

LEAF MORPHOLOGY OF SOME SPECIES OF TRIBE PHASEOLEAE IN EGYPT

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ABSTRACT

Morphological variations of leaf characters of eight species of the tribe Phaseoleae belonging to three genera namely; *Macroptilium*, *Phaseolus* and *Vigna* were studied by macromorphological leaf characters and scanning electron microscopy (SEM) on both leaf surface. SEM clarified that there are seven sculptural patterns namely; unoulate, ruminant, reticulate, rugose, reticulate- rugulose, rugose - tuberculate and sulcate - rugose. Based on leaf morphology and scanning electron microscopy on leaf surfaces, an artificial key was structured to distinguish the studied taxa.

Key words: leaf morphology, leaf surface, scanning electron microscopy (SEM), Tribe Phaseoleae, *Macroptilium*, *Phaseolus*, *Vigna*.

1. INTRODUCTION

The tribe Phaseoleae has the largest number of genera and the greatest economic importance in the family Fabaceae, a part from its genera being highly cultivated legumes and the others contain members that are of considerable importance as food, fodder and ornament (Bandyopadhyay *et al.*, 2005).

The Phaseoleae belongs to the family Fabaceae, subfamily Faboideae (Leguminosae, Papilionoideae). Bentham (1865) divided the Papilionoideae into 11 tribes. Many workers now recognize more than the 11 tribes of Bentham (1865). Hutchinson (1964) lists 50 tribes by elevating many of Bentham's (1865) subtribes to tribes. Gillett *et al.* (1971) took up 17 tribes. Bentham's (1865) divided the Phaseoleae into six subtribes: Glycineae (includes genus *Clitoria*), Erythrinae, Galactieae, Diocleinae, Euphaseoleae (includes genus *Phaseolus* and *Vigna* and *Cajaneae*). The number of Phaseoleae genera has doubled since Bentham's time. Hutchinson's (1964) scheme differs slightly from Bentham's (1865), where he only added new genera and elevated most subtribes to the rank of tribe (where he added genus *Macroptilium* to tribe Phaseoleae). Grin taxonomy website (Angiosperm Phylogeny Group) recently divided subfamily Faboideae into 36 tribes and divided tribe Phaseoleae into 7 subtribes: Cajaninae, Clitoriinae, Diocleinae, Glycininae, Kennediinae, Ophrestiinae and

Phaseolinae; subtribe Clitoriinae includes genus *Clitoria*, while subtribe Phaseolinae included *Macroptilium*, *Phaseolus* and *Vigna* genera.

The Fabaceae are placed in the order Fabales according to most taxonomic systems, including the APG III system. (Angiosperm Phylogeny Group, 2009). The family now includes six subfamilies: Cercidoideae: 12 genera and ~335 species, Detarioideae: 84 genera and ~760 species, Duparquetioideae: 1 genus and 1 species. Dialioideae: 17 genera and ~85 species. Caesalpinioideae: 148 genera and 4400 species and Faboideae (Papilionoideae[5]): 503 genera and ~14,000 species. (The Legume Phylogeny Working Group (LPWG). 2017).

The tribe Phaseoleae is divided into 8 subtribes, one of these Phaseolinae includes 27 genera (three of which are *Macroptilium*, *Phaseolus* and *Vigna*). Many of these beans are cultivated for human and animal food, most importantly from the genera *Phaseolus* and *Vigna*. (Wojciechowski *et al.*, 2004, and Delgado-Salinas *et al.*, 2011).

Surface sculpturing by using Scanning Electron Microscope (SEM) technique may aid in solving problems of identity or relationship concerning taxa at various levels (Werker, 1997).

The currently accepted botanical name for the black-eyed peas *Vigna unguiculata* subsp. *unguiculata*, although was previously

classified in the genus *Phaseolus*. Many varieties are usually distinguished by the different colors of their mature seeds ("USDA GRIN Taxonomy").

Although, yardlong bean resembles pole snap beans (*Phaseolus vulgaris*), it is botanically more closely related to southern cowpeas (*Vigna unguiculata*). However, yardlong bean is much more a trailing and climbing plant than the southern pea, often reaching 9-12 feet in height (<http://eol.org/pages/1231704/overview>). The size and shape of the leaves varies greatly, making this an important feature for classifying and distinguishing cowpea varieties (Pottorff *et al.*, 2012). The size and shape of juvenile leaves in particular are important taxonomic characters in Eucalyptus (Pryor, 1976) with closely related species being differentiated by these traits (e.g. Phillips and Reid 1980; Potts and Reid, 1985). Ostroumove (1990) studied the stomata types on leaves of some species that belong to the tribes Coriandreae and Scandiceae (Umbelliferae) in relation to taxonomy. Szujko-Lacza (1994) studied the leaf characters of *Coriandrum sativum*.

The possible evolutionary-ecological significance of surface sculpturing was briefly discussed. There is evidence that these features may be seen primarily under the aspects of reduced ability of plants to contaminate and as temperature control mechanisms of surfaces. SEM studies revealed an extraordinary diversity of epidermal plant surface structures. These characters, surprisingly, were little affected by the environmental conditions in which the plant grows and thus can be used systematically (Barthlott and Frolich, 1984).

Many micro-characters have diagnostic values only when characterizing lowest taxonomic categories (e.g. many types of cuticular striations, most of the frequent types of cell shapes, many types of widely distributed epicuticular crystalloids). There are many characters that could be used to characterize groups of related species, genera or taxonomic categories up to the sub-family levels. Some characters of the micro-morphology and orientation of epicuticular wax crystalloid are surprisingly high systematic significance. Wax platelets may have parallel orientation patterns resembling electromagnetic field lines around the stomata. This pattern, called Convallaria-type (Cole and Behnke, 1975 and Barthlott, 1981). Dhalgren (1975), indicated the distribution of wax type (hatched) in the revised

classification of angiosperms.

Bandyopadhyay *et al.* (2005) differed in *Vigna unguiculata* result, on the issue of macula-reticulate type of ornamentation. Leaf morphology on some species of family Apiaceae was studied by Abd El-Maksoud (2009).

Nath & Dasgupta, (2015) recorded that SEM of spermoderm was found to be useful in establishing taxonomic and phylogenetic relationship in the Indian species of *Vigna*. The present investigation was an attempt to characterize seed coat on different species of tribe Phaseoleae in Egypt based on scanning electron microscopy (SEM).

2. MATERIALS AND METHODS

The current study was carried out during seasons 2016- 2017 on the leaves of eight species of Tribe Phaseoleae. Fresh leaves of the eight species were collected and identified by Flora and Phytotaxonomy Research Department, Horticultural Research Institute, Agricultural Research Center Giza, Egypt. These species were planted in the Medicinal and Aromatic Plants Research Department, Horticultural Research Institute, Agricultural Research Center, Dokki, Giza, Egypt. The detailed surface scan features were examined by using Scanning Electron Microscope (SEM) with different magnifications. Scanning was carried by JEOL-JSM T 100 Model Scanning Electron Microscope, Central Laboratory, National Information and Documentation Center (NIDoC), Dokki, Giza, Egypt. Photos of the leaf were taken by a digital camera.

Measurements of external leaf characters were recorded separately for each species based on information mentioned by Abd El-Maksoud (2009), Barnard,(1969), Dhalgren (1975), Conway *et al.*(2001), Cook *et al.*, (2005), Hutchinson (1964), Polhill and Raven (1981), Wojciechowski *et al.* (2004) and Pottorff *et al.* (2012).

3. RESULTS AND DISCUSSION

Morphological descriptions of the leaf of eight species of tribe Phaseoleae were studied and summarized in Table (2 & 3), plate 1 and plate 2, a & b including Macromorphological features of leaf; color, shape, petiole (length), stipules shape, stipules length mm, base, leaflets shape, length, width, margin, apex, base, petiolules mm, stipels mm, texture of both surface and scanning electron microscopy (SEM) on leaf surface (upper and lower

Table (1): The studied species of tribe Phaseoleae according to; The Plant List, BSBI List 2007 and NRCS 2016.

No.	Species	Synonyms	Common name
1	<i>Macroptilium lathyroides</i> (L.) Urb.	<i>Phaseolus lathyroides</i> L.	Phasey bean, bean - phasey, one-leaf clover, wild bush-bean, phasemy bean, quail bean, wild dolly bean
2	<i>Phaseolus acutifolius</i> A. Gray	<i>Ph. acutifolius</i> var. <i>tenuifolius</i> A.Gray <i>Ph. tenuifolius</i> (A. Gray) Wootton & Standl.	Tepary bean, Fagiolo Tepary, Fasol Ostrolistnaya, Fasola Ostrolistna, Frijol Tepary, Kvasolya Zolotistaya, Papu, Tepari,
3	<i>Phaseolus lunatus</i> L.	<i>Phaseolus bipunctatus</i> Jacq <i>Ph. ilocanus</i> Blanco <i>Ph. inamoenus</i> L <i>Ph. limensis</i> Macfad, <i>Ph. lunatus</i> var. <i>macrocarpus</i> (Moench) Benth <i>Ph. macrocarpus</i> Moench <i>Ph. portoricensis</i> Spreng <i>Ph. puberulus</i> Kunth <i>Ph. rosei</i> Piper <i>Ph. saccharatus</i> Macfad <i>Ph. tunkinensis</i> Lour	Lima bean, butter bean, sieva bean, Madagascar bean
4	<i>Phaseolus vulgaris</i> L.	<i>Phaseolus aborigineus</i> Burkart <i>Ph. communis</i> Pritz <i>Ph. compressus</i> DC <i>Ph. esculentus</i> Salisb	Green bean, Kidney bean, Common bean
5	<i>Vigna luteola</i> (Jacq.) Benth.	<i>Phaseolus luetolus</i> (Jacq.) Gagnep <i>Ph. marinus</i> Burm <i>Ph. maritimus</i> Hassk <i>Vigna brachystachys</i> Benth <i>Vigna bukombensis</i> Harms <i>Vigna fischeri</i> Harms <i>Vigna glabra</i> Savi <i>Vigna helicopus</i> (E. Mey.) Walp <i>Vigna jaegeri</i> Harms <i>Vigna longepedunculata</i> Taub <i>Vigna marina</i> (Burm.) Merr <i>Vigna nigerica</i> A. Chev <i>Vigna nilotica</i> (Del.) Hook <i>Vigna oblonga</i> Hook. f <i>Vigna repens</i> Kuntze <i>Vigna villosa</i> Savi	Dalrymple vigna, hairy cowpea
6	<i>Vigna radiata</i> (L.) R. Wilczek	<i>Phaseolus abyssinicus</i> Savi <i>Ph. aureus</i> Roxb <i>Ph. chanetii</i> (H.Lev.) H.Lev <i>Ph. hirtus</i> Retz <i>Ph. novo-guineense</i> Baker f <i>Ph. radiatus</i> L <i>Ph. setulosus</i> Dalzell <i>Ph. sublobatus</i> Roxb <i>Vigna opistricha</i> A.Rich <i>V. perrieriana</i> R. Vig <i>V. sublobata</i> (Roxb.) Bairig. & al.	Mung bean, green gram, maash, moong
7	<i>Vigna unguiculata</i> (L.) Walp.		Cowpea, black-eyed pea, southern pea, yardlong bean, catjang
8	<i>Vigna sesquipedalis</i> (L.) Frue.	<i>Vigna unguiculata</i> (L.) Walp. subsp. <i>sesquipedalis</i> (L.) Verdc	Yard long bean, Asparagus bean, Chinese long bean, snake bean

epidermis); type of stomata, stomatal leveling, type of trichomes and sculpture surface patterns.

Artificial key was structured based on

macromorphological and micromorphological features of leaf surface to distinguish the studied species.

Table (2): Macromorphological description of the leaves of the studied species.

Species Characters		1	2	3	4	5	6	7	8
Leaf	Stipules shape	Lanceolate	Lanceolate	exstipulate	oblong	ovate-lanceolate	peltate, ovate, or obovate-oblong	exstipulate	exstipulate
	Stipules length mm	5-6	2-3	-	2-4	3-8	5-18	-	-
	Arrangement	alternate	alternate	alternate	alternate	alternate	alternate	alternate	alternate
	Petiole cm.	2-5	2-10	6.5-9	3.5-8.5	1.5-6	5-21	2.5-10	5-25
	Base	Not swollen	swollen	Not swollen	swollen	negligible Swollen	Not swollen	Not swollen	amplexicaul
Type of lobed		trifoliolate	trifoliolate	trifoliolate	simple or trifoliolate	trifoliolate	trifoliolate (sometimes 5foliolate)	trifoliolate	trifoliolate
leaflets	Shape	Ovate to lanceolate or narrowly elliptic	ovate to ovate-lanceolate	ovate	ovate	ovate or ovate-lanceolate	elliptical, rhomboid or ovate	ovate	ovate
	Margin	entire	sinuate	entire	entire	entire	entire	entire	entire
	Apex	acute or acuminate	acute	acute or short-acuminate	acute	acute or acuminate	acute or acuminate	acute	acute or acuminate
	Base	symmetrical cuneate	subhastate	cuneate or truncate ,terminal asymmetric	symmetrical,the lateral ones are narrow and asymmetric.	rounded or cuneate symmetric	broadly cuneate or rounded, asymmetric	terminal symmetrical,central asymmetrical	acute or rounded to obtuse
	Petiolules mm	1-3	2-4	3-5	3-8	2-3	3-6	2-5	2-4
	Petiolules of terminal mm	7-15	8-15	15-30	14-30	4-9	15-28	13-20	3-6
	Stipels mm	Linear 1-1.5	Linear up to 2	Oblong 1-2	Lanceolate 2-3	Ovate 1	conspicuous, 5-10	Lanceolate 2-3	Ovate 2-3
	Length cm	3-8	4-8	3-19.5	6-15	2.5-11	5-18	3.4-6.5	7-13.5
	Width cm	1-3.5	2-5	1-11	3-11	1-5	3-15	1.5-4	4-9.5
Color		green	slightly green	upper surface dark green, dull, lower surface pale green or glaucous	upper surface green , lower surface pale green	green	dark green	green	green
Texture	Upper surface	glabrous	glabrous	glabrous	pubescent	sparsely pubescent	glabrous or hairy	pubescent	nearly hairless
	Lower surface	adpressed hairy	pubescent	glabrous	pubescent	sparsely pubescent	glabrous or hairy	pubescent	nearly hairless

1. *Macroptilium lathyroides* 2. *Phaseolus acutifolius* 3. *Phaseolus lunatus* 4. *Phaseolus vulgaris* 5. *Vigna luteola* 6. *Vigna radiate* 7. *Vigna unguiculata* 8. *Vigna sesquipedalis*

Table (3): Micromorphological description of the leaves of the studied species using Scanning Electron Microscopy (SEM).

Species Characters		1	2	3	4	5	6	7	8
Upper epidermis	Type of stomata	anomocytic	anomocytic	anomocytic	anomocytic	paracytic	paracytic and actinocytic	actinocytic	actinocytic
	Stomatal leveling	semiraised	superficial & semi-depressed	superficial	superficial	semiraised	Superficial& semi-depressed	Superficial	superficial
	Type of trichomes	non-glandular (vinca)	non-glandular (nux vimic)	non-glandular (nux vimic)	non-glandular (nux vimic)	non-glandular (vinca)& glandular(digitalis purpurea)	non-glandular (nux vimic)& glandular(digitalis purpurea)	non-glandular (vinca)	glandular (mentha)
	Trichome ornamentation	smooth	smooth	warty & lignify	pusticulate	weak tuberculate	weak tuberculate	warty & lignify	smooth
	Sculpture	ruminant	Reticulate-rugulose	rugose	rugose	sulcate - rugose	rugose	rugulose	scrobiculate
Lower epidermis	Type of stomata	anomocytic	anomocytic	anomocytic	anomocytic	paracytic	paracytic and actinocytic	actinocytic	actinocytic & anomocytic
	Stomatal leveling	Superficial& semiraised	Depressed	Superficial& semiraised	raised & semiraised	semiraised	superficial	superficial	raised & semiraised
	Type of trichome	Non-glandular (senna)	non-glandular (vinca)	non-glandular (nux vimic)	non-glandular (nux vimic)	non-glandular (vinca)& glandular(digitalis purpurea),	non-glandular (nux vimic)& glandular(digitalis purpurea)	non-glandular (vinca)	glandular (mentha)
	Trichome ornamentation	Smooth	Smooth	Smooth	Smooth	weak tuberculate	weak tuberculate	lignify	Smooth
	Sculpture	weak ruminant	Reticulate	ruminant	rugose - tuberculate	sulcate - rugose	unoulate	scalariform	scrobiculate

1. *Macroptilium lathyroides* 2. *Phaseolus acutifolius* 3. *Phaseolus lunatus* 4. *Phaseolus vulgaris* 5. *Vigna luteola* 6. *Vigna radiate* 7. *Vigna unguiculata* 8. *Vigna sesquipedalis*

1. *Macroptilium lathyroides* (L.) Urb.

Leaves trifoliolate; leaflets mostly entire margin, ovate to lanceolate, or narrowly elliptic, 3-8 cm long; 1-3.5 cm wide, upper surface glabrous, lower surface adressed hairy, petioles 1-5 cm long, stipules lanceolate, 5-6 mm. long, lateral leaflets sometimes slightly lobed towards the base. Upper epidermis has stomatal type; anomocytic with superficial semi-depressed level and with ruminant sculpture pattern, trichomes; non-glandular (vinca), smooth ornamentation. Lower epidermis has anomocytic stomatal type with superficial and semiraised level and with weak ruminant sculpture pattern, trichomes; non-glandular (senna), smooth ornamentation.

2. *Phaseolus acutifolius* A. Gray

Leaves alternate, trifoliolate; tapering, point-tipped stipules and are green, sparsely hairy, stipules lanceolate, 2-3 mm long, appressed to stem; petiole 2-10 cm long; stipels linear, up to 2 mm long; leaflets ovate to ovate-lanceolate, 4-8 cm × 2-5 cm, acute, sinuate margin, usually pubescent below, lateral ones sometimes slightly subhastate on one side, giving them a lopsided appearance, attenuate at apex. Upper epidermis has stomatal type; anomocytic with superficial and semi-depressed level and with reticulate-rugulose sculpture pattern, trichomes; non-glandular (nux vomica), smooth ornamentation. Lower epidermis has anomocytic stomatal type with depressed level and with reticulate sculpture pattern, trichomes; non-glandular (vinca), smooth ornamentation.

3. *Phaseolus lunatus* L.

The leaves alternate, exstipulate, trifoliolate with ovate leaflets, 3-19.5 cm long x 1-11 cm wide, the apex acute or short-acuminate, the margins entire; upper surface dark green, dull, glabrous, with slightly prominent venation; lower surface pale green or glaucous, glabrous, with the primary and secondary venation prominent; terminal leaflet 5.5-11 × 3.5-7.5 cm, rhombic or deltate, the base cuneate or truncate; lateral leaflets asymmetrically deltate, the base truncate; petiolules 3-5 mm long, pubescent; petioles 6.5-9 cm long, sulcate, puberulent, the base slightly broadened. Upper epidermis has stomatal type; anomocytic with superficial level, with rugose sculpture pattern, trichomes; non-glandular (nux vomica), warty and lignify ornamentation. Lower epidermis has anomocytic stomatal type with superficial and semiraised level and with ruminant sculpture pattern, trichomes; non-glandular (nuxvomica), smooth

ornamentation.

4. *Phaseolus vulgaris* L.

Leaves alternate, upper surface green, lower surface pale green. The leaf may be simple (have only one blade per petiole) or usually trifoliolate which are trifoliolate with ovate leaflets, smooth-edged leaflets, each 6-15 cm long and 3-11 cm wide. acute apex, wider and symmetrical, while the lateral ones are narrow and asymmetric., margin entire. There may be two simple leaves or one compound leaf attached at a spot on the stem called a node. Where the stem and leaf join, there is a swollen area of the petiole (pulvinus). At night the bean leaves fold together and down toward the soil; at dawn the leaves unfold and lifted into the sun. These leaves are fleshy, pubescent on both surfaces. Upper epidermis has stomatal type; anomocytic with superficial level and with rugose sculpture pattern, trichomes; non-glandular (nux vomica), pustulate ornamentation. Lower epidermis has anomocytic stomatal type with raised and semiraised level and with rugose - tuberculate sculpture pattern, trichomes; non-glandular (nux vomica), smooth ornamentation.

5. *Vigna luteola* (Jacq.) Benth.

Leaves trifoliolate, with leaflets ovate or ovate-lanceolate, 2.5-11 cm long, 1-5 cm wide, acute or acuminate at the apex, rounded or cuneate at the base, sparsely pubescent on both surfaces, petiole 2-8 cm long; rachis 0.5-1.2 cm long; petiolules 2-3 mm long; stipules ovate-lanceolate, 3-8mm long, 2 mm wide, shortly bilobed at the base. Both surfaces of epidermis are the same micromorphological features of leaf. Upper epidermis has stomatal type; paracytic with semiraised level and with sulcate - rugose sculpture pattern, trichomes; non-glandular (vinca) and glandular (digitalis purpurea), weak tuberculate ornamentation. Lower epidermis has paracytic stomatal type with semiraised level and with sulcate - rugose sculpture pattern, trichomes; non-glandular (vinca) and glandular (digitalis purpurea), weak tuberculate ornamentation.

6. *Vigna radiata* (L.) R. Wilczek

Slightly pubescent herb. Leaves alternate, trifoliolate (sometimes 5 foliolate), dark green; stipules 5-18 mm × 3-10 mm, peltate, ovate, or obovate-oblong; petiole 5-21 cm long, rachis 1.5-4.5 cm long; stipels conspicuous, 5-10 mm long; petiolules 3-6 mm long; leaflets entire, 5-18 cm × 3-15 cm, elliptical, rhomboid or ovate, base broadly cuneate or rounded, apex acuminate, glabrous or hairy on both surfaces,

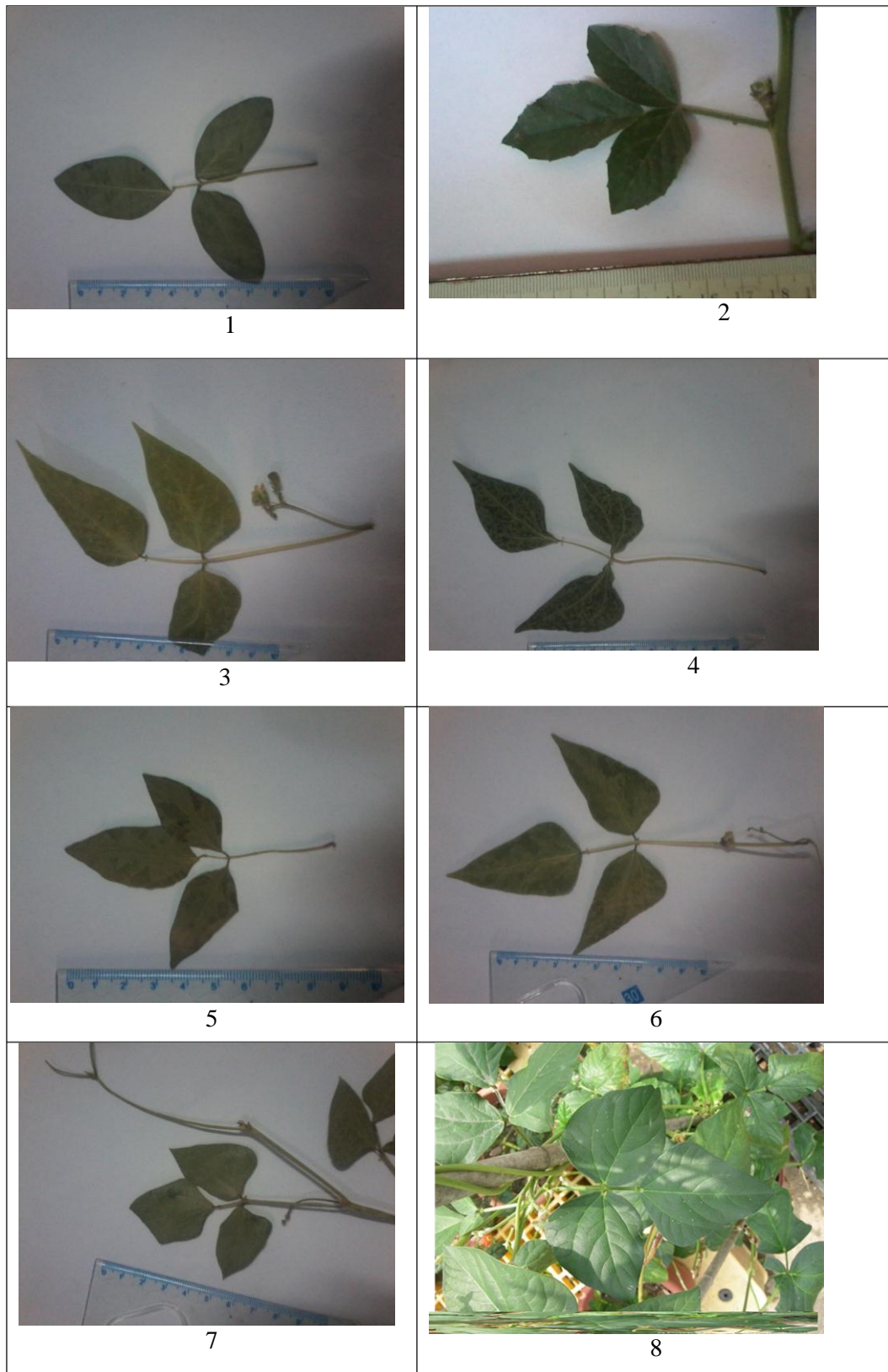


Plate (1): Shapes of leaf; 1. *Macroptilium lathyroides* 2. *Phaseolus acutifolius* 3. *Phaseolus lunatus* 4. *Phaseolus vulgaris* 5. *Vigna luteola* 6. *Vigna radiata* 7. *Vigna unguiculata* 8. *Vigna sesquipedalis*

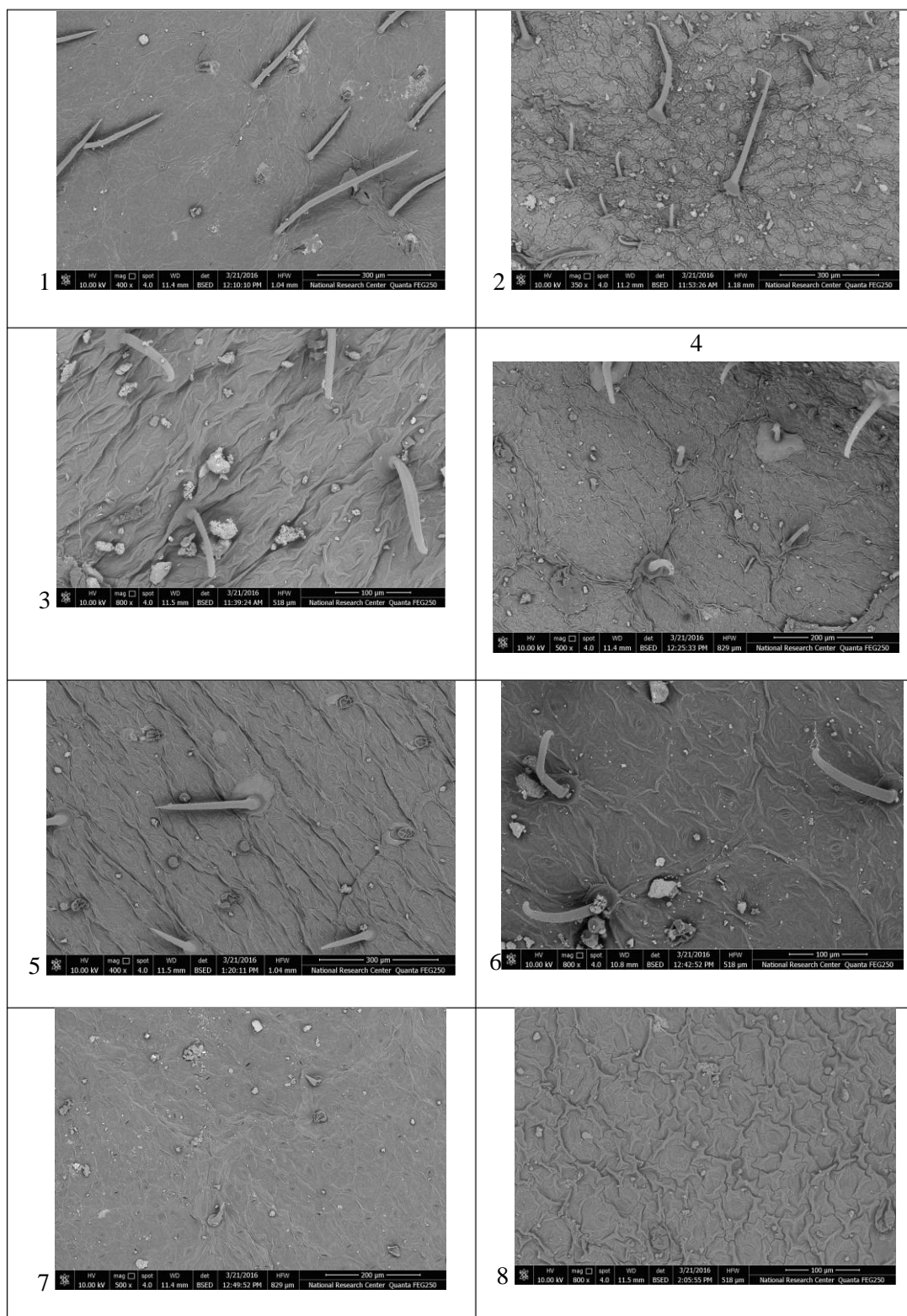


Plate. (2a): SEM on leaf epidermis; upper surface. 1. *Macroptilium lathyroides* 2. *Phaseolus acutifolius* 3. *Phaseolus lunatus* 4. *Phaseolus vulgaris* 5. *Vigna luteola* 6. *Vigna radiata* 7. *Vigna unguiculata* 8. *Vigna sesquipedalis*

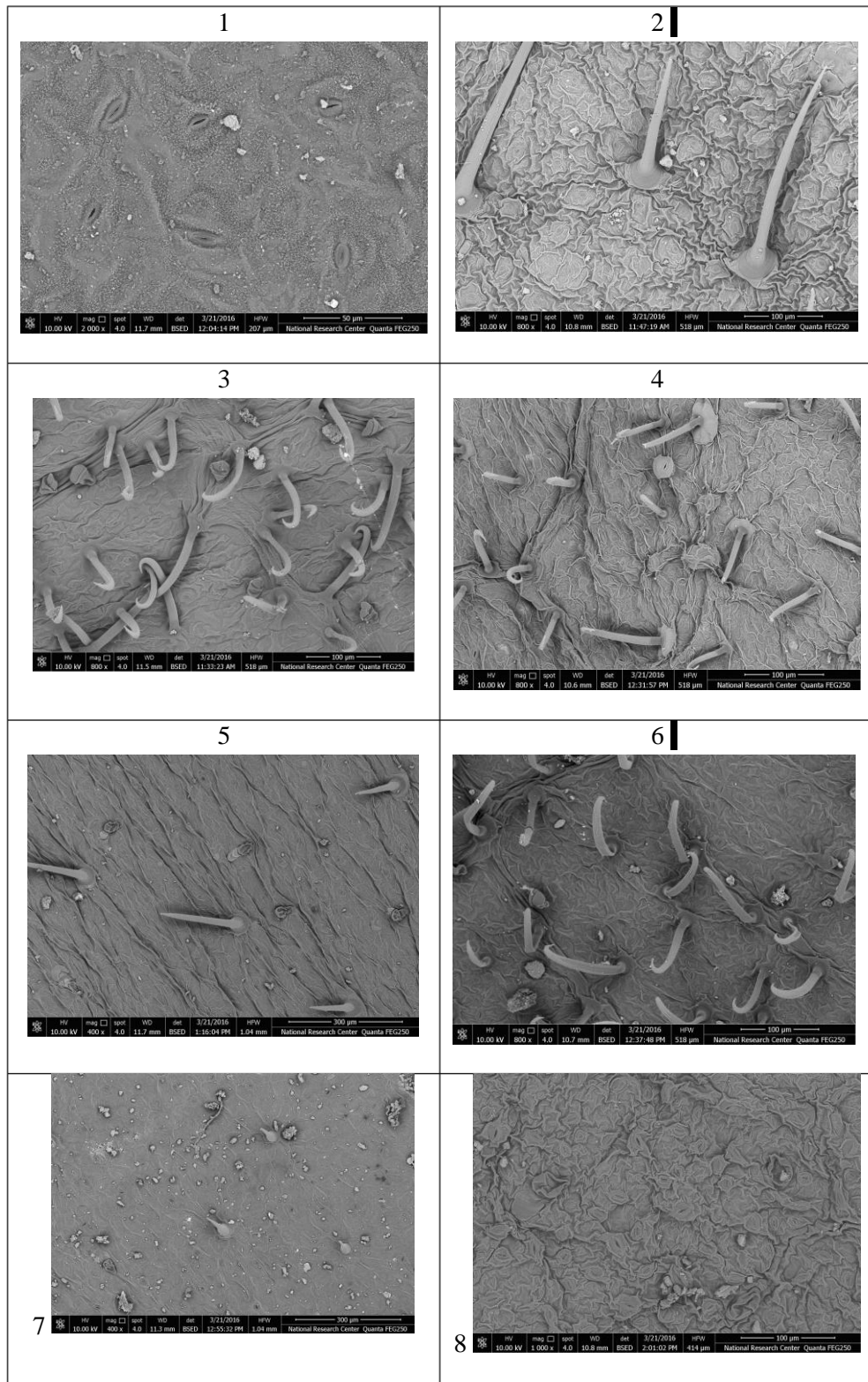


Plate. (2b): SEM on leaf epidermis; lower surface 1. *Macroptilium lathyroides* 2. *Phaseolus acutifolius* 3. *Phaseolus lunatus* 4. *Phaseolus vulgaris* 5. *Vigna luteola* 6. *Vigna radiata* 7. *Vigna unguiculata* 8. *Vigna sesquipedalis*

distinctly 3-veined from the base, the lateral leaflets unequal-sided. Upper epidermis has stomatal type; paracytic and actinocytic with superficial and semi-depressed level and with rugose sculpture pattern, trichomes; non-glandular (*nux vimic*) with weak tuberculate ornamentation and glandular (*digitalis purpurea*). Lower epidermis has paracytic and actinocytic stomatal type with superficial level and with unoulate sculpture pattern, trichomes; non-glandular (*nux vimic*) with weak tuberculate ornamentation and glandular (*digitalis purpurea*).

7. *Vigna unguiculata* (L.) Walp

There is a large morphological diversity found within the crop, and the growth conditions and grower preferences for each variety vary from region to region (Singh *et al.*, 1997). Variability in plant morphology of the different accessions is high. There are three types according to their uses: for grain, forage or dual-purpose.

Leaves alternate, exstipulate, trifoliolate with petioles 5-25 cm long. The lateral leaflets are opposite and asymmetrical, while the central leaflet is symmetrical and ovate. 1.5-4 cm. x 3.4-6.5 cm, petiolule 2-5mm. Terminal leaflet 6.32 - 7.52 cm. width , 8.72 - 10.40 cm length, petiolule length 1.3-2 cm. Upper epidermis has stomatal type; actinocytic with superficial level and with rugulose sculpture pattern, trichomes; non-glandular (*vinca*), warty & lignify ornamentation. Lower epidermis has actinocytic stomatal type with superficial level and with scalariform sculpture pattern, trichomes; non-glandular (*vinca*), lignify ornamentation.

8. *Vigna sesquipedalis* (L.)Frue.

Leaves green, exstipulate, alternately arranged along the stem and are trifoliolate, the first two leaflets being asymmetrical in shape with the terminal leaflet being ovate and symmetrical in shape, nearly hairless leaflets , 7-13.5 cm long, 4-9.5 cm wide, margin entire, base acute or rounded to obtuse, apex acute or acuminate, petiole 5-25 cm long. Upper epidermis has stomatal type; actinocytic with superficial level and with scrobiculate sculpture pattern, trichomes; glandular (*mentha*), smooth ornamentation. Lower epidermis has anomocytic and actinocytic stomatal type with raised and semiraised level and with scrobiculate sculpture pattern, trichomes; glandular (*mentha*), smooth ornamentation.

Surface sculpturing by using Scanning Electron Microscope (SEM) technique may aid

in solving problems of identity or relationship concerning taxa at various levels (Werker, 1997).

Artificial key was structured based on macromorphological and micromorphological features of leaf surface to distinguish the studied species.

A. Leaf exstipulate , leaflet shape ovate

B. Stipels shape ovate with upper epidermis; stomata actinocytic and lower epidermis; stomata actinocytic & anomocytic. Both surface; sculpture scrobiculate and trichomes glandular (*mentha*) *Vigna sesquipedalis*

BB. Stipels shape oblong with upper epidermis; sculpture rugose and lower epidermis; sculpture ruminant. Both surface; stomata anomocytic and trichomes non- glandular (*nux vimic*) *Phaseolus lunatus*

BBB. Stipels shape Lanceolate with upper epidermis; sculpture rugulose and lower epidermis; Sculpture scalariform. Both surface; stomata actinocytic and trichomes non-glandular (*vinca*).....*Vigna unguiculata*

AA. Leaf stipulate

C. Leaf dark green with upper epidermis; sculpture rugose and lower epidermis ; sculpture unoulate. Both surface; stomata paracytic and actinocytic and trichomes non-glandular (*nux vimic*) & glandular (*digitalis purpurea*).*Vigna radiate*

CC. Leaf upper surface green with sculpture rugose , lower surface pale green with sculpture rugose – tuberculate. Both surface; stomata anomocytic and trichomes non-glandular (*nux vimic*) *Ph. Vulgaris*

CCC. Leaf green

D. Leaflet margin sinuate with upper surface sculpture reticulate- rugulose, lower surface sculpture reticulate. Both surface; stomata anomocytic and trichomes non-glandular *Ph. acutifolius*

DD. Leaflet margin entire

E. Both surface; sculpture sulcate – rugose, stomata paracytic and trichomes non-glandular (*vinca*) & glandular (*digitalis purpurea*)*Vigna luteola*

EE. Both surface; sculpture ruminant, stomata anomocytic and trichomes non-glandular*Macroptilium lathyroides*

In conclusion, Macromorphology and micromorphology of leaf are found characteristic to each species and appeared to be species-

specific. So SEM study of leaf could be useful in establishing taxonomic and phylogenetic relationship among the studied species.

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مورفولوجية ورقة بعض أنواع لرتبة الفاصوليا Phaseoleae في مصر

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ملخص

تمت دراسة الاختلافات المورفولوجية لصفات الورقة لـ 8 أنواع من رتبة Phaseoleae تنتمي إلى ثلاثة أجناس هي *Macroptilium* ، *Phaseolus* ، *Vigna* ، وذلك عن طريق بعض الصفات المورفولوجية الخارجية للورقة وفحص بالمجهر الإلكتروني الماسح لسطحي الورقة. أوضح الميكروسكوب الإلكتروني أن هناك سبعة أنماط زخرفية مميزة هي unoulate, ruminata, reticulate, rugose, Reticulate- rugulose, rugose - tuberculate and sulcate – rugose. كما تم عمل مفتاح اصطناعي للتمييز بين الأنواع محل الدراسة، على أساس الصفات المورفولوجية الخارجية للورقة وفحص بالمجهر الإلكتروني الماسح لكلا سطحي للورقة.

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