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STUDY OF SOME MORPHOLOGICAL FACTORS OF LEAVES OF FIG TREES AND THEIR EFFECT ON THE RESISTANCE OF THE WAX SCALE INSECT *CEROPLASTES RUSCI* L (COCCIDAE: HEMIPTERA)

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Abstract:

This study was conducted at Al-Suraie Research Station / National Program for Breeding and Hybridization of Local Vegetable Crops / Department of Horticulture / Ministry of Agriculture and Laboratory of the Department of Life Sciences / College of Science / University of Baghdad for the year 2021 to study some phenotypic characteristics of the leaves of four varieties of fig trees (Waziri, Turki, Aswad Diyala, Sultani). The results showed that the shape of the hairs was of the unicellular type in the fig leaves of the four plant cultivars. The results also showed that there were significant differences in the phenotypic characteristics (number of hairs, length of hairs, cuticle thickness, blade thickness, amount of chlorophyll, leaf area) for cultivars. The four figs, as the Waziri cultivar was superior to the rest of the other plant cultivars in all studied phenotypic traits.

Key words: Morphological factors, wax scale insect *Ceroplastes rusci* L., fig varieties.

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Introduction:

The fig tree, *Ficus carica* L., which belongs to the Moraceae family, is one of the blessed trees, which were mentioned in the Holy Qur'an in Surat (Al-Teen). Milk or white mucilage (latex) in the different tissues of the plant, which has multiple benefits, including for the plant itself, as it is considered a toxic substance and repellent for the larvae and adults of many insects and pathogens, because it contains many important secondary compounds as a means of defense for the plant, as well as antioxidants and multiple proteins, as well as it has benefits Many medical benefits for humans, and fig flowers are of the unisexual type (Solomon *et al*., 2006). Fig orchards are spread all over the world, especially in warm, arid and semi-arid regions, and most fig cultivation in countries is concentrated around the Mediterranean basin (Frodin, 2004).

The fig is a large tree or shrub that may reach a height of more than ten meters and may have more than one stem, with limited branching and untwined branches that take different shapes from pyramidal to spherical and sometimes umbrella and can be predatory. Usually, many branches and crabs come out from under the ground around the trunk. The tree lives 50-70 years and may reach 100 years in appropriate environmental conditions. The stem is upright and not subject to cracking

as the tree ages. It has a thick bark that varies in color from silver to dark gray smooth or It is slightly rough and sometimes has tubercles, the origin of which is due to the presence of dormant buds whose apex is dead while its base is connected to the vessels, and its leaves are round or oval in shape, lobed, with smooth or serrated edges, with a heart-shaped base, and with a sharp or obtuse apex (Saeed & Sabir, 2002) .

And its fruits are of multiple colors of black, dark purple, yellow, white and green (Su *et al*., 2002). Each 100 grams of fresh fig fruits contains 3% protein, 17% carbohydrates, 2% fiber, 0.3% fat, 48 mg carotene. 79% water, 0.3 mg vitamin B6, 2 mg vitamin C, 0.11 mg vitamin E, 22 mg phosphorus, 250 mg potassium, 54 mg calcium, 4 mg zinc and 6 mg iron (Mitra, 1997).

Figs provide the human body with vitamins, minerals, and fiber. They contain a large percentage of sugar and the main mineral salts, such as calcium, phosphorus, and vitamin C. They have health benefits such as getting rid of acne and pimples, preventing constipation, high blood pressure, and protecting against prostate cancer (Howard, 1997). The fig fruit is among the wonderful gifts of nature because it provides many nutrients necessary for the health of the human body and is also considered as an important treatment for maintaining the cells of the human body. It is consumed fresh, but it can also be eaten in a dried state. Almost all dried fruits provide essential nutrients (Makkar *et al*., 2009).

(Hemmatzadeh, 2004) concluded that the milky juice of latex figs works to treat warts and skin keratoses (Corns), as it has an effect similar to that of salicylic acid.

(Martins et al., 2006) explained that the latex milky juice consists of 46% water, some polysaccharides, 3% rubber, proteins such as albumin, fats, proteolytic enzymes such as Ficin, and transferase enzymes that are involved in the formation of the rubber present in the milky juice.

(Wald *et al*., 2000) concluded in experiments conducted on mice that the proteolytic enzymes (Ficin) had a role in the treatment of cancerous tumors and solid tumors, in addition to that between (Robinov *et al.*, 2001) the toxicity of those enzymes on solid cancer cell lines and it was proven Its inhibitory effect on cell growth.

Figs are infected with multiple pests, the most important of which is *Ceroplastes rusci* L. It is one of the most important sucking boring insects belonging to the order Hemiptera and the family of coccidae, which is called the Fig Wax Scale (FWS) (Vu *et al*., 2006).

This insect is considered one of the important pests on fig trees because of the nature of its feeding on the different parts of the plant such as leaves, twigs and fruits, by sucking the plant sap, especially from the soft parts of the plant. It is a cause of a decrease in the processes of photosynthesis and transpiration, and thus a decrease in the quantity of the crop and leads to its poor quality, as well as causes the trees to weaken and deteriorate and decrease in production, and with the continuation of the infection, it leads to the death of the entire tree. Fig orchards in different regions (Al-Momany & Al-Antary, 2008).

Materials and methods:

Preparing the land and cultivating different fig varieties:

This experiment was conducted at the Al-Suraie Research Station / the National Program for Breeding Breeds and Hybrids of Local Vegetable Crops / Horticultural Department for the season

(2021-2022), where seedlings of the four fig varieties were planted in a plot of (300 square meters) with dimensions of (25) meters in length and (12) in width m and a height of (2) m. The land was prepared for cultivation after conducting all the necessary agricultural operations and according to the approved recommendations, and after preparing the soil well. The land was divided for the purpose of cultivation. The experiment was designed in the form of Randomize Complete Block Design (RCBD). Then it was divided in the form of four lines, and drip irrigation pipes were extended along it, and the four cultivars were planted (Waziri, Turki, Aswad Diyala and Sultani) with three replicates for each variety, each one containing three plants.

A distance of (2) m was left from the sides of the cultivated area, and then the plants were planted along the four lines, and the distance between one line and the other was (2) m, and the distance between one plant and another was (1.5) m along the planting line. Planting took place on 15/1/2021 with seedlings Figs at the age of 45 days and for the four varieties. A regular fertilization program was adopted for all plants of the four varieties and in two age stages. The first is from the beginning of plant growth and the appearance of true leaves to the stage of the beginning of production and after it. Urea fertilizer was mixed in an amount of (20) kg with fertilizer N, P, K (20.20.20) in the amount of (40) kg, and they were all mixed in a container of 100 kg. The plants were fertilized as needed during the agricultural season, with foliar fertilization after the appearance of the true leaves of the plants, according to the recommendation.

A study of some phenotypical characteristics of the leaves of fig trees:

Calculating the number of hairs and their lengths in the epidermis of the upper and lower surface of the leaves of fig trees (Waziri, Turki, Aswad Diyala, Sultani):

The number of hairs on the upper and lower surface of the leaves of fig trees and all plant varieties was calculated when the trees were in the stage of fruit formation by taking samples from the leaves and from the three levels of the plant (upper, middle, and lower). These samples were brought to the laboratory and washed with distilled water to get rid of dust and dirt attached to them. It was dried with blotting paper in preparation for subsequent examinations, as it was studied according to the Micro relief (replica) method (Ahmed, 1984), by applying nail polish (transparent) to the blade of the paper whose hairs are to be counted and left for 5 minutes to dry, and then put adhesive tape on it. It was withdrawn and placed on a glass slide for examination under the lens of a simple light microscope with magnification (40X) and using a manual counter. As for the lengths of the filaments, they were measured using a special measuring lens fixed on the eyepiece of the aforementioned microscope and extracting the length in microns. Three plants were used, randomly taken from three replicates (sector) and three levels and the study was repeated three times.

Measuring the thickness of the cuticle layer in the skin of the upper and lower surfaces of the leaf of figs:

Depending on the thickness of the cuticle layer in the skin of the upper and lower surface of the leaf of fig trees for varieties (waziri, Turki, Aswad Diyala and sultani) when the plants became in the stage of forming fruits, as the paper samples were collected from three levels of trees (upper, middle, lower) and washing paper samples With distilled water to remove the soil attached to it

and then it was recovered with flavoring paper and the leaves were cut from the middle next to the middle sweat of the paper in the free hand -having way to make a thin longitudinal and transverse slices of leaves and then put them on a glass slice and then examined them with a microscopy with a magnification force (280x The in -kind lens has a lens with another measuring lens (listed) and extracting the fish rate in the micron unit, and three plants were used for each variety of fig plants, randomly taken and from three bis and three levels, and thus the number of samples becomes 27 plant samples and this study was repeated three times.

Calculate the paper space:

Samples of plant leaves were collected from three plants that were randomly taken from each vegetable variety (experimental unit) and from three repeat and by one paper from each of the three levels The plant is the formation of the fruits, samples were brought to the laboratory and washed with distilled water and dried with drying paper, and then it was included in the scanner (SCANNER) to calculate the paper space by applying the computer program (4.1) that calculates the paper space for plants and irregular shapes.

Measure the thickness of the paper blade:

Three plants were randomly taken from each category (experimental unit) and from three repeat and collected one leaf from each level (upper, middle, lower). The blade area, while staying away from the veins.

Measure the amount of chlorophyll:

The amount of chlorophyll in the leaves of fig trees calculated in the stage of the formation of fruits, as three plants were tested randomly from each plant (experimental unit) of three repeat and three levels (upper, middle, lower) and thus the sample size becomes 27 sheets and used the (SPAD-502Plus) From the Japanese company Konica Minolta and obtained from the National Program for the multiplicity of strains and camels of local vegetable crops / Horticulture state / Ministry of Agriculture, which is a spectral device that measures the relative chlorophyll content in the leaves, as the plant paper was placed in the device and thus the amount of chlorville appears on the digital screen of the device and was done Blogging it.

Statistical analysis:

Field experiments were designed according to the design of the full random sectors C.R.D (Complete Randomized Design) and the data analyzed and the data was analyzed statistically by using the contrast analysis schedule and I adopt the LSD timing test at the probability level of 0.05 to compare the average results according to the (Genstate statistical program, 2016).

Results and discussion:

Study some of the appearance attributes responsible for resistance to fig plants:

Study the effect of the number of hairs and their lengths in the skin of the upper and lower surface of fig leaves (Waziri, Turki, Aswad Diyala and Sultani):

The results shown in Table (5) showed that there were significant differences in the number of hairs between the fig leaves of the plant varieties (Waziri, Turki, Aswad Diyala, Sultani) and for the three plant levels (upper, middle and lower). In fig leaves, it was observed through microscopic examination that the number of hairs (hair / cm^2) in the upper and lower surfaces of

the Waziri cultivar was more than the number of hairs in the leaves of the rest of the other cultivars (Turki, Aswad Diyala, Sultani), and that the number of hairs in the lower surface of the leaf was more than the upper surface of all the four plant varieties and the three plant levels, as The number of hairs in the cultivar (Waziri) for the upper surface was (32.33) hairs / cm^2, as shown in Table No. (5), and for the three plant levels (upper, middle, and lower) (44, 33, 20) hairs / cm^2, respectively, Table (1). While the number of hairs on the lower surface of the same cultivar was (57.0) hairs/cm^2, as in Table (5), and for the three plant levels (upper, middle, and lower) (66, 55, 50) hairs/cm^2, respectively, Table (2).

In the category (Turki), the number of hairs for the upper surface (30.67) hairs / cm^2 table (5) and for the three levels of plants (40, 30, 22) hairs / cm^2, respectively, Table (3), while the number of hairs in the bottom surface (51.3) hair / hairs / cm ^{2} table (5) and for the three levels of plants (60, 50, 44) hairs / cm^2 , respectively table (2), While the number of hairs for the upper surface of the leaves of the cultivar (Aswad Diyala) was (25.00) hairs / cm^2, as in Table (5), and for the three plant levels (upper, middle, and lower) (33, 22, 20) hairs / cm^2, respectively, as in Table (3) While the number of hairs for the same variety for the lower surface was (32.7) hairs / cm^2, as in Table (5), and for the three plant levels (40, 33, 30) hairs / cm^2, respectively, as in Table (3)., While the number of hairs for the fig leaves of the cultivar (Sultani) on the upper surface was (21.00) hairs / cm^2 as in Table (5) and for the three plant levels (30, 22, 11) hairs / cm^2, respectively, as in Table (5), while the number of hairs reached for the lower surface of the same variety (34.3) hairs / cm^2, as in Table (5), and for the three plant levels (35, 33, 30) hairs / cm^2, respectively, as in Table (4).

We conclude from the above that the number of hairs in the leaves on the upper and lower surfaces in all four plant varieties of the upper level is the highest in number stemming from the middle leaves of the middle level and the lowest was in the lower leaves of the lower level. This has a role in the presence of insects in large numbers in their different stages on the upper surface of the plant leaves of fig trees of the four varieties (Waziri, Turki, Aswad Diyala, Sultani) more than their numbers on the lower surface of the different varieties because these hairs are an obstacle to the movement of the insect, especially in the first nymphal stages As well as hinder the fixation of the insect to the parts of its mouth and limbs in the plant tissue of the leaf.

Through the results of the examination, it was found that the shape of the hairs in the fig leaves and for the various varieties was of the unicellular type, as in Figure (1), and that the stomata were recessed between the hairs and could not be seen, and the hairs had smooth walls and a sharp peak in the type *Ficus carica* and a round peak in the type *Ficus Religiosa* and all the hairs centered around the stem and on the homogeneous epidermis and axial of the leaves in both *Ficus carica* and *Ficus Religiosa* species. This is consistent with what was mentioned by (Sonibare *et al*., 2005).

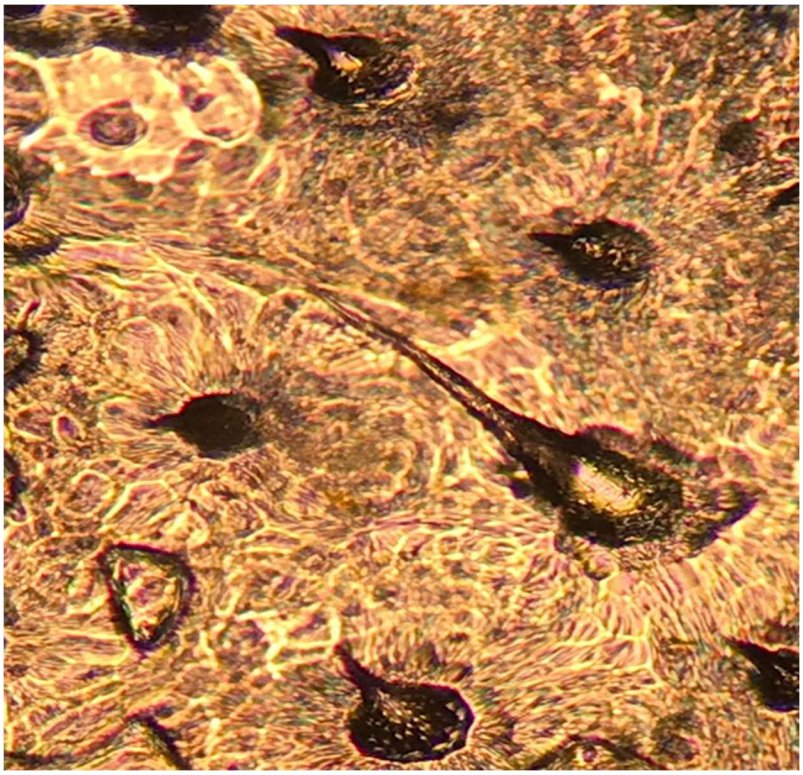

Image (1) the shape of the unicellular simple unilateral hairs in the leaf leaves for the four vegetable varieties.

The lengths of the hairs differed according to the four cultivars, as the results shown in Table (5) showed that there were significant differences in the lengths of the hairs between the fig leaves of the plant varieties (Waziri, Turki, Aswad Diyala, Sultani) and for the three plant levels (upper, middle and lower). Through microscopic examination, the length of the hairs (mm) on the upper and lower surfaces of the Waziri cultivar was longer than the number of hairs in the leaves of the rest of the other cultivars (Turki, Aswad Diyala, Sultani), and that the length of the hairs on the upper surface of the leaf was less than the lower surface of all plant varieties. The length of the hairs in the Waziri cultivar for the upper surface was (135.0) mm in Table (5) and for the three plant levels (110, 140, 155) mm, respectively, in Table (1), while the length of the hairs in the lower surface of the cultivar was The same (150.0) mm, Table (5), and for the three plant levels (130, 150, and 170) mm, respectively, Table (1).

As for the (Turki) variety, the length of the hairs on the upper surface was (126.7) mm, Table (5), and for the three plant levels (110, 130, and 140) mm, respectively, table (2) while the length of the hairs on the lower surface was (145.0) mm, Table (5) and for the levels The three plants (upper, middle, and lower) are (125, 150, 160) mm respectively, Table (2), while the length of the hairs for the upper surface of the leaves of the cultivar (Aswad Diyala) was (73.3) mm, Table (5) and for the three levels of the plant (upper, middle, lower) (70, 80, 90) mm respectively Table (3), while the lengths of the hairs for the same variety for the lower surface were (116.7) mm Table (5)

and for the three plant levels (110, 120, 140) mm, respectively Table (3), while the lengths of the hairs of the fig leaves of the cultivar (Sultani) on the upper surface were (80.0) mm, table (5), and for the three plant levels (60, 70, 90) mm, respectively, table (4), while the length of the hairs for the lower surface of the same variety was (123.3) mm table (5) for the three plant levels (110, 110, 130) mm, respectively, Table (4).

(Al-Ibrahimi, 2013) stated that the hairs on the surface of the leaves and stems take different shapes according to the place they are located on. They may be non-glandular hairs and take different shapes such as single, double, or multi-headed, with sharp or round ends.

It was mentioned (Al-Zubaidi, 1989) that the hairs have an important role in the process of botanical classification of plant species within the genera according to their shapes, lengths, depth in the epidermal layer, and the number of epidermal cells that surround its base, which may be single or multiple, which have a role in the process of delivering nutrients to it.

A study of the effect of the thickness of the cuticle layer in the epidermis of the upper and lower surfaces of fig leaves (Waziri, Turki, Aswad Diyala and Sultani):

The results of Table (5) showed that there were significant differences in the thickness of the cuticle layer between the fig leaves of the plant varieties (Waziri, Turki, Aswad Diyala, Sultani) and for the three plant levels (upper, middle and lower). The cuticle (micron) on the upper and lower surfaces of the Waziri cultivar was more than the thickness of the cuticle layer of the leaves of other cultivars (Turki, Aswad Diyala, Sultani), and the thickness of the cuticle layer on the upper surface of the leaf was more than the thickness of the cuticle layer on the lower surface of all plant varieties The thickness of the cuticle layer in the cultivar (Waziri) for the upper surface was (20.33) microns, Table (5), and for the three plant levels (15.3, 18.4, 19.1) microns, respectively, Table (1), while the thickness of the cuticle layer in The bottom surface of the same variety is (19.67) microns, Table (5), and for the three plant levels (21.4, 23.6, 25.3) microns, respectively, Table No. (2).

As for the Turki variety, the thickness of the cuticle layer for the upper surface was (20.67) microns, Table (5), and for the three plant levels (20, 20, 22) microns, respectively, as in Table No. (2), while the thickness of the cuticle layer on the lower surface was (19.00) microns as shown in Table (5) and for the three plant levels (17, 20, 20) microns, respectively, Table (2), while the thickness of the cuticle layer of the upper surface of the leaves of the Aswad Diyala variety was (11.33) microns, Table (5) and for the three plant levels (10, 12, 12) microns, respectively, Table (3), while the thickness of the cuticle layer of the same variety for the bottom surface was (10.67) microns, Table (5), and for the three plant levels (10, 11, 11) microns, respectively, Table (3), while The thickness of the cuticle layer of fig leaves of the Sultani variety on the upper surface was (11.00) microns, Table (5), and for the three plant levels (10, 11, 12) microns, respectively, Table (4), while the thickness of the cuticle layer of the lower surface of the same variety was (10.66) microns, Table (5) and for the three plant levels (10, 11, 11) microns, respectively As in Table No. (4).

And through the results in the tables above and field observations, which showed that insects are in greater numbers in the new growth of trees, because their leaves are characterized by soft

tissues with a large content of plant sap, and the thickness of the cuticle layer is small compared to the old and old leaves that are close to the surface of the soil or Which are far from the end of the tree branches, where the old leaves are characterized by the thickness of the cuticle layer and the presence of lignin in its outer membranes in larger quantities than it is in the new leaves, which makes it easier for the insect to feed on the new leaves instead of the old leaves, and this is consistent with what he mentioned (Lini *et al*., 2001) He pointed out that the aging of the leaf increases with the increase in the amount of carbohydrates as products of the continuous photosynthesis processes in it, which is accompanied by an increase in the thickness of the cuticle of plant leaves as a result of accumulation with time.

(Haggag, 2007) pointed out that the thickness of the plant tissue with the presence of the waxy layer above it is considered one of the plant's defensive means that enables the plant to keep the pest away before it feeds or lays eggs on the plant.

This is consistent with what was mentioned (Sonibare *et al*., 2006), which was demonstrated in a comparative study of the anatomical characteristics of some fig cultivars belonging to the genus Ficus. It indicated that the thickness of the cuticle layer of the upper surface of the leaves of all varieties was thicker than the cuticle layer of the lower surface, and there were also significant differences in The thickness of the cuticle layer of the different cultivars used in the study, as the thickness of the cuticle layer of the upper surface of the cultivar *F. saussureana* was thicker than that of the cuticle layer of the upper surface of the leaves of the cultivar *F.abutilifolia*, followed by less thickness of the cuticle layer of the upper surface of the leaves of the two cultivars *F. trichopoda* and *F. elasticoides*.

A study of the effect of leaf area on the resistance of the wax scale insect Ceroplastes rusci L.:

The results of Table (6) showed that there were significant differences in the leaf area between the fig leaves of the four plant varieties (Waziri, Turki, Aswad Diyala, Sultani) and for the three plant levels (upper, middle and lower) In fig leaves, it was observed through the scanner that The leaf area (cm^2) at the lower level of the plant was the largest for all cultivars, then followed by the middle level, and the smallest leaf area was recorded at the upper level for all cultivars. In the cultivar (Waziri) the leaf area of plant leaves was (218.3) cm^2, Table (6), for the three levels of the plant. The paper area was (113.67, 264.69, 276.44) cm^2, respectively, Table No. (1).

While in the Turki cultivar, the leaf area of the plant leaves was (217.3) cm^2, Table (6), and for the three levels of the plant the leaf area was (110.50, 259.78, 282.66) cm^2, respectively, Table (2). While the leafy area of the cultivar Aswad Diyala reached (212.7) cm^2, Table (6), and for the three plant levels the leafy area was (113.45, 251.30, 273.44) cm^2, respectively, Table (3). As for the Sultani cultivar, the leaf area of the plant leaves was (216.7) cm^2, Table (6), and for the three levels of the plant the leaf area was (112.29, 260.22, 277.57) cm^2, respectively, Table (4).

The field results showed that the first stage nymphs, crawlers, were spreading in the leaves with a large area more than the leaves with a smaller area.

In a study of (Al-Hamidawi, 2001),(Hmad, 2000) , (Nawal & Sadiq, 2019), it was found that when spraying plants with nutrients (N 0.2% + Fe 0.2% + Zn0.2%), the leaf area of two trees of

the Aswad Diyala variety increased significantly in the 2000 season, while it was not significant in the 1999 season.

A study of the effect of leaf blade thickness on the resistance of the waxy scale insect, Ceroplastes rusci L.:

The results of table (6) showed that there were significant differences in blade thickness between fig leaves for the four plant varieties (Waziri, Turki, Aswad Diyala, Sultani) and for the three plant levels (upper, middle and lower). The thickness of the leaf blade (microns) in the lower level of the plant was the highest for all cultivars, then it was followed by the middle level, and the smallest thickness of the leaf blade was recorded in the upper level for all cultivars. The thickness of the Waziri cultivers was (150, 176, 195) cm^2 , respectively, Table (1).

While in the Turki cultivar, the blade thickness of the plant leaves was (167.7) microns, Table (6), and for the three levels of the plant, the thickness of the leaf blade was (145, 170, 188) microns, respectively, Table (2). While the thickness of the leaf blade of the cultivar Aswad Diyala reached (133.0) microns, Table (6), and for the three plant levels, the thickness of the leaf blade reached (120, 135, 144) microns, respectively, Table (3). As for the Sultani cultivar, the blade thickness of the leaves of the plant was (127.7) microns, Table (6), and for the three levels of the plant (upper, middle, and lower), the thickness of the leaf blade was (120, 130, and 133) microns, respectively, Table (4).

And through the above results, which showed the presence of non-adult roles as well as adult roles of the wax scale insect *Ceroplastes rusci* L. in greater numbers on the two cultivars Aswad Diyala and Sultani, and fewer numbers on the two varieties Waziri and Turki, which prefer leaves with less blade thickness to feed on more than leaves with larger blade thickness.

This is consistent with what was mentioned by (Tarnavschi et al., 1976), that the thickness of the blade differs in thickness in the different fig cultivars of *Ficus carica* L. according to the size of the upper epidermal cells and the lower epidermis, as well as the thickness of the middle mesophyll layer and its various components, and also agrees with what he mentioned (Ummu-Hani and Noraiani, 2013) , that the components of the leaves of *Ficus carica* L. are similar in their components to other Ficus species (*F. annulata*, *F. benghalensis*, *F. superba*, *F. elastic*), but they differ in terms of size, as the thickness of the mesophyll is 436 micrometers and it is differentiated into two layers of barrier tissue With numerous chloroplasts and 7-8 layers of spongy tissue.

A study of the effect of the amount of chlorophyll on the resistance of the wax scale insect Ceroplastes rusci L.

The results shown in Table (6) showed that there were significant differences in the amount of chlorophyll of the plant sap of fig leaves for the plant varieties (Waziri, Turki, Aswad Diyala, Sultani) and for the three plant levels (upper, middle and lower). In fig leaves, it was observed through the device (SPAD-502Plus) that the amount of chlorophyll in plant leaves (mg) in the lower level of the plant was the highest for all cultivars, then followed by the middle level, and the lowest amount of chlorophyll in the leaf was recorded in the upper level and for all cultivars, in the cultivar (Waziri) the amount of chlorophyll in plant leaves was (51.40) mg In Table (6) and for

the three plant levels (upper, middle, and lower), the amount of chlorophyll in plant leaves was (46.4, 51.6, 56.2) mg, respectively, as shown in Table (1).

While in the Turki variety, the amount of chlorophyll in plant leaves was (49.87) mg for Table (6) and for the three plant levels, as the amount of chlorophyll for plant leaves was (45, 49.2, 55.4) mg, respectively, Table (2). While the amount of chlorophyll in the leaf was of the cultivar (Aswad Diyala), as the amount of chlorophyll for plant leaves was (42.90) mg, as in Table (6), and for the three plant levels (upper, middle, and lower), as the amount of chlorophyll for plant leaves was (40, 43.5, 44.2) mg, respectively, as shown in Table (3). In the cultivar (Sultani), the amount of chlorophyll in plant leaves was (42.57) mg, as in Table (6), and for the three plant levels (upper, middle, and lower), the amount of chlorophyll in plant leaves was (45, 41.3, 42.4) mg, respectively, as in Table (4),

This agrees with what was mentioned by (Sabir, 2010), (Adu Dhahi *et al*. , 1997) who proved that the amount of chlorophyll has an important role in the process of photosynthesis and is associated with the iron element, so its concentration increases with the age of the plant leaf, which leads to an increase in the leaf area of the plant leaves as the leaf advances in age more than the modern leaves.

(Al-Mousawi, 2011) mentioned in a study conducted on fig seedlings (Turki variety) that were sprayed with Agroleaf balanced nutrient solution (NPK 20:20:20) at different concentrations (0, 7.5, 15, 22.5) g/L-1, which gave A significant increase in the content of leaves of chlorophyll amounted to (42.94) mg/gm-1, compared to the comparison treatment that gave (40.80) mg/gm-1, so the concentration (15gm/l-1) led to a significant increase in the trait and the content of the leaves of the elements for each of the nitrogen 1.86%, and the comparison was 1.64%, phosphorus 0.48%, and the comparison recorded (0.32%), and potassium, whose value amounted to 1.56%, compared to (1.36%).

Al-Zuhairi (2007) found that when urea was added to one-year-old apple seedlings at a concentration of (23 and 46 gm N / seedling), the concentration of 46 gm N / seedling achieved the highest increase in the nitrogen content of the leaves, while the treatment of spraying with urea at a concentration of 2.3 gm N / liter achieved an increase in the proportion of P and k elements. (Al-Mothafar, 2005), (Nawal *et al*., 2018). All plant growth regulator gave good vegetative growth, but the best result was given when it used the mixture of GA3, humic sequentially. This mixture gave high results in roots length shoots length, root number, leave number, seedling length, chlorophyll percentage, root weight and fresh weight.

Table (1) Phenotypic characteristics of fig leaves of the Waziri cultivar, the number of hairs, the length of the hairs, the thickness of the cuticle layer, the thickness of the leaf blade, the amount of chlorophyll, and the leaf area.

Appearance	level of the plant		
	lower level	middle level	upper level
The number of hairs on the upper surface of the leaf (hair / cm^2)	20	33	44
The number of hairs on the lower surface of the leaf (hair / cm^2)	50	55	66
The length of the hairs on the upper surface of the leaf (mm)	155	140	110
The length of the hairs on the lower surface of the leaf (mm)	170	150	130
The thickness of the upper cuticle layer in the leaf (micron)	19.1	18.4	15.3
The thickness of the lower cuticle layer in the leaf (micron)	25.3	23.6	21.4
Sheet thickness (microns)	195	176	150
Amount of chlorophyll in leaf (mg)	56.2	51.6	46.4
paper area (cm^2)	276.44	264.69	113.67

Table (2) phenotypic characteristics of fig leaves of the Turki cultivar, the number of hairs, the length of the hairs, the thickness of the cuticle layer, the thickness of the leaf blade, the amount of chlorophyll, and the leaf area.

Appearance	level of the plant		
	lower level	middle level	upper level
The number of hairs on the upper surface of the leaf (hair / cm^2)	22	30	40
The number of hairs on the lower surface of the leaf (hair / cm^2)	44	50	60
The length of the hairs on the upper surface of the leaf (mm)	140	130	110
The length of the hairs on the lower surface of the leaf (mm)	160	150	125
The thickness of the upper cuticle layer in the leaf (micron)	22	20	20
The thickness of the lower cuticle layer in the leaf (micron)	20	20	17
Sheet thickness (microns)	188	170	145
Amount of chlorophyll in leaf (mg)	55.4	49.2	45
paper area (cm^2)	282.66	259.78	110.50

Table (3) phenotypic characteristics of fig leaves of the cultivar Aswad Diyala, number of hairs, length of hairs, thickness of the cuticle layer, thickness of the leaf blade, amount of chlorophyll, leaf area.

Appearance	level of the plant		
	lower level	middle level	upper level
The number of hairs on the upper surface of the leaf (hair / cm^2)	20	22	33
The number of hairs on the lower surface of the leaf (hair / cm^2)	30	33	40
The length of the hairs on the upper surface of the leaf (mm)	90	80	70
The length of the hairs on the lower surface of the leaf (mm)	140	120	110
The thickness of the upper cuticle layer in the leaf (micron)	12	12	10
The thickness of the lower cuticle layer in the leaf (micron)	11	11	10
Sheet thickness (microns)	144	135	120
Amount of chlorophyll in leaf (mg)	44.2	43.5	40
paper area (cm^2)	273.44	251.30	113.45

Table (4) phenotypic characteristics of fig leaves of Sultani cultivar, the number of hairs, the length of the hairs, the thickness of the cuticle layer, the thickness of the leaf blade, the amount of chlorophyll, and the leaf area.

Appearance	level of the plant		
	lower level	middle level	upper level
The number of hairs on the upper surface of the leaf (hair / cm^2)	11	22	30
The number of hairs on the lower surface of the leaf (hair / cm^2)	30	33	35
The length of the hairs on the upper surface of the leaf (mm)	90	70	60
The length of the hairs on the lower surface of the leaf (mm)	130	110	110
The thickness of the upper cuticle layer in the leaf (micron)	11	11	10
The thickness of the lower cuticle layer in the leaf (micron)	12	11	10
Sheet thickness (microns)	133	130	120
Amount of chlorophyll in leaf (mg)	42.4	41.3	45
paper area (cm^2)	277.57	260.22	112.29

The results of Table (5) showed that the number of hairs on the upper surface of fig leaves of the Waziri variety amounted to (32.33) hairs / cm^2, while the number of hairs for the same variety on the lower surface was (57.0) hairs / cm^2, while the number of hairs on the upper surface of the fig plant of the variety Turki (30.67) hairs / cm^2, while the number of hairs for the same variety for the lower surface was (51.3) hairs / cm^2, while the number of hairs for fig leaves of the cultivar Aswad Diyala for the upper surface was (25.00) hairs / cm^2, while the number of hairs for the same variety for the lower surface (32.7) hairs/cm^2, while the number of hairs for fig leaves of Sultani variety on the upper surface was (21.00) hairs/cm^2, while the number of hairs for the same variety on the lower surface was (34.3) hairs/cm^2.

We conclude from the above that the number of hairs on the upper surface of all fig leaves was highest in the Waziri variety, while it was the lowest in the Sultani variety, and that the number of hairs on the lower surface of fig leaves was also the highest in the Waziri variety and was the lowest in number in the Sultani variety. Waziri was the most numerous in the number of hairs it contained compared to the rest of the other varieties (Turki, Aswad Diyala, Sultani) and for both the upper and lower surfaces, while the Sultani variety was the least numerous in terms of the rest of the other varieties in terms of the number of hairs and for both the upper and lower surfaces.

The results of the same table also showed that the length of the hairs on the upper surface of fig leaves of the Waziri variety was (135.0) mm, while the length of the hairs of the same variety on the lower surface was (150.0) mm, while the length of the hairs on the upper surface of the Turkish fig plant was (126.7) mm. While the length of the hairs of the same variety for the lower surface was (145.0) mm, while the length of the hairs of the fig leaves of the cultivar Aswad Diyala for the upper surface was (73.3) mm, while the length of the hairs of the same variety for the lower surface was (116.7) mm, while the length of the hairs for the leaves of the plant The fig of the Sultani cultivar had an upper surface of (80.0) mm, while the length of the hairs of the same variety on the lower surface was (123.3) mm. The length of the hairs on the lower surface of the fig leaves was also the highest in the Waziri cultivar and was the lowest in number in the Sultani variety. The upper and lower surfaces, while the Sultani variety was the least compared to the rest of the other varieties in terms of the length of the hairs, and for both the upper and lower surfaces,

The results of the study showed, Table (5), that the thickness of the cuticle layer on the upper surface of fig leaves (Waziri) amounted to (20.67) microns, while the thickness of the cuticle layer of the same variety on the lower surface was (19.67) microns, while the thickness of the cuticle layer on the upper surface of the fig tree was (19.67) microns. The thickness of the cuticle layer of the (Turki) variety was (20.33) microns, while the thickness of the cuticle layer of the same variety for the lower surface was (19.00) microns, while the thickness of the cuticle layer of the fig leaves of the variety (Aswad Diyala) for the upper surface was (11.33) microns, while the thickness of the cuticle layer of the cultivar reached (11.33) microns. Same for the lower surface (10.67) microns, while the thickness of the cuticle layer of fig leaves of the cultivar (Sultani) for the upper surface was (11.00) microns, while the thickness of the cuticle layer of the same variety on the lower surface was (10.66) microns. We conclude from the above that the thickness of the cuticle layer on the upper surface of all fig leaves was the highest in the Waziri variety, while it was the

lowest in the Sultani variety, and that the thickness of the cuticle layer on the lower surface of fig leaves was also the highest in the Waziri variety and was the least thick in the Sultani variety. The Waziri cultivar was the thickest in the cuticle layer it contained compared to the rest of the other cultivars (Turki, Aswad Diyala, Sultani) with both the upper and lower surfaces, while the Sultani cultivar was the thinnest in the cuticle layer compared to the rest of the other cultivars and for both the upper and lower surfaces.

Table (5) shows the significant differences between the phenotypic characteristics of fig leaves (number of hairs, hair length, cuticle thickness) of the four fig cultivars (Waziri, Turki, Aswad Diyala, Sultani)

varieties	The thickness of the lower cuticle layer in the leaf (micron)	The thickness of the upper cuticle layer in the leaf (micron)	The length of the hairs on the lower surface of the leaf (mm)	The length of the hairs on the upper surface of the leaf (mm)	The number of hairs on the lower surface of the leaf (hair / cm^2)	The number of hairs on the upper surface of the leaf (hair / cm^2)
Waziri	19.67 a	20.33 a	150.0 a	135.0 a	57.0 a	32.33 a
Turki	19.00 a	20.67 a	145.0 a	126.7 a	51.3 b	30.67 a
Aswad Diyala	10.67 b	11.33 b	116.7 b	73.3 b	32.7 c	25.00 b
Sultani	10.66 b	11.00 b	123.3 b	80.0 b	34.3 c	21.00 b
LSD $_{0.05}$	1.33	1.20	12.12	12.12	5.58	5.49

The results showed, Table (6), that there were significant differences in the thickness of the leaf blade and for the four plant cultivars (Waziri, Turki, Aswad Diyala, Sultani), that the highest thickness of the leaf blade was in the Waziri variety, reaching (173.7) microns, while it was the lowest thickness of the leaf blade. In the Sultani variety, it reached (127.7) microns, and the results of the same table showed that there was a difference in the content of fig leaf juice in the amount of chlorophyll for the four plant varieties, as well as the presence of significant differences between them. The rest of the other varieties and three levels, as the average content of the leaves in the Waziri variety was (51.40) mg, while the leaves of the Sultani variety were the lowest in the content of its leaves of chlorophyll, as it amounted to (42.57) mg.

The results of the same table showed a difference in the leaf area of the leaves of the fig plant and of the four plant varieties, as the leaves of the Waziri cultivar excelled in the size of the leaf area than the rest of the other three varieties, reaching (218.3) cm^2 , while the leaves of the Sultani cultivar were the lowest in the size of the leaf area compared to the rest of the varieties. plants, reaching (212.7) cm^2.

We conclude from the above that the cultivar Waziri was superior to the rest of the other plant varieties in all the phenotypical characteristics of fig leaves (number of hairs, length of hairs, thickness of the cuticle layer, thickness of the leaf blade, leaf area).

Table (6) Significant differences in the phenotypic characteristics of fig leaves (blade thickness, amount of chlorophyll, leaf area) of the four fig cultivars (Waziri, Turki, Aswad Diyala, Sultani)

varieties	paper area (cm^2)	Amount of chlorophyll in leaf (mg)	Sheet thickness (microns)
Waziri	218.3 a	51.40 a	173.7 a
Turki	217.6 a	49.87 a	167.7 a
Aswad Diyala	216.7 a	42.90 b	133.0 b
Sultani	212.7 a	42.57 b	127.7 b
LSD 0.05	7.68 N.S	6.33	15.4

References:

Abu Dhahi, Yusef Muhammad and Jabbar Abbas Al-Dujaili. 1997. The effect of foliar feeding with Al-Nahrain fertilizer and boron on the quantity and quality of grape yield of Deis al-Anz variety and its content of some nutrients. Iraqi Agricultural Sciences Journal. Volume 28 (1): 31-39.

Ahmed, Riyad Abdul Latif, 1984. Water in plant life, Directorate of Dar Al-Kutub, University of Mosul.

Al-Momany A, Al-Antary T (2008). Pests of garden and home. 2nd edition, Jordan University Publications, Amman, Jordan pp 518.

Al-Ibrahimi, Safa Hisham Abdel-Amir. (2013) A comparative taxonomic study of the species of the genus (Brassicaceae (Aition. T. W. Aethionema) in Iraq. Master's thesis, Faculty of Science - University of Baghdad..

Al-Hamidawi, Abbas Mohsen Salman. 2001. Effect of spraying with gibberellic acid and some nutrients on vegetative and fruiting growth, qualitative and storage characteristics of fig fruits, Aswad Diyala variety. PhD thesis, Department of Horticulture and Landscape Architecture, College of Agriculture, University of Baghdad.

Al-Musawi, Zainab Jarallah Nima, 2011. Effect of spraying with GA3 gibberellic acid and Agroleaf nutrient solution on vegetative growth of fig seedlings and leaf content of some phenolic compounds. Master Thesis. Faculty of Agriculture. Baghdad University.

Al-Mothafar, Noor Abdulkareem,2015. Evaluation the Effect of Different Treatment on Seed Germination and Seedling Growth of Some Legume Plants. Master Thesis. Faculty of Science. Baghdad University.

Al-Zubaidi, Adel Mohan Addai (1989) A taxonomic study of the genera L. Lamium., L Ajuga.L Marrubium, Fisch Lallematia belonging to the Labiatae family in Iraq, PhD thesis, Faculty of Science, University of Baghdad.

Al-Zuhairi, Bushra Sarhan. 2007. The effect of CO2 enrichment and nitrogen fertilization on the growth of apple seedlings of Malus domestica Borkh cultivar Ajimi and Anna. PhD thesis. Faculty of Agriculture. Baghdad University.

D. G. Frodin, "History and concepts of big plant genera," Taxon, vol. 53, no. 3, pp. 753–776, 2004.

Chang, S.K.C., Protein Analysis, in Food Analysis, edited by S. Nielsen, Aspen Publishers, Gaithersburg, MD, 1998, pp. 237–250.

Hamad, Mohamed Shehab and Farouk Farag Gomaa. 2000. The effect of foliar fertilization on the mineral content and percentage of knots in local orange trees (Citrus sinensis Osbeck). Iraqi Agricultural Sciences Journal. Volume (31). The second issue.

Hemmatzadeh, F. 2004. Therapeutic effect of Fig Tree latex on Bovine populate osis in Cow. J. vetmed . 10 : 473 – 474.

Howard BV, Kritchevsky D. 1997. Phytochemicals and cardiovascular disease. A statement for healthcare professionals from the American Heart Association. Circulation 95(11):2591-2593.

Ibrahimi, Safa Hisham Abdel-Amir. (2013). A comparative taxonomic study of the species of the genus Brassicaceae (Aition. T. W. Aethionema) in Iraq. Master's thesis, College of Science - University of Baghdad.

Makkar HPS, Norvsambuu T, Lkhavatsere S, Becker K. Plant secondary metabolites in some medicinal plants of Mongolia used for enhancing animal health and production.Tropicultura 2009; 3:159-167.

Martins Teixeira D, R. Ferreira patio, A.Varela Coelho, and C.Teixeira decosta. 2006. Comparison between sample disruption methadone solid liquid extraction (SLE) to extract phenolic compounds from Ficus carica Leaves . Journal of Chromato graphy A, 1103: 22 – 28 .

M. A. Saeed and A. W. Sabir, "Irritant potential of triterpenoids from Ficus carica leaves," Fitoterapia, vol. 73, no. 5, pp. 417–420, 2002.

Mitra , S . K . 1997 . Postharvest Physiology and storage of tropical and sub – tropical fruits . CAB . INT . Nadia .. West Bengal. India.

Nawal M. Alwan; Nesreen K. Aziz; **Sadiq M. Sadiq. 2018.** Effect of the soaking and concentrations of salicylic acid in the growth and production of iris. (IOSR-JAVS) Journal of agriculture and veterinary science. 11(1).34-41.

Nawal M. Alwan; Sadiq M. Sadiq. 2019. Influnce of tuberous root soaking salicylic acid and follar spray plants with benzyladenine on growth,flowring and tuberous root production of ranunculus asiaticus, Plant Archives.19(2).4137-4144.

Robinov, S Kashman, K. and Rabino wits , R. 2001. Cytotoxic effect of *Ficus carica* Latex on defferent cancer cell lines . J. of Nat. Prod . 64 (7) : 993 – 996 .

Sonibare MA., Jayeola AA, Egunyomi A, Murata J (2005). A survey of epidermal morphology in Ficus Linn. (Moraceae) of Nigeria. Bot. Bull. Acad. Sin., 46: 231-238.

Su, Q.; Rowley, K. G.; Itsiopoulos, C.; O'Dea, K. Identification and quantitation of major carotenoids in selected components of the Mediterranean diet: green leafy vegetables, figs and olive oil. Eur. J Clin. Nutr. 2002, 56, 1149-1154.

Solomon, A., Golubowicz, S., Yablowicz, Z., Grossman, S., Bergman, M., Gottlieb, H E., et al. (2006). Antioxidant activities and anthocyanin content of fresh fruits of common fig (Ficus carica L.). Journal of Agriculture and Food Chemistry, 54,7717-7723.

Sonibare, M., A.; Jayeola, A. A.; Egunyomi, A., 2006. Comparative Leaf Anatomy of Ficus Linn. Species (Moraceae) from Nigeria, Journal of Applied Sciences, 6(15):3016-3025.

Vu NT, Eastwood R, Nguyen CT, Pham LV (2006). The fig wax scale Ceroplastes rusci (Linnaeus) (Homoptera: Coccidae) in south-east Vietnam: Pest status, life history and biocontrol trials with Eublemma amabilis Moore (Lepidoptera: Noctuidae). Entomological Research 36: 196-201..

Wald , M.; Zavadova , E.; Pouckova,P Zadinova , M. and Boubelik, M.(2000). preperation Polyenzme inhibits growth of tumor solid and development of experimental metastases in mice.Life sciences, 63(8): 43-48.