

MORPHOLOGICAL AND ANATOMICAL STUDIES ON THE LEAF OF SOME GENERA OF SOLANACEAE.

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ABSTRACT

This study aimed to find out the morphological and anatomical differences between leaves in 3 genera of Solanaceae, namely; *Solanum tuberosum* L. (potato), *Capsicum annuum* L. (pepper) and *Datura stramonium* L. (datura).

The following morphological characters of leaves were studied for each genus during two successive seasons : number of leaves/ plant; leaf area/ plant and fresh and dry weights of leaves/ plant.

The anatomical studies revealed that the petiole in the cross sections was half-circular in shape in *Solanum* and *Datura* and reniform in shape in *Capsicum*. The number of vascular bundles were 3 in the petiole of all studied genera, where the median one was the largest and bicollateral type, while the others were small and also bicollateral. Concerning the structure of lamina, it was found that, the mesophyll consisted of one layer of palisade tissue, and some layers of spongy tissue ranging between 5-7 rows in all studied genera. It is evident from the print of the lower surface of the lamina, the stomata were anomocytic type in the 3 studied genera. Trichomes on the lower epidermis differed in the three genera; being multicellular uniseriate in *Solanum*, glandular and multicellular uniseriate in *Datura*, while in *Capsicum* it was difficult to observe any type of hairs.

INTRODUCTION

Family Solanaceae is one of the most important economic families of the flowering plants, with about 90 genera and 2000 species. Plants are distributed in the tropical and temperate regions mainly in Central and South America. The family includes several important genera, e.g. *Solanum*, *Capsicum* and *Datura*. Plants are mostly herbaceous, though some are soft wooded shrubs or small trees, with alternate, simple or compound leaves which are often softly hairy; without stipules, (Cobley, 1976) and (Pritishakla and Misra, 1979). Three genera were chosen for this work, to disclose their different morphological and anatomical characteristics in the leaf. The 3 genera are:

Solanum tuberosum L. (potato), is an annual, herbaceous and succulent plant. It spreads now through all parts of the world, especially in regions having a temperate climate. Leaf is compound with netted venation. Tubers are rich in starch and vitamins B and C and used for human food and livestock feed.

Capsicum annuum L. (pepper), is an annual to biennial herb, it is grown in subtropical and tropical areas from the southern United States to the northern parts of South America. It is one of the most important and widely distributed vegetable crops in Egypt, especially under tunnel nowadays. Leaf is simple with netted venation. Fruits of hot pepper contain Capsaicin (2%), therefore it is used as a condiment and for rheumatism treatment by external application as it irritates and reddens the skin

Datura stramonium L. (datura), is an annual or perennial shrub. It is widely distributed in Middle East and Sudan and is grown in Egypt as an important medicinal plants. Leaf is simple with netted venation. The fruit, is often called thorn-apple or mad-apple. Leaves are rich in alkaloids: Hyosyamin, Hyosin and Atropine, which are used for medical treatments of respiration, digestive and nerviace systems and as eye drops. (Robins *et al.*, 1992).

MATERIALS AND METHODS

The current investigation was carried out in a field experiment at the Experimental Station, Faculty of Agriculture, Cairo University, Giza, during two successive seasons; (2002 and 2003), to compare the morphological and anatomical differences, between 3 genera of family Solanaceae; *Solanum tuberosum* L. *Capsicum annuum* L. and *Datura stramonium* L.

Tuber seeds of potato, cv. Spunta, were obtained from the Co-operative Society of Potato Growers, Egypt. While seeds of pepper, cv. Anahiam, were secured from the Vegetable Research Department, Agricultural Research Center. Seeds of datura cv. Stramonium were procured from the Experimental Station of Medicinal Plants, Faculty of Pharmacy, Cairo University, Giza.

The layout of the experiment was a randomized complete block design, in three replicates per genus. The type of soil of the experimental field was a loamy clay soil.

Tuber seeds of potato were sown on 1st February, 2002 and 2003 in 3 plots, each consisted of 8 rows, 4 meters long and 70 cm in width. Whole potato tubers, weighing 45-60 g, were sown in hills and covered with soil.

Pepper seeds were sown on 1st February, 2002 and 2003 in warm seed beds in lines and were transplanted to the field on April 1st in replicates comprised 6 rows, 4.5 meters long and 65 cm in width.

Datura seeds were cultivated on 1st April, 2002 and 2003, in plots 2 × 3 meters with 6 rows each and 50 cm. apart. Seeds were disseminated in hills spaced 50 cm, 3-4 seeds per hill. Plants were thinned to 1 plant per hill after 1 month.

Studied morphological characters:

Fifteen plants, five plants from each of the three replicates, were assigned for the morphological characters, at 15 days intervals in both seasons.

1. leaf description at the age of 45 days.
2. Average number of leaves / plant at different ages.
3. Average leaf area (cm²) / plant, using the "Leaf Area Meter".
4. Average fresh and dry weights (g.), of leaves / plant at different ages.

Samples were dried in an electric oven at 70°C till constant weight, (almost 48 hours).

Anatomical studies:

1. Specimens were taken from plants of the second season at 2 ages, 45 and 60 days, and were taken from the middle of petiole and the middle of the lamina including the midrib. Specimens were killed and fixed for at least 48 hours in F.A.A. (10 ml formalin, 5 ml glacial acetic acid, 85 ml ethyl alcohol 70%). Materials were washed in 50% ethyl alcohol and dehydrated in a normal butyl alcohol series, embedded in paraffin wax (melting point 52-54° C). Transverse sections, 20 μ thick, were cut using a rotary microtome and stained with crystal violet / erythrosine combination, and mounted in Canada balsam, (Willey, 1971). Counts and measurements (μ) of the different tissues were taken, and averages of 10 readings from 5 slides were calculated.
2. Prints of stomata of leaves were made, using an adhesive, to detect the type of stomata in each genus.
3. A peel was taken from abaxial surface of the leaf to examine types of epidermal hairs.

Statistical analysis:

Morphological data were subjected to different methods of statistical analysis according to computer software designed for statistical analysis (MSTAT, 1986).

RESULTS AND DISCUSSION

Morphological studied:

1. *Solanum tuberosum* L. (potato)

a. Leaf shape:

First leaves arising above the cotyledons, were simple, while later leaves were pinnately compound, alternate with 7-9 ovate leaflets. Each leaf had an odd, large terminal leaflet. Margins were entire. Many smaller secondary or tertiary leaflets were found growing between the primary leaflets. The young leaflets were densely pubescent, bearing hairs of multicellular uniseriate type. The leaflets were green and net-veined as illustrated in Fig: (1,a). The description of leaves is in harmony with that of Hayward (1938), Pushkarnath (1976) and Cutter (1992).

b. Average number of leaves per plant:

Data concerning averages of number of leaves per plant at different ages throughout the two growing seasons are given in Table (1).

It is evident that the increase in number of leaves was significant at all stages in the first season, where the maximum number of leaves per plant at the age of 105 days, reached 131.0 leaves/ plant. At the final sampling date, at the age of 120 days, a significant decrease in number of leaves was present being 76.2 leaves. This decrease should be expected due to the defoliation at this age. The highest increase occurred between the ages 75-90 days as it increased from 60.4 to 110.6 leaves/ plant.

In the second season, significant increases were present at all ages, except at the stages 30-45 days, as the increase was insignificant. The maximum number of leaves was achieved at 105 days, 123.8 leaves/ plant. The highest increase occurred between the ages 75-90 days as it increased from 52.8 to 94.2 leaves/ plant. A significant decrease in number of leaves was present in the last stage, 120 days, being 69.2 leaves/ plant. The percentage increases in number of leaves per plant from the age of 30 days to the age 105 days throughout the growing season, were 1719.4 and 1963.3 % in the first and second seasons; respectively.

Table (1): Morphological characters of the leaf of *Solanum tuberosum* L. during two successive seasons 2002 and 2003 (Averages of 5 plants).

Plant age (days)	No. of leaves / plant		Leaf area (cm ²) / plant		Fresh weight of leaves (g.) / plant		Dry weight of leaves (g.) / plant	
	1 st season	2 nd season	1 st season	2 nd season	1 st season	2 nd season	1 st season	2 nd season
30	7.2	6.0	14.3	13.4	0.7	0.3	0.1	0.05
45	13.4	11.2	299.1	262.5	15.4	11.8	1.9	1.5
60	34.4	28.4	1304.9	1278.5	65.3	58.2	10.2	7.5
75	60.4	52.8	2156.3	1940.9	102.9	94.5	15.1	13.3
90	110.6	94.2	2859.8	2419.1	132.0	125.5	17.7	15.9
105	131.0	123.8	3152.2	2901.2	120.6	114.2	15.4	14.0
120	76.2	69.2	862.1	735.2	38.4	32.4	11.2	10.5
L.S.D. at 0.05	4.5	5.9	367.8	342.9	11.0	17.1	1.8	1.9

c. Average leaf area per plant:

values of average leaf area throughout the two consecutive seasons are shown in Table (1).

It is clear that, significant increases in leaf area were present at the age between 45-90 days in the first season, being 2859.8 cm² at 90 days, while in the second one, it was between the age of 45-105 days, being 2901.2 cm² at 105 days.

Insignificant increases in leaf area were gained at the stage between 30-45 days in the first and second seasons, and at the stage of 90-105 days at the first season. Leaf area reached maximum values of 3152.2 and 2901.2 cm² at the age of 105 days in both seasons; respectively. The highest increase in leaf area was achieved during the stage between 45 and 60 days in both seasons.

Significant decreases were recorded at the age between 105 to 120 days in both seasons, being 862.1 and 735.2 cm², respectively. This decrease might be a result of normal defoliation associated with age. The percentage increases of leaf area from the age of 30 days to the age 105 days recorded 21943.3 and 21549.3 % in both seasons; respectively.

d. Average fresh weight of leaves per plant:

Results of average fresh weight of leaves at consecutive ages throughout the two growing seasons are given in Table (1).

Results revealed that the increase in fresh weight of leaves/ plant was significant until the age of 90 days in the first season and reached maximum of 132.0 g. at the age of 90 days, while in the second one the increase was insignificant at the stage of 30-45 days, being 11.8 g. at 45 days. Thereafter, there were significant increases up to the age of 90 days, where the weight reached a maximum of 125.5 g.. Significant decreases in the last 2 stages 90-105 and 105-120 days were present in both seasons.

The highest increase in fresh weight occurred during the period from 45 to 60 days in both seasons. The percentage increases of fresh weight of leaves/ plant from the age of 30 days to the age 90 days recorded 18757.1 and 41733.3 % in both seasons; respectively.

e. Average dry weight of leaves per plant:

values concerning averages of dry weight of leaves per plant at different stages throughout the two successive seasons are given in Table (1).

It is evident from the results that there were significant increases in dry weight of leaves per plant during the stage between 30-90 days in the first season. While in the second season the significant increases were between 45-90 days.

Maximum weights reached 17.7 and 15.9 g. at 90 days in both seasons; respectively. At final 2 stages, 90-120 days, significant decreases were achieved in both seasons due to the defoliation of leaves. The highest increase in dry weight occurred during the period from 45 to 60 days in both seasons. The percentage increases of dry weight of leaves/ plant from the age of 30 days to the age 90 days throughout the two growing seasons were 17600.0 and 31700.0 % in both seasons; respectively.

2. *Capsicum annuum* L. (pepper)

a. Leaf shape:

Leaves are simple petiolate, ovate in shape, with acuminate tips and its base is unequal sided (inaequilaterus). The lamina has netted venation and the margin is entire, Fig. (1,b). The description of leaves is in harmony with that of Bailey (1958).

b. Average number of leaves per plant:

Results pertaining to number of leaves per plant throughout the two growing seasons are given in Table (2).

It is evident that the increases in number of leaves were insignificant till the age of 60 days, reaching 22.0 and 20.0 leaves/ plant in the first and second seasons, respectively. In the following periods, leaf numbers recorded significant increases, throughout all stages in both seasons, recording 811.4 and 793.4 leaves/ plant, at the last age, 150 days, in the first and second seasons; respectively. The highest increase occurred between the age 135-150 days in both seasons. The percentage increases in number of leaves per plant from the age of 30 days to the age 150 days throughout the growing season, were 10864.9 and 11567.6 % in the first and second seasons; respectively.

Table (2): Morphological characters of the leaf of *Capsicum annuum* L. during two successive seasons 2002 and 2003 (Averages of 5 plants).

Plant age (days)	No. of leaves / plant		Leaf area (cm ²) / plant		Fresh weight of leaves (g.) / plant		Dry weight of leaves (g.) / plant	
	1 st season	2 nd season	1 st season	2 nd season	1 st season	2 nd season	1 st season	2 nd season
30	7.4	6.8	17.0	14.4	0.3	0.3	0.06	0.05
45	12.6	11.0	37.7	34.3	1.0	0.9	0.30	0.25
60	22.0	20.0	111.9	100.3	3.5	3.3	1.03	0.96
75	64.6	60.4	313.4	302.3	7.6	7.1	2.10	1.94
90	180.4	174.4	2860.5	2520.2	29.1	27.3	8.41	7.80
105	272.0	265.2	4450.5	4297.0	51.4	47.9	14.80	13.52
120	349.4	341.2	5548.9	5235.9	87.3	81.9	25.20	22.68
135	562.0	554.6	7141.6	6835.8	132.6	129.1	37.42	36.70
150	811.4	793.4	8393.7	8061.5	228.2	218.8	65.16	63.69
L.S.D. at 0.05	29.7	10.9	522.8	281.3	15.7	9.8	3.8	4.2

c. Average leaf area per plant:

Data of leaf area per plant at different stages throughout the two successive seasons are illustrated in Table (2).

It is clear that up to 75 days, leaf area increased slightly and values obtained were insignificant, reaching 313.4 and 302.3 cm² at the age of 75 days in the first and second seasons; respectively. Thereafter, significant increases were continued at a more or less uniform rate starting from 75 days until the end of growth season, 150 days, in both seasons; respectively. The highest increase in leaf area was achieved during the stage between 75 and 90 days in the first and second seasons; respectively. The percentage increases of leaf area through the growing season from the age of 30 days to the age 150 days recorded 49274.7 and 55882.6 % in both seasons; respectively.

d. Average fresh weight of leaves per plant:

Values in Table (2) show the relation between age and average fresh weight of leaves/ plant throughout the two growing seasons.

In early stages 30, 45, 60 and 75 days, increases in the fresh weight of leaves were insignificant reaching 7.6 and 7.1 g. in both seasons; respectively. Thereafter, significant increases in fresh weight were recorded till the age 150 days, reaching a maximum of 228.2 and 218.8 g. in the first and second seasons; respectively. The highest increase in fresh weight of leaves was achieved during the stage between 135-150 days in both seasons. The percentage increases of fresh weight of leaves from the age of 30 days to the age 150 days during the two successive seasons were 75966.7 and 72833.3 % in both seasons; respectively.

e. Average dry weight of leaves per plant:

Data concerning average dry weight (g) of leaves per plant throughout the two successive seasons are shown in Table (2).

Average dry weights of leaves were 0.06 and 0.05 g. at 30 days in the first and second seasons; respectively. Insignificant increases were present up to the age of 75 days, reaching 2.10 and 1.94 g. in the first and second seasons; respectively.

Thereafter significant increases started from the age of 75 days to the end of the growing season, at the age of 150 days in the first and second seasons, where weights recorded 65.16 and 63.69 g. in the two seasons; respectively. The highest dry weight of leaves was recorded during the period 135-150 days. The percentage increases of dry weight of leaves from the age of 30 days to the age 150 days throughout the two growing seasons were 65060.0 and 127280.0 % in both seasons; respectively.

3. *Datura stramonium* L (*Datura*)

a. Leaf shape:

The leaves are simple petiolate, oblong, slightly lobed, with acute tips and cuncate bases. Margin of the lamina is sinuate, midveins light green and its venation is netted, Fig. (1,c). The description of leaves is in harmony with that of Khattab *et al.*(2002).

b. Average number of leaves per plant:

Results in Table (3) show the relation between age and average number of leaves / plant at the consecutive two seasons.

It is obvious that increases in number of leaves were insignificant till the age of 75 and 60 days in the first and second season; respectively. reaching 87.0 and 26.2 leaves/ plant. In the following periods, leaf numbers recorded significant increases reaching a maximum of 414.4 and 406.8 leaves/ plant at the age of 120 days in the two seasons; respectively. Insignificant decreases were found in the first season during the stage from 120 to 150 days, while in the second season, significant decreases were present during the same stage.

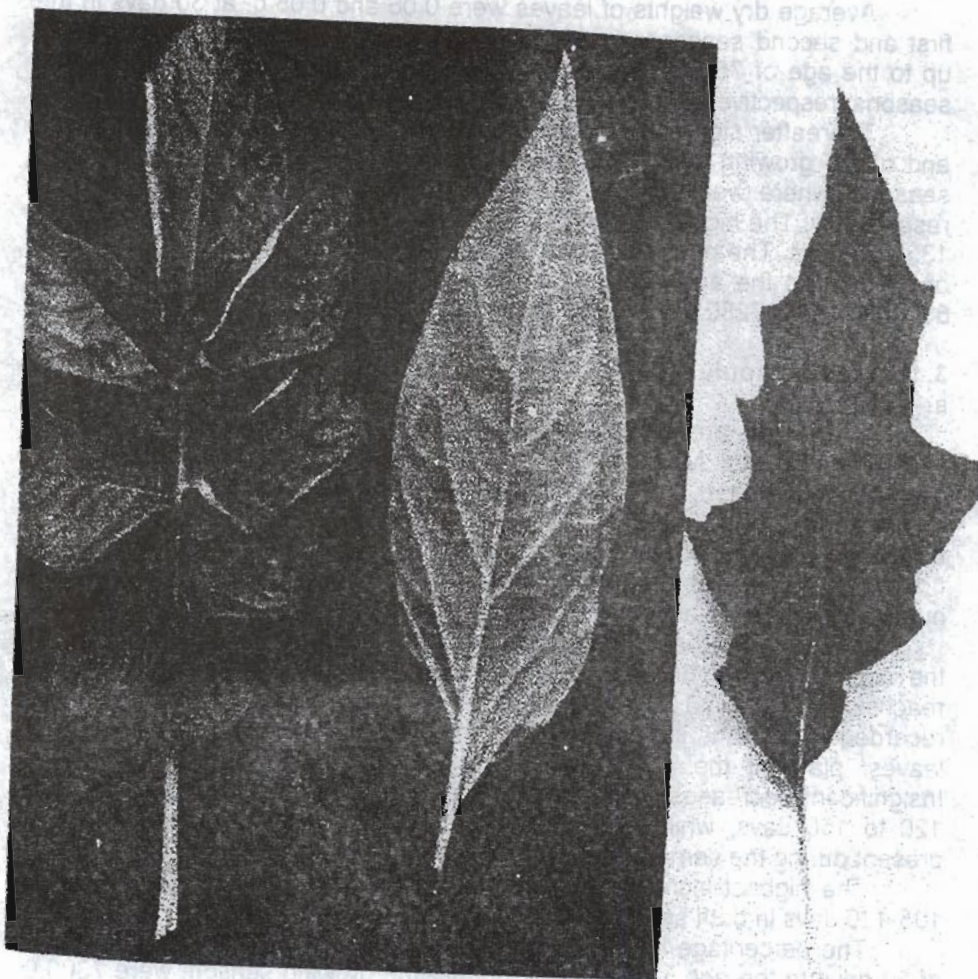
The highest increase in number of leaves occurred between the age 105-120 days in both seasons.

The percentage increases in number of leaves per plant from the age of 30 days to the age 120 days throughout the growing season, were 7300.0 and 7723.1 % in the first and second seasons; respectively.

c. Average leaf area per plant:

Values concerning leaf area per plant at different ages throughout the two successive seasons are shown in Table (3).

It is clear that there were significant increases in leaf area at the stage from 60-120 days during the two seasons, while the earlier stage, from 30 to 60 days, there was insignificant increases in both seasons. A maximum leaf area was recorded at the age of 120 days, where it reached 12010.0 and 11872.9 cm² in the first and second seasons; respectively. At the stage of 120-135 days, insignificant decreases were recorded in the first season, while significant decreases were recorded at the stage of 135-150 days. In the second season, significant decreases were found at the stages of 120-135 and 135-150 days. The highest increases were achieved during the stage 105-120 days in both seasons. The percentage increases of leaf area from the age of 30 days to the age 120 days through the growing season were 31925.1 and 35131.2 % in both seasons; respectively.



(a)

(b)

(c)

Fig. (1): Shapes of leaves of the studied genera:

a- *Solanum tuberosum* L.

b- *Capsicum annuum* L.

c- *Datura stramonium* L.

d. Average fresh weight of leaves per plant:

Results in Table (3) shows the relation between age and the averages of fresh weight of pepper leaves throughout the two growing seasons.

It is evident from the values that, there were significant increases in fresh weight of leaves / plant at the stages between 60-120 days in both seasons, while the first stage, from 30 to 60 days recorded insignificant increases. Significant decreases were recorded at the final 2 stages; 120-135 and 135-150 days in both seasons; respectively. The highest increase in fresh weight occurred during the period from 105 to 120 days in both seasons. The percentage increases of fresh weight of leaves from the age of 30 days to the age 120 days during the two successive seasons were 37187.5 and 40585.7 % in both seasons; respectively.

e. Average dry weight of leaves per plant:

Data concerning average of dry weight of leaves per plant throughout the two growing seasons are shown in Table (3).

Insignificant increases were recorded in dry weight from the age 30 to 60 days, being 0.17 and 0.15 g. at the age of 30 days, 4.2 and 3.6 g. at the age of 60 days in the 1st and 2nd seasons; respectively. Thereafter, significant increases were present until the age of 120 days in both seasons, then significant decreases were detected at the final 2 stages from 120 to 150 days. The highest increase in dry weight of leaves was achieved during the stage 105-120 days in both seasons. The percentage increases of dry weight of leaves from the age of 30 to 120 days throughout the two growing seasons were 36782.3 and 39500.0 % in both seasons; respectively.

Table (3): Morphological characters of the leaf of *Datura stramonium* L. during two successive seasons 2002 and 2003 (Averages of 5 plants).

Plant age (days)	No. of leaves / plant		Leaf area (cm ²) / plant		Fresh weight of leaves (g.) / plant		Dry weight of leaves (g.) / plant	
	1 st season	2 nd season	1 st season	2 nd season	1 st season	2 nd season	1 st season	2 nd season
30	5.6	5.2	37.5	33.7	0.8	0.7	0.17	0.15
45	16.4	13.4	284.3	246.3	12.6	8.9	2.5	1.7
60	30.8	26.2	1041.0	947.5	20.8	18.7	4.2	3.6
75	87.0	78.0	3137.0	2833.2	76.9	68.2	15.4	13.9
90	184.8	179.8	5711.0	5247.6	123.4	118.3	26.5	25.03
105	255.0	246.2	7862.0	7562.7	173.6	165.5	38.3	36.8
120	414.4	406.8	12010.0	11872.9	298.3	284.8	62.7	59.4
135	391.4	364.6	10710.0	8074.8	175.2	169.1	39.8	37.4
150	321.8	275.0	4857.0	3665.2	88.1	83.1	20.4	19.6
L.S.D. at 0.05	89.2	30.5	1423.0	773.8	38.3	29.5	5.2	4.2

Anatomical studies of the foliage leaf

1. structure of the petiole:

Table (4) and Fig. (2.a, b and c) show that, the petiole was half-circular in shape in potato and datura and reniform in shape in pepper.

The petiole was bounded by an epidermis of a uniseriate layer covered with a thin layer of cuticle. The averages of thickness of upper epidermis were 37.5, 16.3 and 12.5 μ , while the lower ones were 27.5, 25.0 and 12.5 μ in potato, pepper and datura; respectively.

The ground tissue, consisted mainly of parenchyma cells, with 3-4, chlorenchymatous tissue and 3-5 layers of angular collenchyma were found. Three vascular bundles were embedded in the ground tissue, and the median one in the 3 genera was the largest and bicollateral, while the others were small. The average numbers of xylem rows in the median bundles were 43.0, 24.5 and 34.7 rows, and their average numbers of vessels were 103.7, 74.7 and 68.7 vessels, in potato, pepper and datura; respectively. The averages of length of the central bundles were 339.6, 246.3 and 296.3 μ , and their widths were 2783.3, 933.7 and 1378.7 μ in the same sequence.

The averages of thickness of xylem in the central bundles were 87.5, 84.0 and 113.7 μ . The averages of external phloem thickness were 39.6, 26.9 and 44.8 μ , while the internal ones were 32.5, 43.7 and 26.3 μ , in the same previous order. On the other hand, the length averages of the central bundles zone were 2641.7, 1141.3 and 1978.7 μ , and their widths were 4254.2, 1591.3 and 2312.5 μ , in the same order stated before.

The present results on the structure of the petiole were in harmony with those obtained by Metcalfe and Chalk (1957).

2. structure of the lamina:

Table (4) and Fig. (3.a, b and c) show the cross sections of the lamina of the 3 genera. The upper and lower epidermal layers were covered with thin cuticle. The measurements of thickness of the upper epidermal layers were 18.8, 12.5 and 21.3 μ , while the lower ones were 18.8, 11.3 and 15.0 μ in potato, pepper and datura; respectively. Measurements of mesophyll thickness were 197.4, 255.2 and 245.4 μ , in the same order. The palisade tissue consisted of one layer in the 3 studied genera. Measurements of lamina thickness were 231.4, 274.3 and 276.4 μ in potato, pepper and datura; respectively. This description agrees with that given by Cutter (1992).

Measurements of palisade tissue thickness were 90.0, 108.7 and 126.3 μ in potato, pepper and datura; respectively. The palisade tissue was extended through the midrib region underlying the upper epidermis, in genus *Capsicum*. Measurements of thickness of spongy tissue were 112.5, 142.5 and 113.7 μ , in the same order stated before. Measurements of thickness of midrib bundle were 232.5, 150.0 and 287.5 μ .

On the other hand, measurements of external phloem thickness of the midrib bundle were 27.3, 22.0 and 39.6 μ , while the internal ones were 37.8, 40.3 and 38.5 μ , in potato, pepper and datura; respectively. Averages of xylem thickness of the midrib bundle were 84.0, 81.9 and 105.0 μ , in the same sequence. The average numbers of xylem rows in the midrib bundle were 25.8, 15.5 and 19.6 rows, and their average numbers of vessels were 52.0, 46.5 and 48.6 vessels, in the same order stated before.

It is evident from the print of the lower epidermis of the lamina that, the stomata type was anomocytic in the 3 studied genera, Fig. (4.a, b and c). Fig. (5.a and b) show the different types of epidermal hairs extend to form

multicellular uniseriate and glandular hairs in potato and datura; respectively. While in pepper, it was difficult to detect any type of hairs.

The present results on the structure of the lamina in potato were in harmony with those stated by Hayward (1938) and Cutter (1992). While the results concerning the structure of the lamina in datura were in harmony with those obtained by El-Sayed (1978), Anozia and Lwu (1989) and Khattab *et al.* (2002). Results concerning the structure of the petiole in pepper and datura were in harmony with those stated by Metcalfe and Chalk (1957).

Table (4): Means of measurements (μ) and counts of different tissues of petiole and leaf of *Solanum*, *Capsicum* and *Datura* (Averages of 10 readings).

Characters	Petiole			Characters	Lamina		
	Genera				Genera		
	<i>Solanum</i>	<i>Capsicum</i>	<i>Datura</i>		<i>Solanum</i>	<i>Capsicum</i>	<i>Datura</i>
Upper epidermis thickness (μ)	37.5	16.3	12.5	Upper epidermis thickness (μ)	16.8	12.5	21.3
Lower epidermis thickness (μ)	27.5	25	12.5	Lower epidermis thickness (μ)	16.8	11.3	15.0
No. of vascular bundles/petiole	3	3	3	Mesophyll thickness (μ)	197.4	255.2	245.4
No. of xylem rows of central bundle	43.0	24.5	34.7	Palisade layer thickness (μ)	90.0	108.7	126.3
No. of xylem vessels of central bundle	103.7	74.7	68.7	Spongy tissue thickness (μ)	112.5	142.5	113.7
				Lamina thickness (μ)	231.4	274.3	276.4
Central bundle thickness (μ)	339.6	246.3	296.3	Midrib bundle thickness (μ)	232.5	150.0	297.5
				Midrib bundle region dimensions: -Length (μ)	1225.0	655.0	1225.0
Central bundle width (μ)	2783.3	933.7	1378.7	-Width (μ)	1337.5	582.5	1712.5
Xylem thickness of central bundle (μ)	87.5	84.0	113.7	External phloem thickness of midrib bundle (μ)	27.3	22.0	39.6
External phloem thickness of central bundle (μ)	39.6	26.9	44.8	Internal phloem thickness of midrib bundle (μ)	37.8	40.3	38.5
Internal phloem thickness of central bundle (μ)	32.5	43.7	26.5	Xylem thickness of midrib bundle (μ)	84.0	81.9	105.0
Dimensions of central bundle zone.				No. of xylem rows of central bundle	25.8	15.5	19.5
-Length (μ)	2641.7	1141.3	1978.7	No. of xylem vessels of central bundle	52.0	46.5	48.6
-Width (μ)	4254.2	1591.3	2312.5				

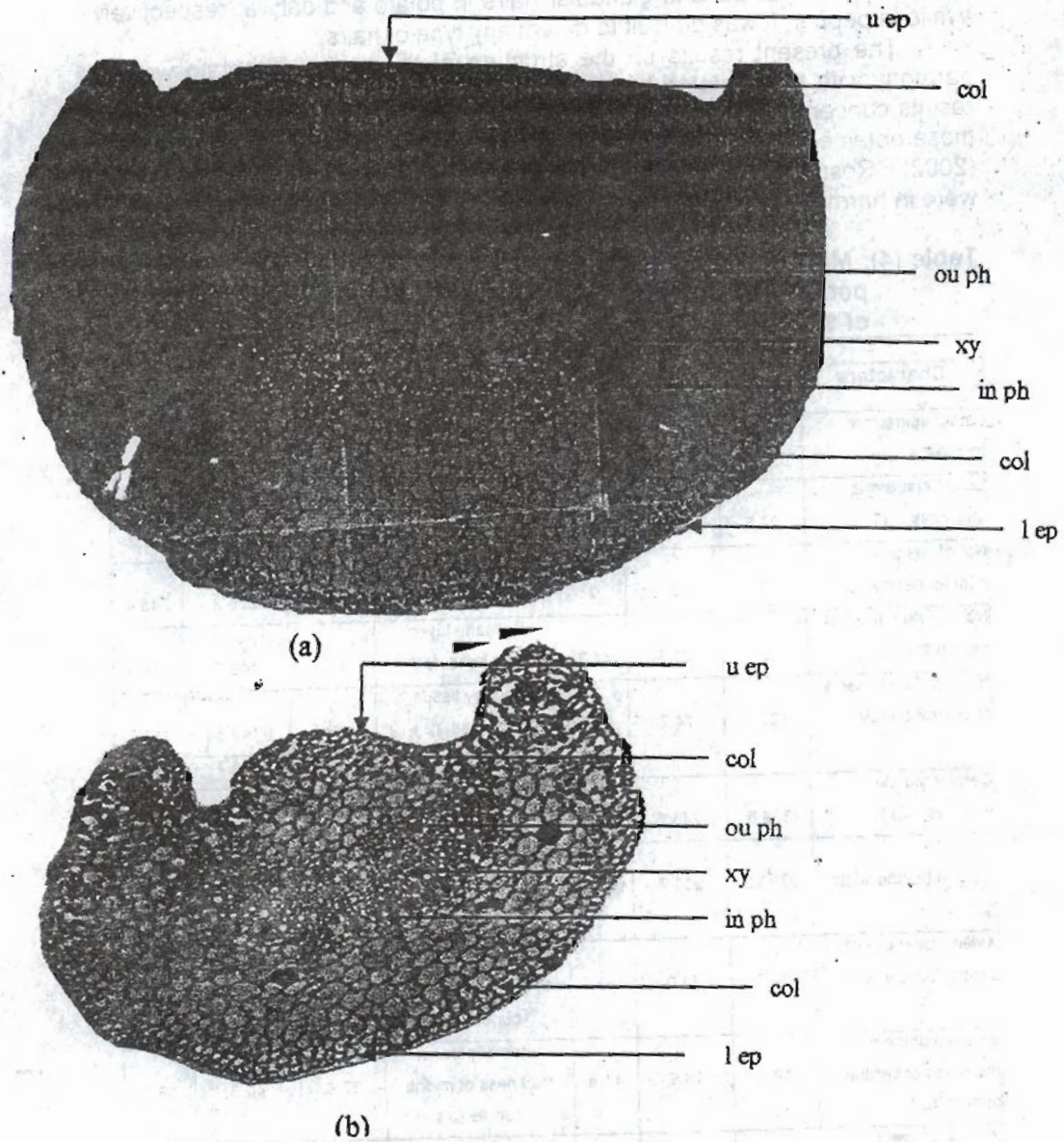


Fig. (2) : Transactions of the leaf petiole of 3 genera of Solanaceae

- a) *Solanum tuberosum* L. (X 17.6)
- b) *Capsicum annum* L. (X 26.0)

Details: u ep: upper epidermis; col: collenchyma; ou ph: outer phloem; xy: xylem; in ph: inner phloem and l ep: lower epidermis.

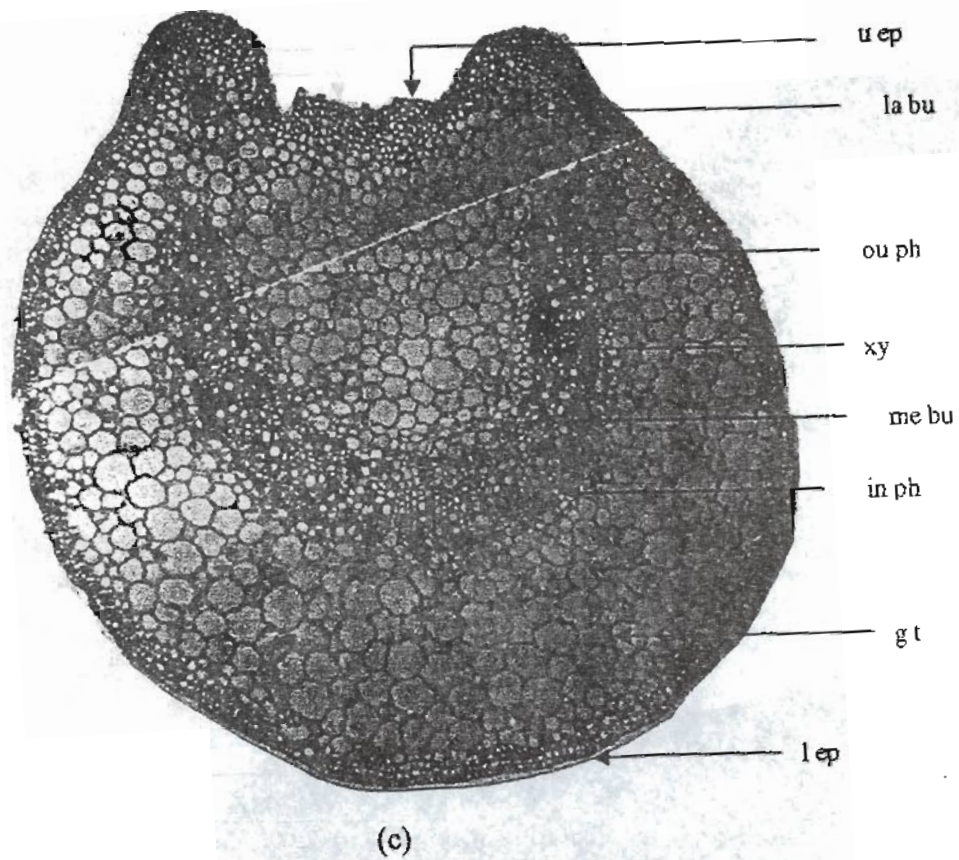


Fig. (2) cont.

(c) *Datura stramonium* L. (X 27.4).

Details: u ep: upper epidermis; la bu: lateral bundle; g t: ground tissue; ou ph: outer phloem; xy: xylem; in ph: inner phloem; me bu: median bundle and l ep: lower epidermis.

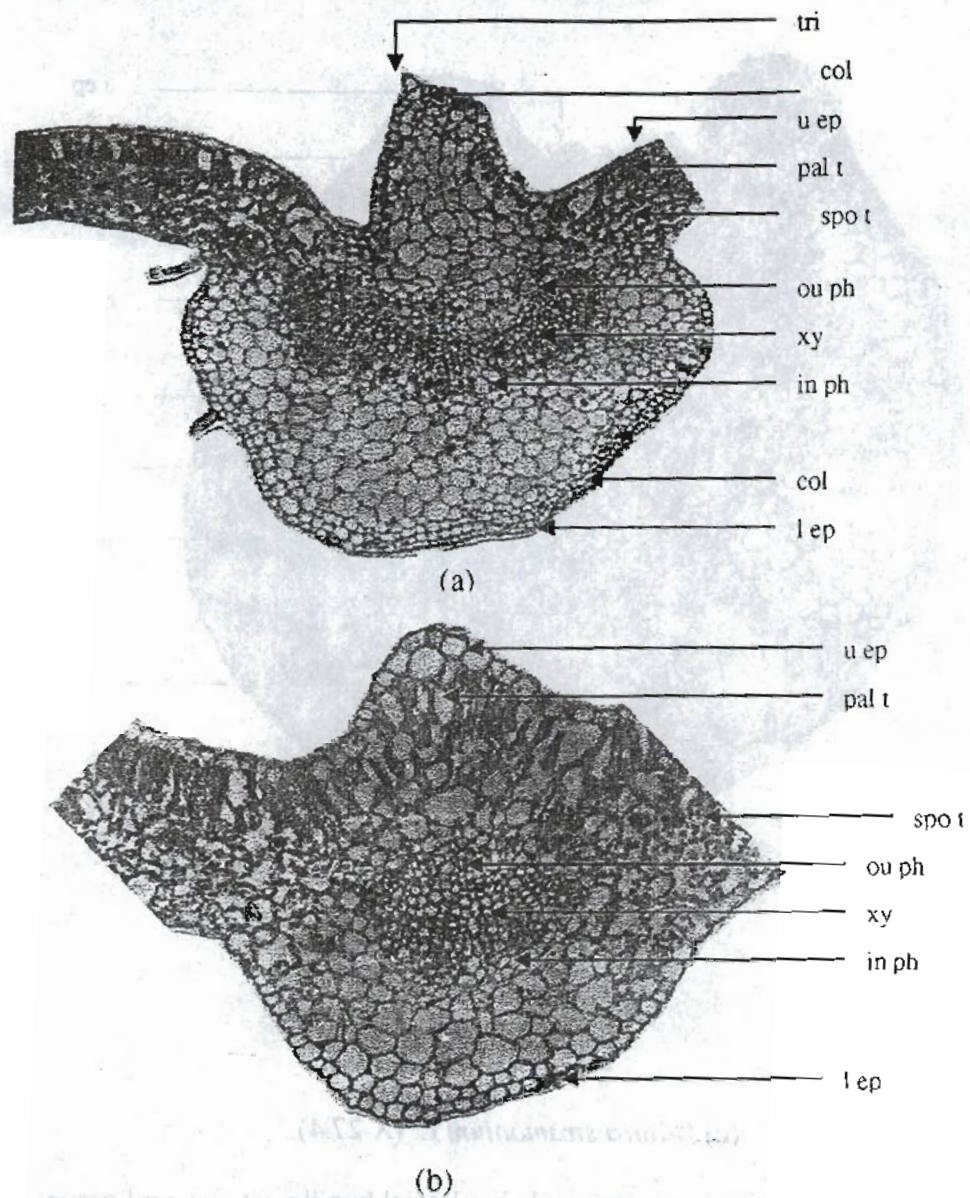


Fig. (3): Transactions of the lamina of

a) *Solanum tuberosum* L. (X 32)

b) *Capsicum annum* L. (X 50)

Details: tri: trichomes; u ep: upper epidermis; col: collenchyma; pal t: palisade tissue; spo t: spongy tissue; ou ph: outer phloem; xy: xylem; in ph: inner phloem and l ep: lower epidermis.

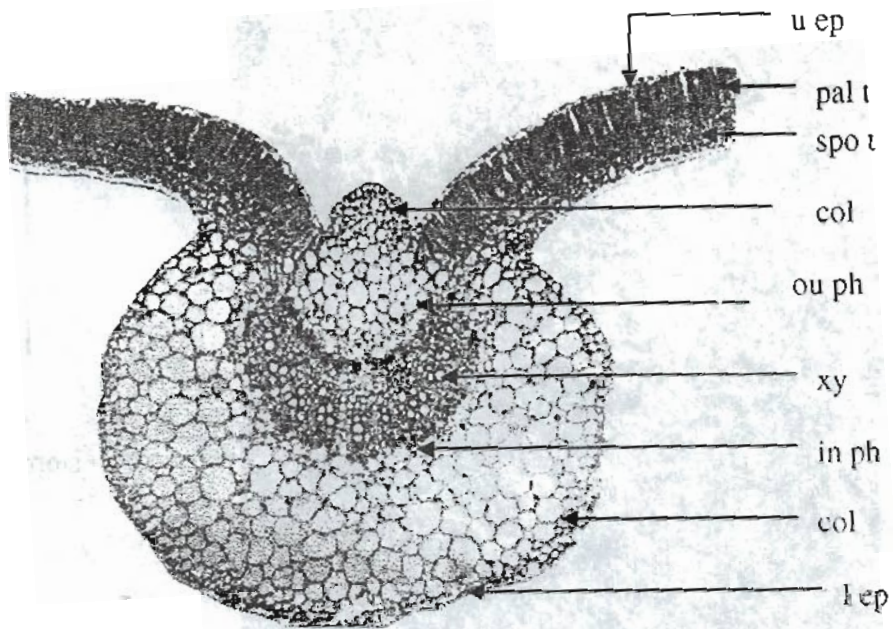


Fig. (3) : Cont.

c) *Datura stramonium* (X 25).

Details: u ep: upper epidermis; pal t: palisade tissue;
spo t: spongy tissue; col: collenchyma; ou ph: outer
phloem; xy: xylem; in ph: inner phloem and l ep: lower
epidermis.

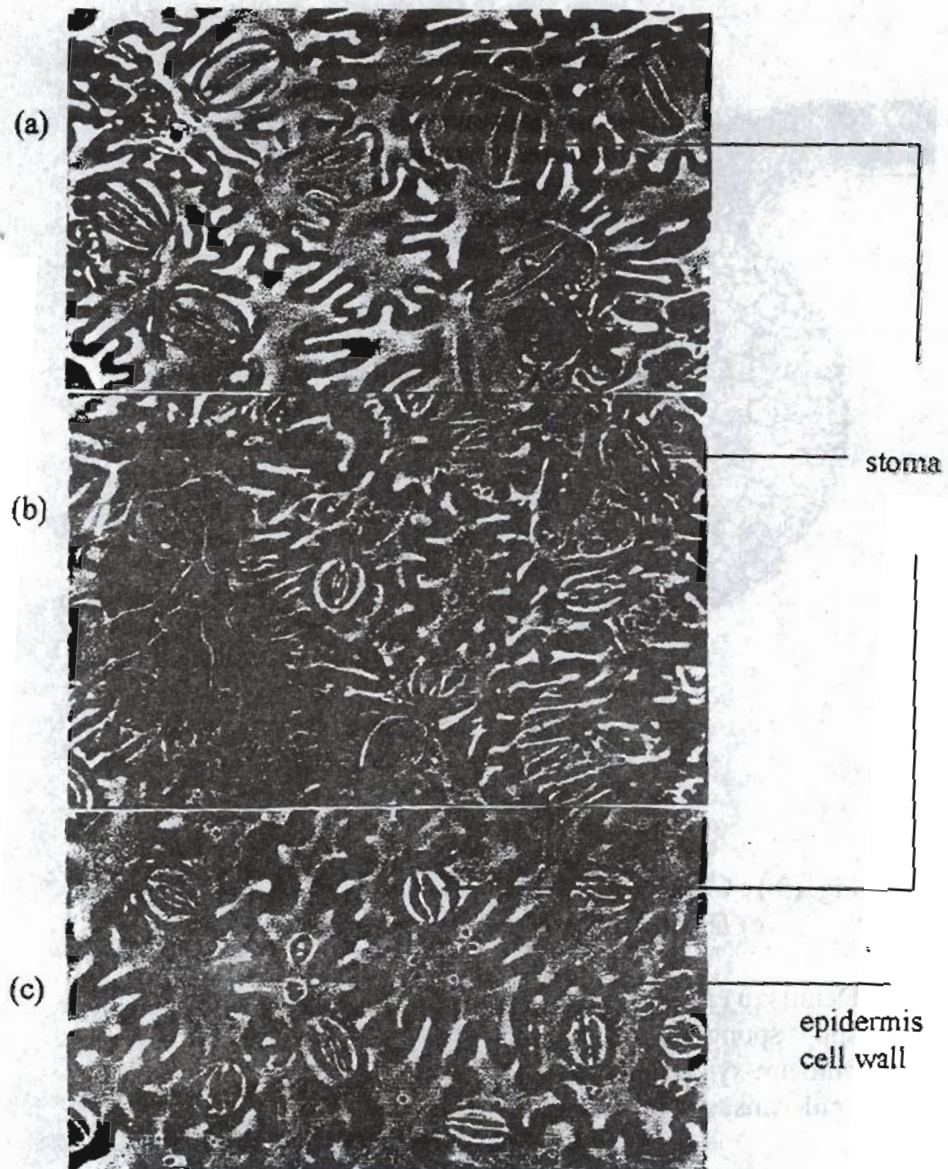


Fig. (4) : Anomocytic stomata type of leaves (X 263):

- a- *Solanum tuberosum* L.
- b- *Capsicum annuum* L.
- c- *Datura stramonium* L.

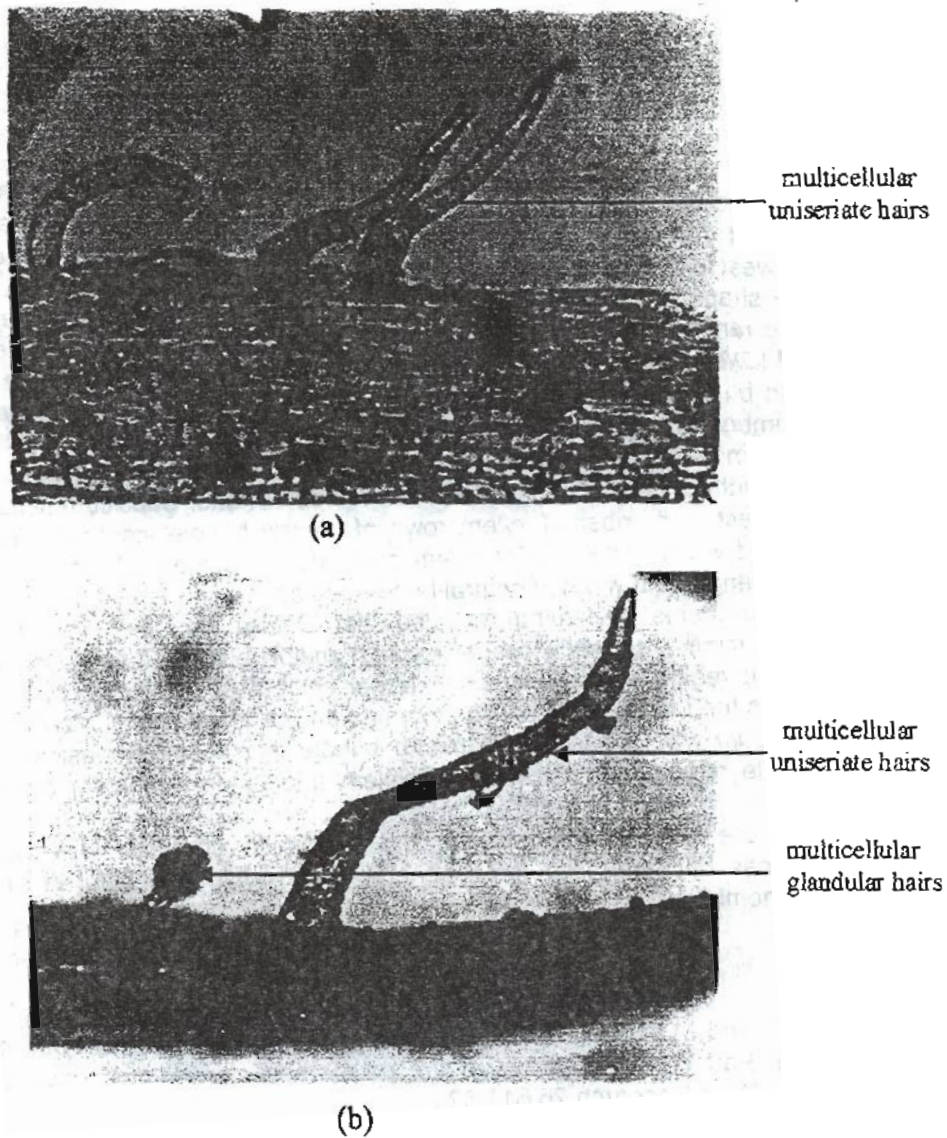


Fig. (5): Different types of hairs (X 166):

- a) Multicellular uniseriate hairs in *Solanum tuberosum* L.
- b) Multicellular uniseriate and multicellular glandular hairs in *Datura stramonium* L.

CONCLUSION

From the prior results, the following could be concluded:

At the end of the growing stage for each genera, (120 days for *Solanum* and 150 days for both *Capsicum* and *Datura*) results showed that, *Capsicum* was the highest in number of leaves/ plant; leaf area/ plant, and the fresh and dry weight/ plant in both seasons. On the contrary, *Solanum* was the lowest in the same characters.

The shape of the petiole differed, being half-circular in *Solanum* and *Datura* and reniform in shape in *Capsicum*. *Solanum* petiole had the thickest upper and lower epidermis and *Datura* petiole was the lowest. Concerning to the median bundle of the petiole, *Solanum* was the thickest and widest, with largest number of xylem rows and vessels, while *Datura* petiole has the thickest xylem and external phloem in median bundle, and the highest in length and width of central bundle zone. On the other hand, *Capsicum* petiole was the lowest in number of xylem rows of central bundle, central bundle thickness and width, thickness of xylem and external phloem of the central bundle, and length and width of central bundle region.

Measurements of lamina revealed that *Datura* was the highest in thickness of lamina, palisade tissue, thickest midrib bundle, dimensions of midrib bundle region and xylem and external phloem of the midrib bundle. *Solanum* was the lowest in thickness of lamina and palisade layers thickness, while *Capsicum* was the lowest in midrib bundle thickness, dimensions of midrib bundle region, and thickness of xylem and external phloem of the midrib bundle.

Thus, the studied morphological and anatomical characters revealed the differences between the three genera which could be useful in any further taxonomic studies.

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دراسات مورفولوجية وتشريحية مقارنة في الورقة لبعض أجناس الفصيلة الباذنجانية.

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تهدف الدراسة إلى إيجاد الاختلافات المورفولوجية والتشريحية بين أوراق ثلاثة أجناس من الفصيلة الباذنجانية وهي: السلانم (البطاطس) - الكاسيكم (الفلفل) و الداتوره (الداتوره). تمت دراسة الصفات المورفولوجية الأتية لكل جنس خلال موسمين متتالين: عدد الأوراق لكل نبات - مساحة الأوراق لكل نبات بالإضافة إلى الوزن الرطب و الجاف للأوراق للنبات. أوضحت الدراسة التشريحية أن العنق كان شكله شبه دائريا في كل من البطاطس و الداتوره بينما كان شكله كلويا في الفلفل كما ان عدد الحزم الوعائية بالعنق كان ثلاثة في الأجناس موضع الدراسة وكانت الحزمة الوسطية هي الأكبر حجما بالنسبة للآخرين وكانت من النوع ذات اللحنيين وكذا في الحزمتين الأصغر.

كما أوضحت دراسة نصل الورقة أن النسيج الوسطي لها كان يحتوي على طبقة واحدة عمادية و عدة طبقات إسفنجية بجميع الأجناس موضع الدراسة. عند دراسة البصمة للشعور على السطح السفلي للنصل وجد أن جميعها من النوع الخلوي الشاذ (Anomocytic) و أيضا عند دراسة الشعيرات الموجودة على السطح السفلي وجد أنها من النوع العددي الخلايا غير المتفرع في البطاطس ومن النوع العددي العديد الخلايا و الغير متفرع في الداتوره بينما لم تلاحظ أية أنواع من الشعيرات في الفلفل.