Morphological Variations and Morphometry in the Genus *Plantago*

Lamiaa Farouq Shalabi and Maged Mahmoud Abou-El-Enain

***Abstract*—**Morphology and morphometry of stems, leaves, inflorescence, flowers and fruits were studied in 20 species of *Plantago* (Plantaginaceae), namely *P. afra* L., *P. albicans* L., *P. amplexicaulis* Cav., *P. arenaria* Waldst. & Kit., *P. ciliata* Desf., *P. commutata* Guss., *P. coronopus* L., *P. crassifolia* Forssk., *P. crypsoides* Boiss., *P. cylindrical* Forssk., *P. exigua* Murray., *P. lagopus* L., *P. lanceolata* L., *P. macrorhiza* Poir., *P. major* L., *P. notata* Lag., *P. ovata* Forssk., *P. phaeostoma* Boiss. & Heldr., *P. sinaica* (Barn.) Decne and *P. squarrosa* Murray. Phenetic relationships of these species were established based on UPGMA-clustering method for 72 selected characters by using Jaccard coefficient of the NTSYS-pc 2.2 program. The produced data were confirmed by measuring the phenogram distortion from its relevant data matrix based on the cophenetic (ultrametric) correlation coefficient (*r*). These data were useful in providing more information about the taxonomic relationships of the studied species.

***Keywords*—**NTSYS, Phenetic analysis, *Plantago*, Plantaginaceae.

I. Introduction

THE genus *Plantago* L., (Sp. Pl. 112. 1753; Decne. in A.DC., Prod. 13: 694. 1852), Plantaginaceae comprises 270 species and has a cosmopolitan distribution [1]. The name of the genus comes from the Latin word 'planta' which means 'sole of foot' referring to the basal rosette of the broad leaves touching the ground in most of the species [2]. Morphological variation among species in genus *Plantago* is low, and how the species are grouped is unclear [3]. The first systematic treatment of the genus was published by [4], who recognized three genera in the whole family and subdivided the genus *Plantago* into six sections.

Reference [5] subsequently divided this genus into 17 sections. Reference [6] recognized 12 sections within *Plantago*; these were divided among two subgenera, one of which contained a single section. Classification of [2] recognized two subgenera within *Plantago*: *Euplantago*, with 247 species divided among 18 sections, and *Psyllium*, containing 13 species in a single section. Reference [7] published a revision of the genus in which he divided it into 3 subgenera, i.e. *Plantago*, *Cornopus* and *Psyllium* (Juss.) Harms & Reiche.

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According to [3] the genus is divided into 6 subgenera: *Plantago*, *Cornopus*, *Albicans*, *Psyllium*, *Littorella* and *Bougueria*.

The earlier studies on genus *Plantago* [5], [8], [2] describe the macromorphological features of the species. References [9], [10] reviewed the taxonomy of some species using cytological and morphological criteria. Other works reported data of embryological characters [11]; pollen morphology [12]-[15]; seed structure [11], [16]-[20]; chromosome numbers [21]-[24]; hair types [25]-[30]. Chemical compounds as chemotaxonomic markers have also been studied using e.g. sugars [31]; phenolcarboxylic acids [32]; phenylethanoid glycosides [33], [34]; flavonoid glycosides [35], [36]; and iridoid glucosides [37]-[41], [34].

Plantago is a problematic genus; most of the species are closely similar so that discovering stable aspects of variation among them is not easy. In the present work, morphological and morphometric data are used to: characterize 20 *Plantago* species; establishing and comparing their phenetic relationships based on statistical methods by using NTSYS program packages in order to reassess their taxonomic delimitation as recognized in earlier reports.

II. Material And Methods

A. Samples

The present study is established based on specimens from 20 species representing the subgenera *Albicans, Coronopus, Plantago and Psyllium sensu* [3]. A list of the species and collection data of the specimens representing them is given in Appendix (1). Identification of the specimens is verified by re-identifying them with the aid of appropriate floras [42], [43], [44] and by matching with numerous well-authenticated specimens in Cairo University Herbarium (CAI) and the herbarium of the Agricultural Museum (CAIM).

Aspects of morphological and morphometric variation in stems, leaves, inflorescence, flowers and fruits as defined in Appendix (3) are recorded and scored comparatively for the species into a data matrix (Appendix 2), at least 10 specimens for each species were used for morphometric analyses.

B. Data analysis

In preparing the raw data matrix, multistate characters were transformed into two-state characters in coding and their presence or absence was coded 1 and 0 respectively (Appendix 2).The program NTSYS-pc 2.2 [45] was used in the data analysis as follows: the raw data matrix was

standardized with STAND module; similarity matrix was generated by SIMQUAL module based on Jaccard coefficient. Clustering was performed using unweighted pair-group method with arithmetic average (UPGMA) and represented in phenogram (tree).

TABLE I
PLACEMENT OF THE STUDIED PLANTAGO SPECIES IN SELECTED CLASSIFICATION SYSTEMS AT SUBGENERIC LEVEL.
*Data on this taxon could not be traced in the presented classificatory systems.

No.	Taxa	[2]	[7]	[3]	[47]
1	*P. afra* L.	Psyllium	Psyllium	Albicans	Psyllium
2	*P. albicans* L.	Plantago	Psyllium	Albicans	Albicans
3	*P. amplexicaulis* Cav.	Plantago	Psyllium	Albicans	Albicans
4	*P. arenaria* Waldst. & Kit.	Psyllium	Psyllium	Psyllium	Psyllium
5	*P. ciliata* Desf.	Plantago	Psyllium	Albicans	Albicans
6	*P. commutate* Guss.	*	*	Coronopus	Coronopus
7	*P. coronopus* L.	Plantago	Coronopus	Coronopus	Coronopus
8	*P. crassifolia* Forssk.	Plantago	Coronopus	Coronopus	Coronopus
9	*P. crypsoides* Boiss.	*	*	*	*
10	*P. cylindrica* Forssk.	Plantago	Psyllium	Albicans	*
11	*P. exigua* Murray.	*	*	*	*
12	*P. lagopus* L.	Plantago	Psyllium	Albicans	Albicans
13	*P. lanceolata* L.	Plantago	Psyllium	Albicans	Albicans
14	*P. macrorhiza* Poir.	*	*	Coronopus	Coronopus
15	*P. major* L.	Plantago	Plantago	Plantago	Plantago
16	*P. notata* Lag.	*	*	*	*
17	*P. ovata* Forssk.	Plantago	Plantago	Plantago	Albicans
18	*P. phaeostoma* Boiss. & Heldr.	*	*	*	*
19	*P. sinaica* (Barn.) Decne	Psyllium	Psyllium	Psyllium	*
20	*P. squarrosa* Murray	Psyllium	Psyllium	Psyllium	Psyllium

The distortion between each tree and its related distance matrix [46] was evaluated by computing the tree's cophenetic (ultramatric) value matrix using COPH and comparing them using MXCOMP modules.

III. RESULTS AND DISCUSSION

The selected 72 macromorphological characters for the numerical analysis of this study are given in Appendix 2. The produced phenogram based on UPGMA clustering of these characters is illustrated in Figure 1. The produced correlation coefficients value is r = 0.95 and revealed no distortion between the phenogram and its related data matrix. The produced phenogram revealed that, the two species *Plantago major* (15) and *P. ciliata* (5) are split-off in two separate lines at the similarity levels of 0.38 and 0.41, respectively. The remaining 18 species are divided equally in two major clusters A and B at the similarity levels of 0.47 and 0.50 respectively (Figure 1). Cluster A comprises each of *P. afra* (1), *P. phaeostoma* (18), *P. sinaica* (19), *P. squarrosa* (20), *P. exigua* (11), *P. amplexicaulis* (3), *P. arenaria* (4), *P. ovate* (17) and *P. notata* (16). Cluster B comprises each of *P. albicans* (2), *P. cylindrical* (10), *P. macrorhiza* (14), *P. commutate* (6), *P. coronopus* (7), *P. crypsoides* (9), *P. crassifolia* (8), *P. lagopus* (12) *and P. lanceolata* (13).

Separation of *P. major* L. (15) is mainly due to its large sized leaves (5 cm or more long), rounded leaf apex, angled peduncle, obtuse sepale apex and the large number of seeds per capsule (20 or more). This result is compatible with its placement in Subgenus *Plantago* and could support the taxonomic treatment of [2], [7], and [3]. On the other hand, delimitation of *P. ciliata* L. (5) is mainly due to its ciliated bract and sepal margins, obtuse bract apex and the length to width ratio of leaf (8 or more). The deviation of such species from the rest of the studied species supports its placement in Subgenus *Albicanus* as defined by [3] and [47]. (Table I)

In cluster A, *Plantago notata* (16) subgenus *Plantago* splits from the group (A) at the similarity level of 0.47 because of inconspicuous stem internodes, the long inflorescence (2.8 cm or more), small bracts (3.5 mm or less in length and 2 mm or less in width), the reduction of bracts and sepals to fleecy tuft

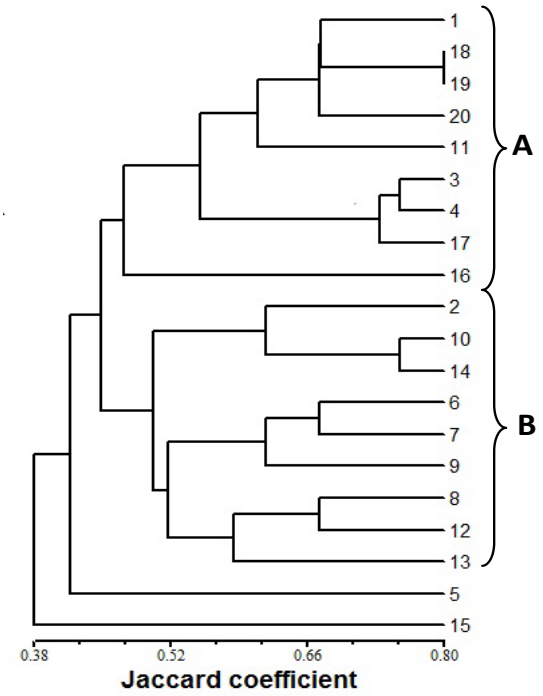

Fig. 1 UPGMA phenogram showing the relationships within the 20 species of genus *Plantago* based on the selected 72 morphological characters.

and the hairy petals with acuminate apex. The four species *P. afra* (1), *P. phaeostoma* (18), *P. sinaica* (19), *P. squarrosa* (20), all belong to subgenus *Psyllium* are grouped together at the level of 0.67 due mainly to their sharing the acute to acuminate bract apex, bract shorter than flower and the similarity of apical and basal bract. *P. phaeostoma* and *P. sinaica* are very close to each other because they have the same characters except the larger bract in *P. sinaica*. On the other hand, *P. exigua* (11) is clustered at the similarity level of 0.6, it differs from the previous species by wider, glabrous leaf and bracts are shorter than flowers with ovate or obovate shape.

Reference [48] studied the seed coat characters of the genus *Plantago* and reported a good relationship between *P. arenaria* subgenus *Psyllium* and *P. ovata* subgenus *Plantago*. In the present study, both species 4 and 17, respectively in addition to *P. amplexicaulis* (3) subgenus *Albicans* are actually clustered together in the same group. This may be because of their short inflorescences (2 cm or less), obtuse bract apex and free sepals. Thus, the present data supports

those of [48] and, on the other hand both arguments reveal the possibility of transferring *P. ovata* to subgenus *Psyllium*, which needs a further study.

In cluster B, the three species *P. albicans* (2) subgenus *Albicans*, *P. cylindrical* (10) subgenus *Albicans* and *P. macrorhiza* (14) subgenus *Cronopus* are clustered together at the similarity level of 0.616; due to hairy leaf, connate sepals and the long inflorescence raising the subtending leaf. The three species *P. commutate* (6) subgenus *Cronopus*, *P. coronopus* (7) subgenus *Cronopus* and *P. crypsoides* (9) are clustered together at the similarity level of 0.16; due to the leaf with toothed-sinuate margin, Inflorescence equal or shorter than subtending leaf, unequal sepals, glabrous petals and lenticular seeds. The two species *P. commutate* and *P. coronopus* is more related to each other than the third one and clustered at the similarity level of 0.67. This result is compatible with that of [49] based on morphological and ecological approaches.

The three species *P. crassifolia* (8) subgenus *Cronopus*, *P. lagopus* (12) subgenus *Psyllium* and *P. lanceolata* (13) subgenus *Psyllium* are clustered together at the similarity level of 0.58; due to the inconspicuous internodes, the longer inflorescence than subtending leaf, glabrous petals and cymbiform seeds. The two species *P. crassifolia* and *P. lagopus* appear closer to each other than *P. lanceolata*, this may be because of the short inflorescence (2 cm or less) and large bracts of *P. lanceolata*, this is an unusual result as many of the previous works [49], [48], and [47] placed the both in a unique group.

Finally, a comprehensive study covering all *Plantago* species is necessary to construct a more satisfactory classification and also it would be much better if further studies use other parameters to focus on the infrageneric classification of *Plantago*.

APPENDIXES

APPENDIX (1) LIST OF THE *PLANTAGO* SPECIES AND COLLECTION DATA OF THE SPECIMENS

No.	Species	Collection data of specimens
1	*Plantago afra* L.	V. Täckholm *et al*, 7/2/1961, Gebel Hamata, Red Sea Coast; CAI.; V.T. *et al*, 6/2/1963, Gebel Samiuki, Red Sea Coast; CAI.
2	*P. albicans* L.	El Hadidi *et al*, 23/4/1983, Sinai, Wadi Gharandel; CAI.; A. Amer, 9925, 20/3/1987, Beheira Province, Abuel Matamir; CAI.
3	*P. amplexicaulis* Cav.	V. Täckholm *et al*, 7/2/1961, Gebel Hamata, Red Sea Coast; CAI.
4	*P. arenaria* Waldst. & Kit.	A. Amer, 9648, 17/3/1987, Beheira Province, Idku; CAI.
5	*P. ciliata* Desf.	□□ M. Migahid, 4/3/1973, Horimela Valley; CAI.; El Hadidi et al, 7/5/1982, Sinai, Kathrina, Wadi Sehab; CAI.; L.F. Shalabi, 4/3/2008, Edku; Edu. A. Shams. Herb.
6	*P. commutata* Guss.	L. Boulos, 25/4/1959, N. Sinai, W. El-Mizeirie, G. El-Maghara region; CAI.; M. Imam, 9/4/1977, Mariut; CAI.
7	*P. coronopus* L.	M. Imam *et al*, 8/3/1978, Sidi Abdel Rahman; CAI.
8	*P. crassifolia* Forssk.	El Hadidi *et al*, 6/4/1976, Idku; CAI.
9	*P. crypsoides* Boiss.	M. Imam *et al*, 8/3/1978, Sidi Abdel Rahman; CAI.; Sven Snogerup, 1837, 1/3/1980, Wadi Habis, C. 18 km W. of Mersah Matrouh; CAI.
10	*P. cylindrica* Forssk.	El Hadidi *et al*, 27/1/1966, Wadi Digla, Maadi; CAI.; Amin *et al*, 7/7/1976, 166 km from Cairo on desert road to Alexandria; CAI.; E. Shamso, 21/3/1987, at kilo 90 from Alexandria- Cairo desert road; CAI.
11	*P. exigua* Murray	M. Abdel Ghani, 306, 28/2/1978, Al-Harra, Bahariya Oasis, weed in cultivation
12	*P. lagopus* L.	V. Täckholm *et al*, 25/3/1976, El Faiyum; CAI.; E. Shamso, 16/3/1987, El Faiyum, Ain Silein; CAI.; L.F. Shalabi, 14/5/2008, Alex-Cairo road; Edu. A. Shams. Herb.
13	*P. lanceolata* L.	L. Boulos, 24/9/1952, Fouad 1st Park at Benisuef; CAI.;V. Täckholm, 15/4/1960, in the field as weed to the left of the road Cairo-Inshas; CAI.; L.F. Shalabi, 14/5/2008, Alex-Cairo road; Edu. A. Shams. Herb.
14	*P. macrorhiza* Poir.	Simpson, 4/1937, Egypt in arides; CAI.
15	*P. major* L.	Chrtek *et al*, 15/4/1977, Qena; CAI.; Amry, 871, 20/9/1979, Minya Gahin farm; CAI.; L.F. Shalabi *et al*, 12/11/2008, Shebeen, Qaliobia; Edu. A. Shams. Herb.
16	*P. notata* Lag.	Sven Snogerup, 2/3/1980, Halzin, C.40 km W. of Mersah Matruh, sand field, after unusually heavy rains; CAI.; El Garf, 29/12/1989, Sidi Barrani; CAI.
17	*P. ovata* Forssk.	El Hadidi, 28/1/1956, Wadi Angabya, Suez road; CAI.
18	*P. phaeostoma* Boiss. & Heldr.	V. Täckholm *et al*., 23/3/1974, Saniet Hagg Ayyad, Wadi Habis, between Mersa Matrouh and Agiba; CAI.
19	*P. sinaica* (Barn.) Decne.	El Hadidi, 10/5/1956, Gebel Deir near St. Catherin, Sinai; CAI.
20	*P. squarrosa* Murray	Soliman, 11/3/1978, Sidi Abdel Rahman; CAI.; A. Amer, 9543, 17/3/1987, Beheira Province Rosetta; CAI.

APPENDIX (2): BASIC DATA MATRIX USED IN THE NUMERICAL CLASSIFICATION OF *PLANTAGO* SPECIES.

haracters/Species	**No.**		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Stem internodes	1	conspicuous	1	1	1	1	1	0	0	0	0	1	1	0	0	1	0	0	1	1	1	1
	2	inconspicuous	0	0	0	0	0	1	1	1	1	0	0	1	1	0	1	1	0	0	0	0
Average leaf length	3	3 cm or less	1	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	1	1	1
	4	5 cm or more	0	1	1	0	0	1	1	1	1	1	0	1	1	1	1	1	1	0	0	0
Average leaf width	5	0.8 cm or less	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1
	6	2 cm or more	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0
L/W ratio of leaf	7	8 or less	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	8	12 or more	0	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0
Leaf margin	9	entire	1	1	0	1	1	0	0	1	0	1	1	1	1	0	0	0	1	1	1	1
	10	toothed-sinuate	0	0	1	0	0	1	1	0	1	0	0	0	0	1	1	1	0	0	0	0
Leaf apex	11	acute-acuminate	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1
	12	obtuse	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Petiole	13	distinct	0	0	1	0	1	0	1	0	1	0	0	1	1	1	1	0	1	0	0	0
	14	indistinct	1	1	0	1	0	1	0	1	0	1	1	0	0	0	0	1	0	1	1	1
Leaf texture	15	glabrous	0	0	0	0	0	0	1	1	1	0	1	1	1	0	1	0	0	0	0	0
	16	hairy	1	1	1	1	1	1	0	0	0	1	0	0	0	1	0	1	1	1	1	1
Inflorescence	17	equal or shorter than subtending leaf	1	0	0	0	0	1	1	0	1	0	1	0	0	0	0	0	1	1	1	0
	18	longer than subtending leaf	0	1	1	1	1	0	0	1	0	1	0	1	1	1	1	1	0	0	0	1
Peduncle in cross-section	19	Terete	1	1	1	1	1	1	1	1	1	1	1	0	0	1	0	1	1	1	1	1
	20	angled	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0
Average inflorescence	21	2 cm or less	1	0	1	1	1	0	0	0	1	0	1	0	1	0	0	0	1	1	1	1

length																						
	22	2.8 cm or more	0	1	0	0	0	1	1	1	0	1	0	1	0	1	1	1	0	0	0	0
Average inflorescence width	23	0.5 cm or less	0	1	0	0	0	1	1	1	0	1	0	0	0	1	0	0	0	0	0	0
	24	0.7 cm or more	1	0	1	1	1	0	0	0	1	0	1	1	1	0	1	1	1	1	1	1
L/W ratio of inflorescence	25	5 or less	1	0	1	1	1	0	0	0	1	0	1	1	1	0	0	1	1	1	1	1
	26	7 or more	0	1	0	0	0	1	1	1	0	1	0	0	0	1	1	0	0	0	0	0
Bract	27	longer than flower	0	0	1	1	0	0	0	0	0	1	1	1	0	1	1	1	1	0	0	0
	28	shorter than flower	1	1	0	0	1	1	1	1	1	0	0	0	1	0	0	0	0	1	1	1
Average bract length	29	3.5 mm or less	1	0	0	0	0	1	1	1	1	0	0	1	0	0	1	1	0	1	0	1
	30	4 mm or more	0	1	1	1	1	0	0	0	0	1	1	0	1	1	0	0	1	0	1	0
Average bract width	31	2 mm or less	1	0	0	0	0	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1
	32	3 mm or more	0	1	1	1	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0
L/W ratio of bract	33	1.5 or less	0	1	1	1	1	1	1	1	0	0	0	1	1	0	1	0	1	1	0	0
	34	2 or more	1	0	0	0	0	0	0	0	1	1	1	0	0	1	0	1	0	0	1	1
Bract shape	35	ovate or obovate	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1
	36	lanceolate / cymbiform	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Bract apex	37	acute - acuminate	1	0	0	0	1	1	0	0	1	0	1	1	1	1	1	0	0	1	1	1
	38	obtuse	0	1	1	1	0	0	1	1	0	1	0	0	0	0	0	1	1	0	0	0
Bract margin	39	ciliate	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	40	not ciliate	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Bract nature	41	reduced to fleecy tuft	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
	42	intact	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1
Apical and basal bracts	43	similar	0	1	0	0	1	0	1	1	1	1	0	1	1	1	1	0	1	0	0	0
	44	dissimilar	1	0	1	1	0	1	0	0	0	0	1	0	0	0	0	1	0	1	1	1
Sepals	45	free	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	1	1	1	1
	46	connate	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	0	0	0	0
Sepals shape	47	Ovate- obovate	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	48	lanceolate	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sepals margin	49	ciliate	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	50	not ciliate	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Sepals apex	51	Acute-acuminate	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
	52	obtuse	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Sepals nature	53	reduced to fleecy tuft	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
	54	intact	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1
Sepals length	55	equal	0	1	0	0	0	0	0	0	1	0	0	0	1	0	1	1	1	1	1	0
	56	unequal	1	0	1	1	1	1	1	1	0	1	1	1	0	1	0	0	0	0	0	1
Petals	57	ovate-orbicular	0	1	1	1	0	1	0	1	0	1	1	1	1	1	0	1	1	1	1	1
	58	lanceolate	1	0	0	0	1	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0
Petals apex	59	acute	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	1
	60	acuminate	1	1	1	1	1	1	1	1	1	1	0	1	0	1	0	1	1	1	1	0
Petals	61	glabrous	1	1	1	1	0	0	0	1	0	0	1	1	1	0	1	0	1	1	1	1
	62	hairy	0	0	0	0	1	1	1	0	1	1	0	0	0	1	0	1	0	0	0	0
Brown spot on petal base	63	present	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
	64	absent	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1
Seed colour	65	black	1	0	1	1	1	0	1	0	1	0	1	1	1	0	1	1	1	1	1	1
	66	brown	0	1	0	0	0	1	0	1	0	1	0	0	0	1	0	0	0	0	0	0
Seed shape	67	cymbiform	1	0	1	0	1	0	0	1	0	1	1	1	1	0	0	1	1	1	1	1
	68	lenticular	0	1	0	1	0	1	1	0	1	0	0	0	0	1	1	0	0	0	0	0
Seed length	69	2 mm or less	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1
	70	3 mm or more	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Seeds number per capsule	71	4 or less	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1
	72	20 or more	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0

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