edulis* (acc4 & acc5), whereas the second cluster possessed two sub clusters. All the varieties of *P.foetida* were grouped together in the second sub cluster along with the species, *P.apoda* and *P.quadrangularis*. However close relationship among the accessions of *P.foetida* var. *foetida* (acc 7, acc 8, acc 9, acc 12, acc 13 and acc14) was evident even though the accessions 10 and 11 differed

extensively from the others. It was observed that the accession *P. foetida* var. *gossippifolia* was a connecting link between *P. foetida* var. *foetida* and *P. foetida* var. *hispida*. The two hybrid varieties of *Passiflora* (*P. 'manapany'* and *P. 'canelle'*), were clustered together with the varieties of *P. edulis* var. *flavicarpa* and *P. edulis* var. *panamared*, but the accessions of *P. edulis* var. *edulis* (acc 4 and acc 5) were seen grouped in the sub cluster of the second principal cluster.

A taxonomic key constructed based on the foliar features and the trichome characteristics distinguished the taxa at the inter and intra specific levels.

Table 1:- Accessions of *Passiflora* and the places of collection.

Subgenera	Section	Series	Species	Variety	No. Accession	Place of collection	Altitude (ft)
Plectostema	Cieca		<i>P. apoda</i>		1	TVM	112
	Decaloba	Miserae	<i>P. trifaciata</i>		1	TVM	112
Distephna			<i>P. coccinea</i> <i>P. vitifolia</i>		1 1	TVM TVM	112 112
		Quadrangulareae	<i>P. quadrangularis</i>		1	KKD	75
		Lobatae	<i>P. subpeltata</i>		1	KTM	59
Granadilla (Passiflora)			<i>P. edulis</i>	<i>edulis</i>	3	KVTM, KLM, MUNR	112 35 2956
		Incarnatae	<i>P. edulis</i>	<i>flavicarpa</i>	2	MUNR EDKI	2956 2565
			<i>P. edulis</i>	<i>panamared</i>	1	TVM	112
Dysosmia			<i>P. foetida</i>	<i>foetida</i>	8	MTPLYM CHTA MDRI, TSSR, KULPZA , PTTA, VM	171 181 175 29 106 70 112
			<i>P. foetida</i>	<i>hispida</i>	4	KLM, TSSR, KULPZA , KVTM	35 29 106 112
			<i>P. foetida</i>	<i>gossippifolia</i>	1	TVM	112

*TVM Trivandrum, KVTM Kariyavattom, KLM Kollam, KKD Kozhikkodu, EDKI Edukki, MTPLYM

Mettuppalayam, CHTA Chenkotta, TSSR Thrissur, KULPZA Kulathuppuzha, MUNR Munnar, PTTA Pathanamthitta, MDRI Madhurai

Table 2:- List of qualitative and quantitative characters analysed with their character states Qualitative character.

No	character	Description
1	Leaf attachment	'0' petiolate; '1' sessile; '2' stipulate; '3' perfoliate
2	Stipule	'0' filiform; '1' fringed; '2' connate
3	Leaf arrangement	'0' opposite; '1' alternate; '2' whorled
4	Petiole nature	'0' with gland; '1' without gland
5	Petiole groove	'0' present; '1' absent
6	Leaf texture	'0' glabrous; '1' pubescent; '2' fleshy
7	Leaf colour	'0' green; '1' light green; '2' dark green; '3' reddish green; '4' purple
8	Leaf size	'0' large; '1' medium; '2' small
9	Leaf shape	'0' ovate; '1' hastate; '2' pinnately trilobed; '3' palmately trilobed
10	Leaf margin	'0' serrate with gland; '1' serrate without gland; '2' entire with gland; '3' entire without gland; '4' crenate with gland; '5' crenate without gland; '6' ciliate; '7' wavy serrate with gland; '8' wavy serrate without gland
11	Marginal teeth order	'0' 1 st order; '1' 2 nd order; '2' 3 rd order
12	Marginal teeth spacing	'0' regular; '1' irregular
13	Teeth shape	'0' convex; '1' straight; '2' concave; '3' flexuous; '4' retroflexed
14	Teeth apex	'0' simple; '1' non specific glandular; '2' mucronate; '3' setaceous; '4' papillate; '5' spinous; '6' spherolate
15	Sinus shape	'0' angular; '1' rounded
16	Leaf tip	'0' acute; '1' acuminate; '2' cuspidate; '3' mucronate; '4' obtuse
17	Leaf base	'0' attenuate; '1' shortly attenuate; '2' cordate; '3' subcordate; '4' hastate
18	Nature of hair	'0' hispid; '1' puberlose; '2' hirsute; '3' peltate; '4' stellate; '5' glandular
19	Venation	'0' pinnately reticulate; '1' palmately reticulate
20	Oil gland	'0' present; '1' absent
21	Umbellicul gland	'0' present; '1' absent
22	Umbellicul gland position	'0' near to the laminar junction; '1' away from the laminar junction; '2' throughout the petiole
23	Lobe tip gland	'0' absent; '1' present
24	Smell	'0' absent; '1' pleasant; '2' punchent
25	Pubescent	'0' absent; '1' sparse; '2' dense
26	Leaf polymorphism	'0' absent; '1' present
27	Trichome	'0' unicellular; '1' multicellular; '2' branched; '3' glandular; '4' none of these; '5' all of the above
28	Stomata	'0' anisocytic; '1' anomocytic; '2' monocytic
Quantitative characters		
1	Laminar length (cm)	LML
2	Laminar width area(cm)	LMW
3	Length of guard cell (µm)	LGD
4	Width of guard cell (µm)	WGD
5	Length of stomatal complex (µm)	LSC
6	Width of stomatal complex (µm)	WSC
7	Length of stomata (µm)	LSto
8	Width of stomata (µm)	WSto
9	Lower stomatal density(mm)	LSD
10	Upper stomatal density (mm)	USD

Table 3:- Inter and intra specific qualitative data.

Accession	Leaf lobing	Stipule	Leaf Arrangement	Petiole Nature	Petiole Groove	Leaf texture	Leaf color	Leaf size	Leaf shape	Leaf margin	Marginal teeth order	Marginal teeth spacing	Teeth shape	Teeth apex
<i>P. edulis</i> var. <i>flavicarpa</i>	0	0	1	0	0	0	1	0	3	0	0	1	0	1
<i>P. edulis</i> var. <i>flavicarpa</i>	0	0	1	0	0	0	1	0	3	0	0	1	0	1
<i>P. edulis</i> var. <i>flavicarpa</i>	0	0	1	0	0	0	1	0	3	0	0	1	0	1
<i>P. edulis</i> var. <i>edulis</i>	0	0	1	0	0	0	2	0	3	2	0	1	0	1
<i>P. edulis</i> var. <i>edulis</i>	0	0	1	0	0	0	2	0	3	2	0	1	0	1
<i>P. edulis</i> <i>panamared</i>	0	0	1	0	0	0	2	0	3	2	0	1	0	0
<i>P. foetida</i> var. <i>foetida</i>	0	1	1	0	0	1	0	1	3	6	0	1	2	4
<i>P. foetida</i> var. <i>foetida</i>	0	1	1	0	0	1	0	1	3	6	0	1	2	4
<i>P. foetida</i> var. <i>foetida</i>	0	1	1	0	0	1	0	1	3	6	0	1	2	4
<i>P. foetida</i> var. <i>foetida</i>	0	1	1	0	0	1	0	1	3	6	0	1	2	4
<i>P. foetida</i> var. <i>foetida</i>	0	1	1	0	0	1	0	1	3	6	0	1	2	4
<i>P. foetida</i> var. <i>foetida</i>	0	1	1	0	0	1	0	1	3	6	0	1	2	4
<i>P. foetida</i> var. <i>foetida</i>	0	1	1	0	0	1	0	1	3	6	0	1	2	4
<i>P. foetida</i> var. <i>foetida</i>	0	1	1	0	0	1	0	1	3	6	0	1	2	4
<i>P. foetida</i> var. <i>foetida</i>	0	1	1	0	0	1	0	1	3	6	0	1	2	4
<i>P. foetida</i> var. <i>hispida</i>	0	1	1	0	0	1	0	1	3	6	0	1	2	4
<i>P. foetida</i> var. <i>hispida</i>	0	1	1	0	0	1	0	1	3	6	0	1	2	4
<i>P. foetida</i> var. <i>hispida</i>	0	1	1	0	0	1	0	1	3	6	0	1	2	4
<i>P. foetida</i> var. <i>hispida</i>	0	1	1	0	0	1	0	1	3	6	0	1	2	4
<i>P. foetida</i> var. <i>gossypifolia</i>	0	1	1	0	0	1	3	1	3	6	0	1	2	4
<i>P. vitifolia</i>	0	2	1	0	0	1	3	0	3	7	0	1	0	4
<i>P. coccinia</i>	1	2	1	0	0	1	4	0	0	7	0	1	0	0
<i>P. trifaciata</i>	0	2	1	0	1	0	2	1	2	3	0	1	0	0
<i>P. apoda</i>	0	2	1	0	0	1	1	1	2	3	0	1	0	0
<i>P. quadrangularis</i>	0	2	1	0	0	0	1	0	0	3	0	1	0	0
<i>P. subpeltat</i>	0	2	1	0	1	0	1	1	2	3	0	1	0	0

<i>a</i>														
<i>P. 'Manapany'</i>	0	2	1	0	0	0	3	1	2	7	0	1	0	0
<i>P. 'Cannelle'</i>	0	2	1	0	0	1	1	1	2	7	0	1	0	0

'0'absent '1'present '2'small '3'medium '4' large '8'dense '9'sparse

Continued.....

Accession	Sinus shape	Leaf tip	Leaf base	Nature of hair	Venation	Oil gland	Umbellical gland	Umbellical gland position	Lo betip gland	Smell	Pubescent	Leaf polymorphism	Trichome	Stomata
<i>P. edulis</i> var. <i>flavicarpa</i>	0	0	2	0	1	1	0	0	1	1	0	1	0	1
<i>P. edulis</i> var. <i>flavicarpa</i>	0	0	2	0	1	1	0	0	1	1	0	1	0	1
<i>P. edulis</i> var. <i>flavicarpa</i>	0	0	2	0	1	1	0	0	1	1	0	1	0	1
<i>P. edulis</i> var. <i>edulis</i>	0	0	2	0	1	1	0	0	1	1	0	1	0	1
<i>P. edulis</i> var. <i>edulis</i>	0	0	2	0	1	1	0	0	1	1	0	1	0	1
<i>P. edulis</i> panamare d	0	0	2	0	1	1	0	0	1	1	0	1	0	1
<i>P. foetida</i> var. <i>foetida</i>	1	0	2	5	1	0	0	2	1	2	9	1	9	1
<i>P. foetida</i> var. <i>foetida</i>	1	0	2	5	1	0	0	2	1	2	9	1	9	1
<i>P. foetida</i> var. <i>foetida</i>	1	0	2	5	1	0	0	2	1	2	9	1	9	1
<i>P. foetida</i> var. <i>foetida</i>	1	0	2	5	1	0	0	2	1	2	9	1	9	0
<i>P. foetida</i> var. <i>foetida</i>	1	0	2	5	1	0	0	2	1	2	9	1	9	0
<i>P. foetida</i> var. <i>foetida</i>	1	0	2	5	1	0	0	2	1	2	8	1	8	1
<i>3P. foetida</i> var. <i>foetida</i>	1	0	2	5	1	0	0	2	1	2	8	1	8	1
<i>P. foetida</i> var. <i>foetida</i>	1	0	2	5	1	0	0	2	1	2	8	1	8	1
<i>P. foetida</i>	1	0	2	2	1	0	0	2	1	2	8	1	8	1

<i>varhispid</i>														
<i>P. foetida</i> <i>var.hispida</i>	1	0	2	2	1	0	0	2	1	2	8	1	8	1
<i>P. foetida</i> <i>var.hispida</i>	1	0	2	2	1	0	0	2	1	2	9	1	9	1
<i>P. foetida</i> <i>var.hispida</i>	1	0	2	2	1	0	0	2	1	1	9	1	9	1
<i>P. foetida</i> <i>var.gossipifolia</i>	1	0	2	0	1	0	0	2	1	1	9	0	9	1
<i>P. vitifolia</i>	1	0	2	1	1	0	0	0	1	1	1	1	1	1
<i>P. coccinia</i>	0	0	3	1	1	0	0	0	1	1	1	1	1	1
<i>P.trifaciata</i>	0	4	2	0	1	1	0	0	0	1	0	1	0	1
<i>P. apoda</i>	2	3	2	1	1	0	0	1	1	4	1	1	1	1
<i>P.quadrangularis</i>	0	0	1	0	1	1	0	1	0	4	0	1	0	1
<i>P.subpeltata</i>	0	4	2	0	1	1	0	0	0	1	0	1	0	1
<i>P. 'Manapany'</i>	0	0	2	0	1	1	0	0	1	1	0	1	0	1
<i>P. 'Cannelle'</i>	1	0	2	1	1	0	0	0	1	2	1	1	1	1

'0'absent '1'present '2'small '3'medium '4' large '8'dense '9'sparse

Table 4:- Mean, standard deviation, range, coefficient of variation and F values of the quantitative traits.

Character	Mean	SD	Range	CV (%)	F value
PTL	15.945	1.467	6.03-6.63	19.195	86.51**
LML	65.041	1.88	4.88-5.38	30.2507	93.056**
LMW	41.825	24.42	2.23-2.88	38.333	155.574**
LGD	1.57	1.122	1.40-7.70	18.2055	26.835**
WGD	0.12	1.51	33.76-36.44	16.1221	14.773**
LSC	32.44	7.87	14.2-17.6	20.7707	50.305**
WSC	98.063	1.43	2.0-10	29.2374	28.096**
LSto	0.142	0.6147	2-5.10	18.5206	47.951**
W Sto	1.4266	.2768	.80-2.60	19.4028	21.272**
LSD	1.8769	0.4066	.90-3.90	21.6634	37.825**
USD	2.22	0.8164	1-6.70	36.7748	47.47**

Table 5:- Principal component analysis in 27 taxa of Passiflora species accounted by the first three principal components.

Variables	PC1	PC2	PC3
Leaf lobing	0.332	-0.504	0.850
Stipule	0.092	-0.191	-0.025
Leaf arrangement	-0.291	0.312	-0.081
Petiole nature	0.092	-0.191	-0.060
petiole groove	-0.358	0.383	-0.015
leaf texture	-0.488	-0.293	0.072
leaf color	-0.933	0.34	0.288
leaf size	-0.842	-0.689	-0.127

leaf shape	-0.319	0.362	-0.226
leaf margin	0.332	-0.504	0.850
order margin sheath	0.847	-0.387	0.714
Marginal sheath spacing	0.654	0.280	0.265
Tooth shape	-0.216	-0.280	-0.114
sinus shape	1.690	1.021	-0.333
tooth apex	-0.078	-0.388	-0.015
leaf tip	2.351	0.431	0.267
leaf base	0.494	-0.355	-0.259
nature of hair	0.823	0.722	0.233
Venation	0.595	-0.456	-0.132
Stomata	0.641	-0.083	-0.117
Presents of oil gland	-1.158	-0.144	-0.067
Umbilical gland position	-1.133	-0.144	0.130
Pubescence lower leaf	-0.319	-0.210	-0.321
lob tip gland	-1.082	-0.308	0.275
leaf trichome	4.637	0.412	-0.284
Eigen values	17.432	3.664	1.764
Percent variation	64.563	13.570	6.532
Cumulative percentage	64.563	78.133	84.665

Discussion:-

The analysis of variance on the quantitative data revealed significant differences among the taxa at $P < 0.05$ level. The highest coefficient of variation (Table 3.) estimated for laminar width (38.3cm), upper stomatal density (36.7), laminar length (30.25cm), and width of stomatal complex (29.23) suggests high degree of variability with regard to these characters. Of those, characters like laminar width and upper and lower stomatal density were found to be useful for distinguishing the taxa at inter specific level. *Passiflora foetida* var. *gossippifolia* was characterized by the presence of stomata on the adaxial surface, whereas in *P.foetida* var. *foetida* and *P.foetida* var.*hispida* they were amphistomatic. The lowest coefficient of variation was observed in characters like length and width of stomata and guard cells in varieties of *P. foetida* indicating that they had only a minimal role in delimiting the taxa at the intra specific level. The significance of stomata and trichomes in the delimitation of the varieties of *P.edulis* was reported earlier by Chrochemore et al. [3].

Principal component analysis using qualitative morphological data exhibited significant differences at the inter and intra specific levels among the wild and cultivated species of *Passiflora* (Table 4). Analysis of data revealed that characters like leaf lobing (0.850), leaf trichome(4.637), sinus shape (1.021), and leaf margin (0.850) were highly significant in differentiating the wild and cultivated taxa of *Passiflora* at the inter and intra specific levels. This may be the reason for the variation observed among the varieties of *P.foetida*. Researches like Viscosi and Cardini [14], Al-shammery and Gornall [15] and Ogundipe [10] emphasized the significance of foliar characters like lobing, leaf trichome, leaf margin and sinus shape in distinguishing the intra specific variations in legumes, members of Saxifragaceae and in *Alternanthera* respectively.

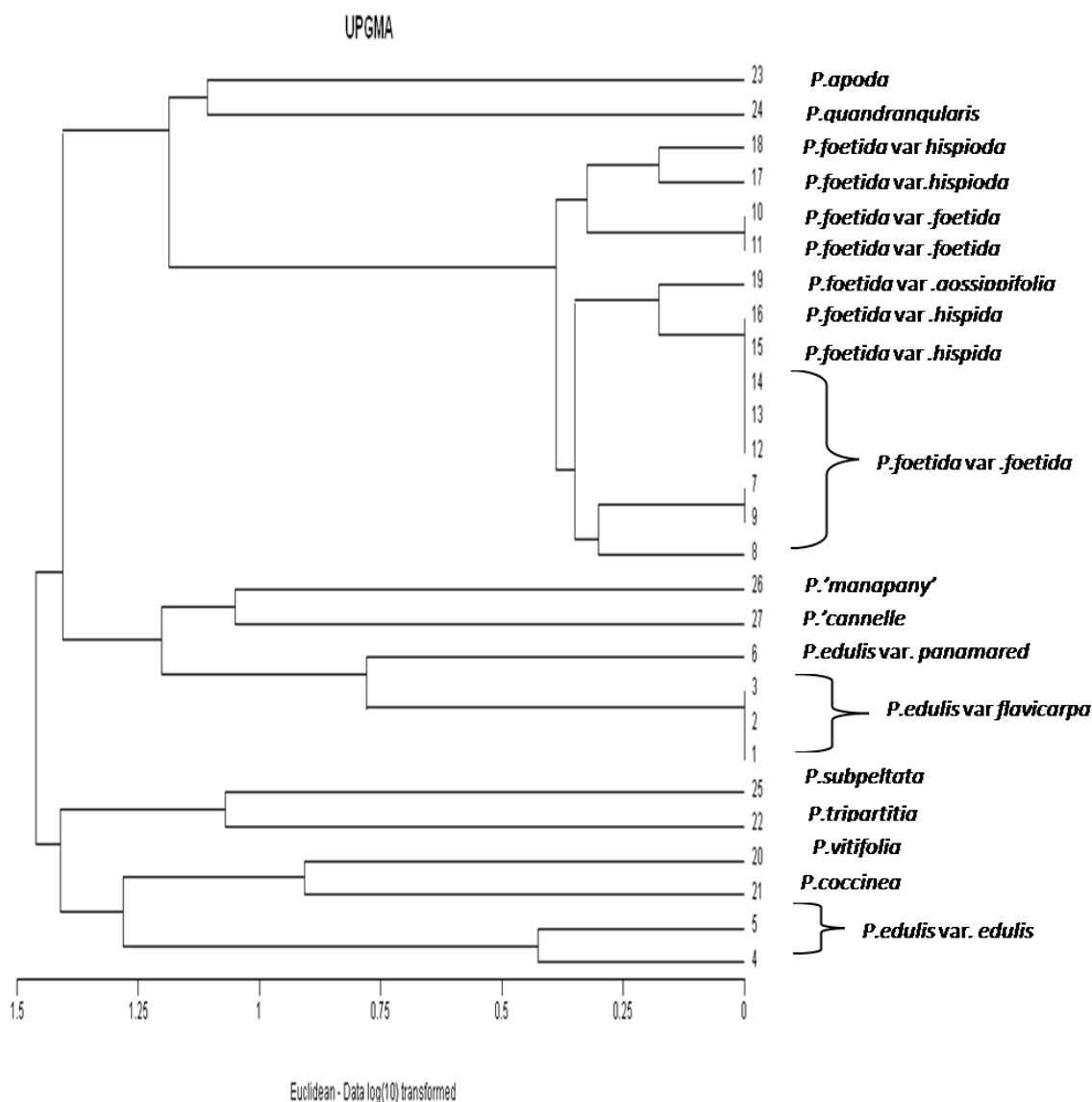
UPGMA dendrogram (Fig.2) revealed the close relationships between the two species, *P. vitifolia* and *P.coccinea*. This may be due to presence of multicellular trichomes with characteristic leaf lobing, leaf base, leaf color, and leaf shape and teeth apex. The presence of the two accessions of the *P. edulis* var. *edulis* (acc 5 and acc 4) in the first cluster and *P. edulis* var.*flavicarpa* and var. *panamared* in the second cluster suggest the significance of foliar morphology in the delimitation of the taxa at the varietal level. The three varieties were clearly demarcated by the color of the leaves and the nature of leaf margin. Even though inter varietal differentiation was noticed in the varieties of *P. foetida*, the foliar characters did not support the delimitation of varieties at the intra varietal level. However, separation of the accessions (acc10 and acc 11) of *P.foetida* var.*foetida*, from the rest of accessions may be due to the presence of anisocytic stomata and dense pubescent leaves. The clustering of the accessions of *P.foetida* var.*hispida*, into two different groups may be due to variations in the number and length of trichomes. The interlinking of *P.foetida* var.*gossippifolia* and the varieties *P.foetida* var.*hispida* and *P.foetida* var.*foetida* may be due to the foliar characters (absence of leaf polymorphism, trilobed leaves, lob tip gland and entire leaf margin with glands) shared by them.

The data suggest that the inter and intra specific variations in *Passiflora* may be primarily due to the foliar variations. The study emphasizes the significance of foliar characters in the delimitation of taxa at the inter and intra specific levels. The taxonomic key prepared, based on foliar features supports the findings.

Fig 1:- Foliar morphological variation.



Fig 3:- Dendrogram based on UPGMA analysis generated from Euclidean distance of Leaf morphological characters.



Taxonomic Key

Leaves simple

1. Glabrous with entire margin.....*P. quadrangularis*
2. Pubescent with serrate margin.....*P. coccinea*

Leaves lobed

1. Partially lobed, entire margin
2. Gland absent at the leaf tip
3. Leaves purple colored*P. trifaciata*
4. Leaves green colored.....*P. subpeltata*

Gland present at the leaf tip

1. Trichomes are non glandular and multicellular*P. apoda*
2. Trichomes are both glandular and non glandular
3. Unicellular non glandular, dense hispid trichomes

....*P.foetida* var. *hispid*a

1. Unicellular non glandular, dense, pubescent trichomes

.....*P.foetida* var. *foetida*

1. Unicellular non glandular, sparsely pubescent trichome,
Petiole with pink color.....

P.foetida var. *gossippifolia*

1. Deeply lobed, serrate margin

2. Glabrous leaves

3. Marginal gland present

4. Wavy serrate margin

5. Pale green color.....*P.edulis* var. *edulis*

6. Linear serrate margin

7. Dark green color

8. Green color petiole....*P.edulis* var. *flavicarpa*

9. Red color petiole..... *P.edulis* 'panamared '

10. Marginal gland absent

11. Linear serrate margin dark green

color.....*P. 'Cannelle'*

12. Leaves pubescent

13. Serrate margin, absent marginal gland, light green color.....*P. 'Manapany'*

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