General Discussion

The present study made a multidisciplinary and multifaceted approach to delve into the species specific characters of two *Crinum* species. The purpose was to scrutinize the nature and extent of similarity and dissimilarity of two congeneric species, *C. asiaticum* and *C. latifolium* and also to visualize the range of different traits of each species by studying the features at infraspecific level. In turn, infraspecific characterization if work out any subtle difference among the individuals of different localities, considered as provenances, would facilitate practicing selection in search of any desirable feature.

The morphological, anatomical and pharmacognostic studies for the provenances of both the species of *Crinum* L. have shown much similarities with certain differences. Diversities are mainly related to the plant height, bulb shape, size, weight, leaf size, width, nature of inflorescence, flower shape, size, colour of perianth, leaf anatomical features, vascular bundle concerning number of xylem and phloem strands. In intraspecific consideration highest plant height of 197.00 cm in Paschim Medinipur provenance of *C. asiaticum* was found quite contrast with that of Mungpoo provenance, which was of 22, 28 cm heights. Similarly Purba medinipur provenance of *C latifolium* having highest height of 93.80 cm is quite greater than the Shilong provenance of lowest height of 30.96 cm. Difference in bulb character has also been found remarkable and for the provenances of *C. asiaticum* three groups can be formed as i) larger round neck, ii) narrow round neck, iii) absent of neck. Among the eight two provenances namely Shillong and Mungpoo have no neck in the bulb. And out of eight provenances only Shillong and Mungpooare of globose shaped bulb, rest provenances are of ovate shape. North 24 Paraganas provenance of this species has the highest scape height and number of flower per scape. In case of *C. latifolium* among the ten five provenences namely Gangtok, Kolkata, Paschim medinipur, Purba medinipur and Shilong have no neck in the bulb. Whereas, Bankura and Odisha have narrow round neck, narrow flatten neck is present in Nadia contrast of it Asssam consist large flatten neck and highly enlarge round neck found in Kashmir.

The leaf anatomy of *C. asiaticum* has shown the deviation only in two provenances on shape and the number of the vascular bundle present in leaf. Regarding root anatomical study only North 24 Paraganas provenance contain highest number of xylem strand in the vascular bundle. Similarly the leaf anatomy of *C. latifolium* has shown the deviation among six provenences in number of vascular bundle. Regarding root anatomical study only Odisha shows highest number of xylem strand in the vascular bundle. Diversities, in this regard, have been noticed much in case of *C. latifolium* in comparison with *C. asiaticum*.

Pharmacognostic studies have revealed that some differences (Table 4.3). Physico -chemical study of the powder drugs of both species have shown difference in colour in presence of visible and ultraviolet light. Such findings have been found to be quite helpful for identifying two species and their ready recognition. However, microscopic analyses for both species have shown same type of raphaids, stone cells, xylem fiber, parenchymatous tissue, tracheides and trachea.

Chromosomal studies have shown outstanding uniformity in somatic diploid chromosome number as, 22. Constancy in chromosome number in two species points to their evolutionary relatedness. However, finer characters concerned with the range of chromosome lengths, length of largest and smallest chromosomes, forms of chromosomes in respect of centromeric position and the symmetry of karyotype, diversity is apparent, to some extent, amongst the provenances of same species and quite prominently between two species. Morphologically, according to centromeric position of each chromosome has shown different nature. On the basis of centromere position both of the species has shown four types of chromosome like Median, nearly median, sub-median and sub-telocentric.

Lycorine, an indolizidine alkaloid, has been chosen for examining its presence in *Crinum* L. and its quantity in two species and the provenances of each of them. As reported earlier (Ghosal et al. 1983, 1989, Endo et al. 2019), too, the present work confirmed the presence of this bioactive molecule in both of the studied species of *Crinum*, however with a notable difference in their amount of presence. Variation in the amount of lycorine has also been noted to differ among different provenances of two species, a feature that has been proved to be promising for selection to be practiced for establishing the best producer provenances and other following ones in sequence. In this regard within the species *C. asiaticum* the provenance Nadia has shown highest amount followed by Paschim Medinipur provenance Purba Medinipur provenance Shillong provenance. Likes wise, in the species *C. latifolium* the provenance Paschim Medinipur showed best result followed by Assam, Odisha, Nadia, Kolkata and Kashmir provenances**.**

The amount of lycorine has been found greatest (1.247 g/100g) bulb in Nadia provenance of *C. asiaticum*. In the decreasing order of occurrence the provenances are Paschim Medinipur, Purba Medinipur, Shilong, North 24 Paraganas, Kolkata, Mangpoo and the least amount is Sundarban (0.023g). Presence of Lycorine has been noted to be associated with the micro and macro morphological data. Nadia provenance has the medium sized plant with ovate shaped bulb, large round neck and large diameter and leaves with longer length and widest width. Its scape is also longer than others. Anatomically the transverse section of the leaf has shown ovoid. Vascular bundle with eighteen strands of xylem or phloem in leaf and transverse section of root has shown highest diameter of stele amongst eight provenances and second greatest number of xylem strand (16) and highest amount of biomass than others. The characteristic chromosomal features of this provenance have been found as length of the chromosome is 10.4μm and 8m+ 6sm+ 8st chromosome type. Among the eight provenances *Crinum asiaticum* L. of Sundarban have contain lowest amount of lycorine (0.023g) and it is also shown variation morpho-anatomical parameter. The gross morphological appearance of these plant looks like a small herbs than others. It is so short than the Nadia. Though it has short height but the plant growth diameter shows bushy in nature. The bulb has ovate shaped but the neck is very narrow and the growth rate of the bulb is very slow as a result the diameter shown the lowest (2.50 cm) in nature than the others, leaf length is medium and width of the leaf is narrow. It has only two bracteoles and 8.72 cm length of tepal is present. These charters are helps to identify the plant in necked eye. In micro morphological study of the collected plant have shown ovoid shaped vascular bundle near about 18 – 19 in a leaf and plant shown uneven shape of upper epidermal layer in leaf whether root contain eight number of xylem strand and medium cortex region and diameter of the stele also. Biomass of the plant is 0.78g. The given data prove that the size of the bulb of Sundarban plant not a big size like others. Whether chromosome study has revealed that the chromosome length of this location is longer than the Nadia and it is shown 8m + 12sm + 2st types of chromosome present in the somatic cell. In this way we can correlate all the parameter with the productivity of the plants (Table no 7.1 and 7.2).

In case of *Crinum latifolium* L. here ten different provenances have been scrutinized. Among them plants of Paschim Medinipur has contain highest amount of lycorine (1.205g). Morphologically we can demark the plants from others with the help of flower colour which is red in colour but the tepals are shown white tint on the red. Beside of these the bulb morphology also helps to separate the plant to each other's with spherical shaped bulb without neck or collar and have long length leaf with narrow width and the plant has 4-5 number of flower present per scape and shape of the perianth is differ from others (Table No 3.9). The dorsifixed and attachment is middle of the anther just 50% with the filament. In micro morphological study has depicted that elliptical vascular bundle with 35- 36 vascular bundle present in the leaf and it has only 8 xylem strand. On the chromosomal study it is noted that average length of the chromosome is 15.39 µm which is far differ from *Crinum asiaticum* L. and chromosome type is 10m + 6sm + 6st. The *Crinum latifolium* L. of Kashmir have contain lowest amount of lycorine (0.014 g) in the present study and the plant can identified with the help of morphological study , the presence of spherical bulb with highly elongated round neck and long leaf with narrow width. Interestingly the plant of Kashmir have highest number of flower in per scape which is differ from other rest nine provenance and colour of the flower is also a demarcating whole flower is white in colour with pink stripe. Flowering time also showing variation it is bloom in the month of September- October, whether other provenance are bloomed in nearly March to April. In the micromorphology leaf has elliptical vascular bundle nearly 37 numbers and root contains only 6 xylem strand. Chromosome morphology has shown variation related to somatic chromosome. Average chromosome length is 06.61 µm which is the shortest length among total studied species. It is also shown 3 types of chromosome like 12m + 6sm + 4st so the present study can indicate the interpretation in relation to highest productivity with macro and micro morphological variation.

Present study has been revealed that both the species having different concentration of same active component. The active component lycorine is differentiate all the studied provenances among them the provenance of Nadia for the species *Crinum asiaticum* L. is contain highest amount of lycorine on the other hand, provenance of Paschim Medinipur of *Crinum latifolium* L. is showing the highest amount of lycorine. The better productive plant among different provenance of *Crinum asiaticum* L. can identified through higher plant height, leaf size, scape height than normal plants and the large rounded neck of bulb can separate the provenance from others.

The better productive plant from *C. latifolium* L. is related to the higher plant height with large leaf size and underground spherical neckless bulb with red flower with yellow tint. In micro-mophological study found that this better productive provenance has shown highest no of leaf vascular bundle.

Table no 7.1 : Correlation of different provenances of *C. asiaticum*.

	plheight	pgdiameter	bulblengthassam	bulbdiameter	leaflength	leafwidth	scapeheight	scapediameter	numberflower	lengthbract	numberbracteole	lengthbracteole	lengthpetiole	widthpetiole	lengthtepal	venetiontepala	antherlength	antherattachment	stylelength	ovarylength	ovarywidth	vbshape	vbno	cortexregion	noxylem	diastele	biomassfresh	biomassdryweg	percentlycorine	amountlycorine
plheight Pearson Correlation		.848*	.896*	.822*	.847**	.947**	.916**	.755*	.736*	.787*	.471	.578	-.074	-.466	.645	.404	.103	.337	-.396	.607	-.535	.467	.166	.193	.693	.358	.371	.269	.266	.240
Sig. (2-tailed)		.008	.003	.012	.008	.000	.001	.030	.038	.020	.239	.134	.861	.245	.084	.321	.808	.414	.332	.110	.172	.243	.695	.648	.057	.384	.365	.520	.524	.567
pgdiameter Pearson Correlation			.957**	.468	.999**	.945**	.922**	.827*	.824*	.863**	.651	.461	-.314	-.507	.358	.563	.021	.096	-.612	.381	-.351	.643	.218	.373	.769*	.539	.294	.228	.268	.311
Sig. (2-tailed)			.000	.242	.000	.000	.001	.011	.012	.006	.080	.251	.448	.199	.384	.146	.961	.821	.107	.351	.394	.085	.603	.363	.026	.168	.480	.587	.520	.453
bulblengthassam Pearson Correlation				.633	.961**	.933**	.954**	.899**	.929**	.934**	.601	.580	-.264	-.548	.373	.447	-.188	.018	-.569	.342	-.349	.590	.320	.274	.809*	.487	.246	.159	.170	.211
Sig. (2-tailed)				.092	.000	.001	.000	.002	.001	.001	.115	.132	.527	.159	.363	.266	.655	.966	.141	.407	.396	.124	.439	.511	.015	.221	.558	.706	.687	.615
bulbdiameter Pearson Correlation					.475	.669	.676	.590	.550	.505	.198	.478	.196	-.304	.650	.003	-.049	.408	-.135	.362	-.500	.173	.370	-.115	.621	.006	.292	.159	.024	-.002
Sig. (2-tailed)					.234	.070	.065	.124	.158	.201	.638	.231	.641	.464	.081	.995	.908	.316	.750	.378	.207	.683	.367	.786	.100	.988	.482	.707	.954	.996
leaflength Pearson Correlation						.946**	.919**	.831*	.832*	.859**	.663	.468	-.310	-.503	.374	.563	.006	.076	-.636	.358	-.375	.654	.242	.374	.789*	.532	.289	.226	.256	.306
Sig. (2-tailed)						.000	.001	.011	.010	.006	.073	.242	.456	.204	.362	.146	.989	.858	.090	.383	.361	.078	.564	.361	.020	.175	.487	.591	.540	.461
leafwidth Pearson Correlation							.952**	.816*	.754*	.804*	.509	.486	-.107	-.404	.600	.427	.141	.261	-.486	.449	-.546	.501	.168	.371	.807*	.497	.465	.376	.346	.390
Sig. (2-tailed)							.000	.013	.031	.016	.198	.222	.800	.321	.116	.292	.740	.533	.222	.265	.162	.206	.691	.366	.015	.210	.245	.358	.401	.339
scapeheight Pearson Correlation								.858**	.820*	.903**	.377	.583	-.219	-.538	.405	.255	-.076	.192	-.356	.373	-.330	.361	.227	.242	.777*	.468	.489	.390	.382	.413
Sig. (2-tailed)								.006	.013	.002	.358	.129	.603	.169	.319	.543	.858	.649	.386	.363	.425	.380	.589	.564	.023	.242	.218	.340	.351	.310
scapediameter Pearson Correlation									.927**	.871*	.443	.285	.070	-.218	.264	.254	-.272	-.049	-.356	.139	-.237	.431	.230	.468	.796*	.668	.162	.027	-.057	.077
Sig. (2-tailed)									.001	.005	.271	.494	.870	.604	.527	.544	.515	.908	.387	.743	.571	.286	.584	.243	.018	.070	.702	.949	.892	.855
numberflower Pearson Correlation										.932**	.585	.512	-.197	-.452	.176	.389	-.476	-.251	-.537	.176	-.187	.581	.349	.287	.729*	.530	-.018	-.109	-.105	-.029
Sig. (2-tailed)										.001	.128	.194	.641	.261	.677	.341	.233	.548	.170	.678	.657	.131	.397	.491	.040	.177	.966	.798	.805	.945
lengthbract Pearson Correlation											.423	.630	-.317	-.562	.155	.337	-.372	-.157	-.383	.351	-.123	.429	.142	.282	.611	.583	.202	.123	.203	.230
Sig. (2-tailed)											.297	.094	.445	.148	.713	.415	.364	.711	.349	.394	.771	.289	.737	.498	.108	.129	.632	.772	.630	.584
numberbracteole Pearson Correlation												.174	-.318	-.358	.219	.891**	.016	-.076	-.899**	.275	-.304	.995**	.403	.157	.490	.168	-.409	-.412	-.333	-.342
Sig. (2-tailed)												.680	.442	.384	.602	.003	.971	.857	.002	.510	.464	.000	.323	.711	.217	.691	.314	.311	.420	.407
lengthbracteole Pearson Correlation													-.570	-.771*	.294	.122	-.397	-.199	-.364	.316	-.288	.185	.263	-.260	.333	-.058	.326	.359	.477	.373
Sig. (2-tailed)													.140	.025	.480	.774	.330	.637	.376	.446	.490	.661	.528	.534	.421	.891	.430	.383	.232	.363
lengthpetiole Pearson Correlation														.868**	.372	-.291	.274	.187	.420	-.087	-.311	-.303	-.355	.457	-.020	.275	.001	-.100	-.358	-.206
Sig. (2-tailed)														.005	.364	.485	.511	.657	.300	.838	.453	.466	.388	.255	.963	.510	.999	.814	.383	.624
widthpetiole Pearson Correlation															.099	-.246	.305	-.049	.393	-.292	-.137	-.330	-.496	.533	-.271	.267	-.126	-.148	-.347	-.171
Sig. (2-tailed)															.815	.557	.463	.907	.335	.483	.747	.424	.211	.174	.516	.523	.766	.726	.399	.685
lengthtepal Pearson Correlation																.234	.443	.339	-.304	.402	-.960**	.235	-.030	.292	.485	.137	.433	.395	.245	.278
Sig. (2-tailed)																.577	.272	.412	.464	.323	.000	.575	.944	.484	.223	.747	.284	.332	.558	.505
venetiontepala Pearson Correlation																	.252	-.043	-.753*	.549	-.297	.921**	-.025	.299	.178	.293	-.388	-.358	-.173	-.233
Sig. (2-tailed)																	.547	.919	.031	.159	.476	.001	.952	.472	.674	.482	.342	.384	.681	.578
antherlength Pearson Correlation																		.729*	.100	.448	-.353	.022	-.414	.216	-.129	.005	.303	.302	.296	.242
Sig. (2-tailed)																		.040	.814	.265	.391	.960	.308	.608	.761	.991	.466	.467	.476	.563
antherattachment Pearson Correlation																			.285	.443	-.120	-.117	-.004	-.234	.061	-.255	.368	.278	.229	.108
Sig. (2-tailed)																			.494	.271	.776	.782	.992	.577	.886	.542	.369	.506	.585	.799
stylelength Pearson Correlation																				-.051	.467	-.897**	-.490	-.144	-.581	-.092	.208	.157	.123	.087
Sig. (2-tailed)																				.904	.243	.003	.217	.733	.131	.829	.621	.710	.772	.837
ovarylength Pearson Correlation																					-.237	.316	-.421	.072	-.120	.201	.055	.022	.240	.045
Sig. (2-tailed)																					.572	.446	.299	.865	.777	.633	.897	.959	.566	.916
ovarywidth Pearson Correlation																						-.325	-.025	-.370	-.523	-.163	-.362	-.361	-.202	-.280

	Sig. (2-tailed)																					.432	.954	.368	.184	.699	.378	.380	.631	.501
vbshape	Pearson Correlation																						.328	.205	.449	.213	-.423	-.419	-.325	-.335
	Sig. (2-tailed)																						.428	.626	.265	.612	.296	.302	.433	.418
vbno	Pearson Correlation																							-.527	.582	-.492	-.111	-.132	-.257	-.247
	Sig. (2-tailed)																							.179	.130	.215	.793	.755	.539	.555
cortexregion	Pearson Correlation																								.258	.914**	.133	.098	.024	.242
	Sig. (2-tailed)																								.538	.001	.753	.817	.954	.563
noxylem	Pearson Correlation																									.291	.359	.273	.078	.231
	Sig. (2-tailed)																									.485	.383	.513	.854	.582
diastele	Pearson Correlation																										.135	.069	.071	.246
	Sig. (2-tailed)																										.750	.871	.868	.558
biomassfresh	Pearson Correlation																											.980**	.872**	.921**
	Sig. (2-tailed)																											.000	.005	.001
biomassdryweg	Pearson Correlation																												.925**	.961**
	Sig. (2-tailed)																												.001	.000
percentlycorine	Pearson Correlation																													.950**
	Sig. (2-tailed)																													.000

Table no 7.2: Correlation of different provenances of *C. latifolium*.

	pgdiameter	bulblengthassam	bulbdiameter	leaflength	leafwidth	scapeheight	scapediameter	numberflower	numberbract	lengthbract	numberbracteole	lengthbracteole	lengthpetiole	widthpetiole	lengthtepal	venetiontepala	venetiontepalb	venetiontepalc	venetiontepald	venetiontepale	venetiontepalf	antherlength	filamentlengtha	filamentlengthb	filamentlengthc	filamentlengthd	filamentlengthe	filamentlengthf	antherattachment	stylelength	stigmalength	ovarylength	ovarywidth	vbshape	vbno	cortexregion	noxylem	diastele	biomassfresh	biomassdrywe	lycorinepercent	lycorineamount
plheight Pearson Correlation	.928*	.309	.500	.915*	-.042	.329	.248	.238	.130	-.166	.063	.085	.166	.276	.284	-.170	-.039	-.071	.433	.182	.205	.684*	.432	.456	-.173	-.367	.192	.211	.365	.066	.295	.319	.340	.087	.415	-.290	-.222	-.154	-.040	.162	-.104	.129
Sig. (2-tailed)	.000	.384	.141	.000	.909	.353	.489	.508	.720	.647	.862	.816	.646	.440	.427	.638	.915	.846	.211	.614	.569	.029	.213	.186	.633	.297	.594	.558	.299	.856	.408	.368	.336	.811	.233	.416	.537	.672	.912	.654	.774	.730
pgdiameter Pearson Correlation		.204	.554	.994*	.010	.432	.146	.330	.145	-.112	.081	-.024	.219	.285	.447	-.074	-.091	-.081	.558	.245	.223	.751*	.554	.600	.009	-.121	.378	.366	.260	-.092	.244	.236	.017	.226	.577	-.308	-.238	-.156	-.113	.016	-.179	-.053
Sig. (2-tailed)		.571	.096	.000	.978	.212	.688	.352	.690	.758	.825	.947	.544	.425	.196	.839	.803	.825	.094	.495	.536	.012	.096	.067	.980	.739	.282	.298	.468	.800	.497	.512	.963	.531	.081	.386	.508	.667	.755	.965	.620	.884
bulblengthassam Pearson Correlation			.823*	.270	.556	-.505	.459	-.247	-.417	.239	-.439	.743*	.475	.481	.153	.376	.235	.009	-.229	-.047	-.152	.651*	.153	-.135	.181	-.204	.144	.383	.357	.560	.100	.736*	.319	.513	-.073	-.001	.070	.236	-.069	.169	.240	.307
Sig. (2-tailed)			.003	.451	.095	.136	.183	.491	.231	.505	.204	.014	.165	.159	.674	.284	.513	.981	.525	.896	.674	.041	.673	.709	.617	.571	.691	.275	.312	.092	.783	.015	.368	.129	.842	.998	.847	.511	.850	.640	.505	.388
bulbdiameter Pearson Correlation				.617	.666*	-.131	.492	-.082	-.442	.339	-.361	.531	.606	.610	.440	.436	.324	-.006	.284	-.074	.043	.902**	.461	.177	.225	-.011	.485	.694*	.435	.420	.291	.533	-.016	.567	.239	-.209	-.204	.080	-.140	.008	-.096	-.088
Sig. (2-tailed)				.058	.036	.718	.148	.823	.201	.337	.306	.115	.063	.061	.204	.208	.362	.986	.426	.839	.906	.000	.180	.624	.531	.975	.156	.026	.209	.227	.414	.113	.964	.087	.507	.562	.571	.827	.700	.983	.792	.809
leaflength Pearson Correlation					.078	.387	.171	.308	.073	-.065	.096	.034	.292	.348	.505	.013	-.049	-.033	.544	.211	.191	.791**	.565	.588	.021	-.112	.434	.408	.276	-.084	.239	.264	-.015	.266	.566	-.285	-.269	-.155	-.155	-.016	-.195	-.079
Sig. (2-tailed)					.830	.269	.638	.386	.841	.859	.792	.926	.413	.325	.136	.971	.893	.928	.104	.559	.597	.006	.089	.074	.954	.758	.210	.242	.441	.817	.506	.460	.967	.458	.088	.425	.452	.668	.669	.965	.590	.827
leafwidth Pearson Correlation						-.220	.583	-.342	-.882**	.873**	-.257	.693*	.754*	.751*	.487	.534	.729*	-.046	.298	-.278	-.257	.530	.427	.137	.196	.317	.515	.650*	.348	.465	.620	.426	-.282	.168	-.275	.096	-.202	.053	.003	-.016	-.126	-.199
Sig. (2-tailed)						.541	.077	.333	.001	.001	.474	.026	.012	.012	.153	.112	.017	.900	.403	.438	.474	.115	.219	.706	.588	.371	.128	.042	.324	.176	.056	.220	.431	.643	.441	.792	.576	.885	.993	.965	.728	.582
scapeheight Pearson Correlation							.082	.657*	.377	-.082	.279	-.394	.166	-.087	.216	.044	.250	.231	.551	-.298	.025	-.048	.294	.391	-.127	.018	.103	.006	.159	-.542	.320	-.242	-.109	.083	.006	-.425	-.251	-.326	-.244	-.458	-.095	-.401
Sig. (2-tailed)							.822	.039	.282	.823	.436	.260	.646	.811	.548	.905	.487	.521	.099	.403	.945	.896	.410	.265	.726	.961	.776	.988	.660	.106	.367	.501	.764	.821	.987	.220	.484	.359	.497	.183	.794	.251
scapediameter Pearson Correlation								-.460	-.526	.297	-.152	.281	.443	.181	-.066	.265	.639*	.230	.361	-.294	-.473	.249	.510	.165	.176	.093	.488	.665*	.305	.249	.438	.456	.315	.104	-.298	-.385	-.316	-.280	-.246	-.215	.102	-.117
Sig. (2-tailed)								.181	.119	.404	.675	.431	.200	.617	.856	.459	.047	.523	.305	.409	.168	.488	.132	.649	.627	.798	.152	.036	.391	.488	.205	.185	.376	.775	.404	.272	.373	.433	.493	.550	.779	.747
numberflower Pearson Correlation									.550	-.105	.162	-.057	.210	.107	.387	.162	-.012	.155	-.004	-.255	.222	.060	-.151	.049	-.243	-.277	-.329	-.446	.137	-.444	.059	-.099	-.104	.381	-.022	-.097	.084	.038	-.083	-.216	.096	-.049
Sig. (2-tailed)									.100	.773	.655	.875	.561	.768	.269	.654	.975	.668	.990	.477	.538	.868	.676	.893	.498	.439	.353	.196	.706	.198	.871	.785	.776	.278	.952	.789	.817	.917	.820	.549	.791	.892
numberbract Pearson Correlation										-.800**	-.075	-.551	-.626	-.692*	-.412	-.452	-.664*	-.128	-.280	.326	.262	-.318	-.225	.015	.071	-.168	-.544	-.496	-.175	-.384	-.486	-.215	.203	.150	.298	-.148	.438	.183	-.048	-.055	.294	.215
Sig. (2-tailed)										.005	.837	.099	.053	.027	.236	.190	.036	.725	.433	.358	.464	.370	.532	.968	.845	.643	.104	.145	.629	.274	.155	.551	.573	.678	.403	.683	.206	.612	.895	.879	.409	.552
lengthbract Pearson Correlation											-.083	.666*	.728*	.798**	.584	.411	.732*	-.112	.280	-.336	-.205	.330	.229	.102	-.038	.261	.278	.297	.230	.327	.747*	.282	-.367	-.035	-.458	.230	-.148	.009	.229	.102	-.112	-.117
Sig. (2-tailed)											.820	.036	.017	.006	.076	.238	.016	.758	.433	.342	.570	.351	.525	.779	.917	.466	.436	.405	.522	.357	.013	.431	.296	.923	.183	.523	.683	.981	.524	.779	.758	.748
numberbracteole Pearson Correlation												-.326	.144	.034	.356	.190	.039	.662*	.185	-.261	-.219	-.293	-.109	.084	-.463	-.174	.321	-.247	-.296	-.722*	-.159	-.373	-.149	-.326	-.041	.016	-.587	-.627	-.294	-.350	-.292	-.282
Sig. (2-tailed)												.358	.691	.925	.313	.600	.914	.037	.609	.467	.543	.411	.765	.819	.178	.631	.365	.492	.407	.018	.661	.289	.682	.358	.911	.966	.074	.052	.410	.321	.412	.431
lengthbracteole Pearson Correlation													.664*	.743*	.425	.439	.511	-.142	-.281	-.146	-.280	.473	.146	-.014	.064	-.051	-.027	.109	.463	.531	.483	.706*	.073	.222	-.461	.425	.252	.407	.057	.191	.259	.317
Sig. (2-tailed)													.036	.014	.221	.205	.131	.695	.432	.688	.433	.168	.688	.970	.861	.889	.941	.764	.178	.114	.157	.023	.841	.538	.180	.221	.483	.243	.876	.597	.471	.373
lengthpetiole Pearson Correlation														.804**	.758*	.797**	.789**	.403	.228	-.566	-.373	.483	.314	.128	-.049	.020	.456	.357	.365	-.009	.531	.431	-.211	.402	-.402	-.001	-.337	-.147	-.270	-.327	-.015	-.228
Sig. (2-tailed)														.005	.011	.006	.007	.248	.527	.088	.288	.157	.377	.724	.893	.956	.186	.311	.300	.980	.114	.214	.558	.249	.249	.997	.342	.686	.450	.357	.968	.526
widthpetiole Pearson Correlation															.809**	.492	.611	-.012	.283	-.326	.069	.678*	.221	.121	-.262	-.107	.291	.234	.490	.363	.662*	.292	-.230	.072	-.151	.240	-.296	.051	.101	.150	-.316	-.129
Sig. (2-tailed)															.005	.149	.061	.973	.428	.358	.849	.031	.540	.738	.464	.768	.415	.516	.151	.302	.037	.413	.522	.844	.676	.504	.406	.889	.781	.679	.374	.722
lengthtepal Pearson Correlation																.584	.398	.161	.334	-.185	-.041	.563	.376	.425	-.079	.139	.490	.227	.295	-.177	.414	.110	-.579	.160	.073	.284	-.290	-.014	-.227	-.236	-.341	-.345
Sig. (2-tailed)																.076	.255	.657	.345	.608	.910	.090	.284	.221	.829	.703	.150	.528	.408	.625	.234	.762	.080	.659	.841	.427	.416	.968	.529	.511	.336	.328
venetiontepala Pearson Correlation																	.620	.618	-.071	-.589	-.385	.179	.175	-.036	.123	.141	.458	.305	.335	-.179	.063	.135	-.364	.479	-.294	.144	-.262	.032	-.649*	-.680*	-.100	-.491
Sig. (2-tailed)																	.056	.057	.846	.073	.271	.621	.628	.922	.735	.698	.183	.392	.344	.621	.863	.709	.301	.162	.409	.691	.465	.930	.042	.030	.784	.150
venetiontepalb Pearson Correlation																		.321	.330	-.735*	-.311	.150	.261	.010	-.177	.028	.299	.309	.530	.183	.724*	.166	-.049	.022	-.608	-.047	-.381	-.149	-.194	-.309	-.151	-.389
Sig. (2-tailed)																		.366	.352	.015	.382	.679	.466	.978	.624	.939	.401	.385	.115	.613	.018	.647	.893	.951	.062	.898	.277	.682	.591	.385	.677	.272
venetiontepalc Pearson Correlation																			-.020	-.680*	-.395	-.255	-.203	-.298	-.293	-.291	.314	-.040	-.139	-.595	-.291	-.127	.098	.265	-.297	-.324	-.602	-.602	-.550	-.631	-.027	-.335
Sig. (2-tailed)																			.955	.031	.259	.477	.573	.403	.411	.414	.377	.913	.701	.070	.415	.727	.787	.460	.405	.360	.065	.065	.099	.050	.940	.344
venetiontepald Pearson Correlation																				-.141	.262	.402	.496	.447	-.166	.133	.570	.539	.157	-.037	.553	-.252	-.240	-.190	.334	-.472	-.656*	-.498	.081	-.042	-.580	-.525
Sig. (2-tailed)																				.697	.464	.249	.145	.195	.647	.715	.086	.108	.665	.920	.097	.482	.504	.599	.346	.168	.040	.143	.824	.908	.079	.119
venetiontepale Pearson Correlation																					.062	.145	.328	.511	.541	.410	-.003	.110	-.239	.090	-.265	.180	-.142	-.176	.577	.337	.575	.418	.134	.322	.170	.379
Sig. (2-tailed)																					.866	.689	.355	.131	.106	.239	.994	.761	.506	.805	.459	.618	.697	.627	.081	.341	.082	.230	.712	.364	.639	.280
venetiontepalf Pearson Correlation																						.259	-.299	-.215	-.425	-.378	-.324	-.199	.229	.369	.020	-.541	.000	-.159	.571	-.122	-.152	.140	.442	.481	-.596	-.167
Sig. (2-tailed)																						.469	.402	.551	.220	.281	.361	.582	.525	.294	.956	.106	1.000	.660	.085	.737	.676	.700	.201	.159	.069	.646
antherlength Pearson Correlation																							.492	.362	.106	-.045	.392	.553	.431	.417	.402	.451	-.088	.366	.423	-.094	-.149	.125	.060	.229	-.209	-.005
Sig. (2-tailed)																							.149	.304	.771	.902	.262	.097	.214	.231	.249	.191	.810	.298	.223	.795	.681	.731	.869	.525	.561	.989
filamentlengtha Pearson Correlation																								.902**	.590	.629	.693*	.775**	.389	.004	.420	.310	-.364	.029	.292	.092	.026	.165	-.452	-.366	-.117	-.329
Sig. (2-tailed)																								.000	.072	.052	.026	.008	.267	.991	.227	.383	.301	.937	.413	.801	.943	.650	.190	.298	.748	.353
filamentlengthb Pearson Correlation																									.492	.607	.539	.491	.223	-.208	.335	.173	-.446	-.137	.382	.230	.132	.168	-.350	-.282	-.109	-.226
Sig. (2-tailed)																									.149	.063	.108	.150	.535	.565	.344	.633	.196	.707	.276	.523	.716	.643	.321	.430	.763	.531
filamentlengthc Pearson Correlation																										.816**	.338	.566	-.071	-.027	-.197	.378	-.397	.375	.202	.192	.564	.473	-.385	-.349	.370	-.013

	Sig. (2-tailed)	.004	.340	.088	.845	.940	.585	.282	.256	.285	.575	.595	.089	.168	.272	.322	.292	.971
filamentlengthd	Pearson Correlation		.496	.554	-.103	-.137	.052	.028	-.740*	-.013	.136	.333	.321	.313	-.304	-.396	.017	-.328
	Sig. (2-tailed)		.145	.096	.776	.706	.886	.939	.014	.973	.708	.347	.366	.379	.393	.258	.964	.355
filamentlengthe	Pearson Correlation			.829**	.028	-.227	.119	.050	-.492	.085	.304	-.106	-.524	-.327	-.501	-.487	-.378	-.568
	Sig. (2-tailed)			.003	.938	.529	.742	.891	.148	.815	.393	.771	.120	.356	.140	.153	.282	.087
filamentlengthf	Pearson Correlation				.206	.190	.248	.259	-.325	.249	.318	-.221	-.251	-.050	-.322	-.284	-.214	-.415
	Sig. (2-tailed)				.567	.598	.490	.469	.360	.487	.370	.540	.483	.890	.363	.427	.552	.233
antherattachment	Pearson Correlation					.488	.546	.063	.048	-.038	-.001	.248	0.000	.481	-.305	-.136	-.356	-.348
	Sig. (2-tailed)					.153	.102	.863	.894	.917	.998	.489	1.000	.159	.391	.708	.313	.324
stylelength	Pearson Correlation						.402	.257	.279	-.128	-.011	.156	.189	.456	.455	.629	-.122	.227
	Sig. (2-tailed)						.249	.474	.435	.724	.976	.667	.602	.186	.186	.052	.736	.529
stigmalength	Pearson Correlation							.225	-.038	-.237	-.318	.021	-.156	.000	.260	.188	-.185	-.109
	Sig. (2-tailed)							.532	.917	.510	.370	.953	.666	1.000	.468	.603	.608	.764
ovarylength	Pearson Correlation								.321	.466	-.314	.010	.377	.162	.032	.159	.707*	.631
	Sig. (2-tailed)								.366	.175	.378	.979	.283	.655	.929	.660	.022	.050
ovarywidth	Pearson Correlation									-.011	-.284	-.403	.000	-.208	.260	.394	.396	.587
	Sig. (2-tailed)									.976	.427	.248	1.000	.565	.469	.260	.257	.074
vbshape	Pearson Correlation										.003	-.369	.131	.060	-.246	-.292	.440	.089
	Sig. (2-tailed)										.992	.295	.718	.869	.494	.414	.203	.807
vbno	Pearson Correlation											-.075	-.096	.106	-.080	.079	-.489	-.260
	Sig. (2-tailed)											.837	.793	.770	.827	.828	.152	.469
cortexregion	Pearson Correlation												.500	.694*	-.156	.004	-.073	.035
	Sig. (2-tailed)												.141	.026	.668	.990	.841	.924
noxylem	Pearson Correlation													.789**	.082	.160	.621	.532
	Sig. (2-tailed)													.007	.823	.658	.056	.114
diastele	Pearson Correlation														-.112	.064	.111	.105
	Sig. (2-tailed)														.758	.860	.761	.772
biomassfresh	Pearson Correlation															.910**	.078	.543
	Sig. (2-tailed)															.000	.831	.105
biomassdrywe	Pearson Correlation																.046	.646*
	Sig. (2-tailed)																.899	.044
lycorinepercent	Pearson Correlation																	.749*
	Sig. (2-tailed)																	.013
lycorineamount	Pearson Correlation																	