

The Mulberry Tree and Some of Its Specific Pests

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Abstract

The mulberry tree is one of the fruit trees not only with economic-industrial and food values, but also with decorative and health values. It is affected by a number of well-known diseases, but almost no mention is made of a very specific group of pests that, for our part, have also been found in this type of plant. We have given in this paper some of the values of the mulberry, especially those in the medical field. Thus, based on the importance of cultivating this plant, we have addressed in this paper the problem of its contamination by some representatives of a very specific group of insects, by representatives of the N/Order Coccoinea of the Order Homoptera. Research in the field has been extended for a period of more than 4 years in four regions, in that of Vlora, in that of Tepelena, in that of Përmet and in that of Gjirokastra, in Southern Albania. From the material collected in the field and processed in the laboratory, we have identified, from this group, as parasitic species of the mulberry plant, in the entire area in question, eight species: *Coccus pseudomagnoliarum* Kuw., *Parthenolecanium persicae* F., *Parthenolecanium corni* Bouche., *Eulecanium mali* Schr., *Eulecanium rugulosum* Arch., *Palaeolecanium tiberculatum* Targ., *Pseudaulecaspis pentagona* Targ., *Carulaspiscaruelei* Targ. - Toz.

Based on all the results obtained, in this article, results are given on the distribution of these species in the four regions examined. Data are also given on the frequencies of the spread of each of them in these regions, as well as a series of illustrations made on the basis of binocular observations of permanent micropreparations prepared in the laboratory by us. As a result of data processing, the material in question is accompanied by a series of results and conclusions important especially for the growers of this plant.

Keywords: Mulberry, Fruit, Sub/Fam. Paleococcoidea, Fam. Lenannidae (Coccidae), Fam. Diaspididae, parasites, medicinal value, pests

INTRODUCTION:

The mulberry is a perennial plant that belongs to the Kingdom: Plantae, Phylum: Magnoliophyta, Class: Magnoliopsida, Order: Rosales, Family: Moraceae, Genus: *Morus* (L.) which in our country is represented by three species:

- a. *Morus alba* L. (White mulberry)
- b. *Morus nigra* L. (Black mulberry)
- c. *Morus rubra* L. (Red mulberry). (**Fig. 1**)

The plant lives for 200-300 years and gives production 5 years after planting. It also presents, apart from decorative and economic values, also medical values.



Fig. 1. - The three varieties of the mulberry plant that are also found in our country

Today there is talk of the existence of 10-16 types of berries from Asia, Africa, or North America. Mulberry fruits are used both for food and for the production of brandy (brandy with curative value for gastric problems).

The leaves of the white mulberry (*Morus alba* L.) are used as food for silkworms that weave silk cocoons (**Fig. 2**). The plant itself is used in parks as a decorative plant or as a cultivar for the consumption of its delicious fruits. [1-2]



Fig. 2 - Silkworm feeding on the mulberry leaves

Mulberries, depending on climate and variety, ripen from late May to August. In addition to these advantages, the mulberry tree is also a medicinal plant. Their fruits contain flavonoids, morin, carotene, fatty acids and iron salts. Mulberries are an excellent source of vitamin C, 100 grams mulberry's fruits contain 36.4 mg of vitamin C or 61% of the recommended daily dose as well as 1.85 mg of iron (23% of the recommended daily dose). This, in fact, is a unique property in the case of such fruits. Mulberries contain smaller amounts of vitamins A, B, C, K, B6 and E, significant amounts of niacin and folic acid, as well as a number of other antioxidants and flavonoids including zeaxanthin and beta carotene (in smaller amounts but quite significant). Meanwhile, mulberry's fruits are also a rich source of Fe, K, Mg and Mn minerals. Potassium is a precious component of cells and body fluids that keeps heart rate and blood pressure under control [2].

Due to the content in mulberry's fruits of many vitamins and minerals, Niacin, Folic Acid, a number of antioxidants and other flavonoids (including Zeaxanthin and Beta carotene), this plant takes on considerable importance in terms of the use of fruits its for medical and health effects. Mulberries are rich in flavonoids known as "anthocyanin" which, according to scientific studies, have an effect against atypical cells, against aging, neurological diseases, inflammation, diabetes and bacterial infections [2]. The contents of mulberry's fruits allow us to use it not only for preventive purposes, but also in the treatment of many diseases as:

- The antioxidant functions of Zea-xanthin protect the retina of the eye from ultraviolet rays (they act as a light blocker), while the juice of the leaves is a godsend for patients with hypertension. The juice of the ripe bark is a very strong

anthelmintic. Taking the syrup of its fruits helps relieve coughs, against colds, to cope with stomatitis and infections of the oral mucosa, for periodontal diseases or throat diseases. They stabilize the work of the stomach and intestines, the gastritis with low acidity, dysbiosis or colitis. They cure ischemic heart diseases, arrhythmias, tachycardia and arteriosclerosis. Loosens the body from toxins and other dangerous substances, fighting insomnia and restoring restorative sleep. The white mulberry is included in weight loss diets and is irreplaceable in cosmetology (for various masks). Having a significant diuretic effect, they contribute to the rapid recovery of kidney diseases.

However, we must keep in mind that:

- From the use of these fruits, based on the individual intolerance of the body, there is also the possibility of developing an allergic reaction (very rare). Care should be taken in their intake by patients suffering from hypertension and patients with diabetes mellitus, as the substances in their composition increase the level of sugar in the blood and dramatically lower blood pressure. [1-2]

Based on these economic-industrial, food and medical values of this crop, we have undertaken the following study and on this basis we have identified, in addition to the well-known diseases of this plant, its impact by some representatives of the N/Order Coccoinea of the Order Homoptera, Class Insecta. These represent a specific group of pests that are typical for other types of plants, but the study in question shows that quite a few of them also parasitize the mulberry plant. These not only lead to the degradation of the vegetation by absorbing the juices in the leaves and stems (and deforming and drying them), but also transmit a number of toxic viral diseases to the plant.

MATERIALS AND METHODS:

For the realization of this study, we used the method of collecting and analyzing the data obtained after the processing and determination of the concrete material in the laboratory. For this reason, we have carried out expeditions in the field for a period of over 4 years, for every season of the year and for every region mentioned above, such as: in Vlora, in Tepelena, in Përmet and in Gjirokastra. The material collected in the field was conserved directly in alcohol over 75°, in special test tubes with the dimensions; Ø = 1 cm and length 10 cm. From there, we processed the material in the laboratory in order to directly determine the species by means of the relevant switches (in cases where this was possible) or for the preparation of samples in the form of permanent microscopic preparations necessary for their determination. After that we determined the types encountered by means of different keys and processed all the collected data. [3-13]

The processing of the material for the preparation of permanent microscopic preparations was carried out according to the methods given in the literature [14-15]. The methodology according to [14] is the most operative since the preservative solution (a mixture in certain ratios of eugenol with carbol-xylene and Canadian balsam) was added directly on the preparation and the prepared material was then only dried. However in these cases the sample was not colored and the clarity, as a result of the lack of strong contrasts, often appeared substandard. So to exclude such a consequence we prepared several series simultaneously for the same sample. Then we selected the most complete one among them. However, based on the methodology [15], the finalization of the sample was really longer and a number of eyes could be lost during coloring, but the result gave us a colored sample, of better quality and with

strong contrasts. This is because the processed material goes through the following processes:

- The material is placed in a NaOH or KOH solution with a concentration of 8-10% (for over 12 hours) and then it is heated for about ½ hour in Banjo Mari (without boiling) for the removal (melting and complete cleaning) of its waxy covering.

- After 5-6 rinses with distilled water, the material is fixed again in alcohol 70° - 90° for a few minutes (10-15') and then it is passed for coloring.

- The material is placed in fuchsine solution for over 30 minutes.

- The color is fixed by passing the material from fuchsine to alcohol solutions with increasing concentrations (from 70 °, 90 ° and 96 °) for a time of 15' - 20' for each.

- From here we put it to Eugenol or carbol-xylene for about 30 minutes.

- Then they are treated with pure xylene for more than 15 minutes.

- Finally, the material is arranged on a slide (lama), a drop of Canadian balsam is dropped on it and covered with a lamell.

- The material dries slowly over currents of warm air, a process for which we have improvised a simple and practical mechanism with incandescent electric lamps (not led).

Such a thing facilitated and speeded up the process of species determination.

For some species, which are characterized by considerable size (observable with the naked eye) with well-developed waxy covering, there is little need to prepare microscopic preparations.

They can be easily determined on the basis of morphology and specific formations that characterize their shell (the wax cover).[16]

RESULTS AND DISCUSSIONS:

Based on the material collected in the field as well as the results obtained from its processing, we have determined that the mulberry tree, in the region where we have extended our research, is also contaminated by these representatives of the Class of Insecta, Order Homoptera, Over/FamilPaleococcoidae:

- From the Family Lenaniidae (Coccoidae)

- a. The genus Coccus L.

- 1. *Coccus pseudomagnoliarum* Kuw.

- b. The genus Parthenolecanium Sulc.

- 1. *Parthenolecanium persicae* F.

- 2. *Parthenolecanium corni* Bouche.

- c. The genus Eulecanium Ckll.

- 1. *Eulecanium mali* Schr.

- 2. *Eulecanium rugulosum* Arch.

- d. The genus Paleolecanium Sulc.

- 1. *Paleolecanium bituberculatum* Targ.

- From the Family Diaspididae

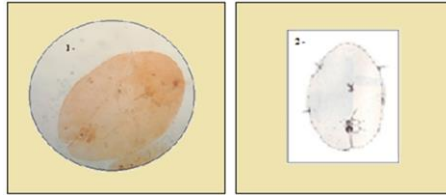
- a. The genus Pseudaulecaspus Mac.G.

- 1. *Pseudaulecaspus pentagona* Targ.

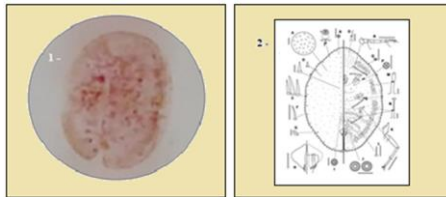
- b. The genus Carulaspis Mac.G.

- 1. *Carulaspis carueleii* Targ.- Toz.

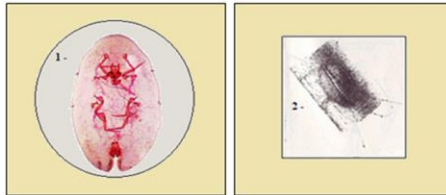
From the work done in the laboratory and from the processing of the material for these species, we can present the following illustrations: (Fig. 3 - a, b, c, d, e, f, g, h)



a - *Coccuspseudomagnoliarum*Kuw. 1 - View of the body under binoculars
2 - Sketch of the view of the body under binoculars



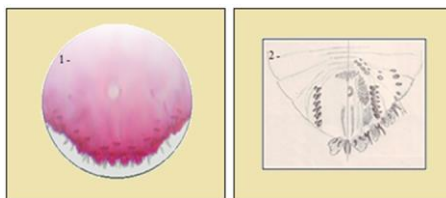
b - *Parthenolecaniumpersicae* F. 1 - View of the body under binoculars
2 - Sketching its determining elements



c - *Parthenolecaniumcorni* Bouche. 1 - View of the body under binoculars
2 - Sketch of the external appearance of her body



d - *Pseudaulecaspispentagona*Targ. 1 - Binocular view of the body
2 - Binocular view of her pygidium



e - *Carulaspiscarueleii*Targ.-Toz. 1 - Binocular view of her pygidium
2 - Sketch of pygid elements under binoculars



f - *Eulecaniumrugulosum* Arch. g - *Eulecaniummali*Schr. h- *Parthenolecaniumbituberculatum*Targ.

Fig. 3 - Fig. 3 (a,b,c,d,e,f,g,h) – Illustrations extracted during our work in the laboratory under binocular

The following maps show the entire region where this study was carried out and its position in the territorial extent of the country (Fig. 4) as well as our checkpoints (visited by us no less than twice for each season of the year, for over four years in a row), along with the meeting points of the types given in this material (Fig.5).



Fig. 4 - National map and its studied area



Fig. 5 - Map of checkpoints and meeting points of these species

The detection of these species in the mulberry plant was observed only in its stem and in no case in its leaves. The spread of representatives of this group in the region in question has been evidenced in the territory of Gjirokastra, in the city of Gjirokastra itself, but also in its village of Sopik. In the territory of Vlorë, in the city of Vlorë itself (Kuzum - Baba) but also in the village of Novoselë. In the territory of Tepelena, it was found only in the village of Krahës, and recently in the territory of Përmet only in its town (Fig. 5). From what can be seen in Fig. 5, in the territory of the region of Vlorë

and in that of Gjirokastra, these species were found at two control points, while in the other two regions (that of Tepelena and that of Përmet) they were found at one control point. The number of meet, of each of these species during this study period is presented in the following table: (Tab. 1)

Table 1 - Frequency of encounter for each species during our field expeditions.

No.	Symbol	Species	Met / in x cases
1.	S ₁	<i>Coccuspseudomagnoliarum</i> Kuw	in 27 cases
2.	S ₂	<i>Parthenolecaniumpersicae</i> F.	in 7 cases
3.	S ₃	<i>Parthenolecaniumcorni</i> Bouche.	in 4 cases
4.	S ₄	<i>Eulecaniummali</i> Schr.	in 5 cases
5.	S ₅	<i>Eulecanumrugulosum</i> Arch.	in 3 cases
6.	S ₆	<i>Paleolecaniumbituberculatum</i> Targ.	in 2 cases
7.	S ₇	<i>Pseudaulecaspuspentagona</i> Targ.	in 18 cases
8.	S ₈	<i>Carulaspiscaruleii</i> Targ.- Toz.	in 1 cases
Total number of effective cases for this parasite group			67 cases

The probability of the effectiveness of the meeting (relative frequency) of each of these species in the given case is:

$$P_{S-1} = 27/67 = \mathbf{0,403} ; P_{S-2} = 7/67 = \mathbf{0,104} ; P_{S-3} = 4/67 = \mathbf{0,059} ; P_{S-4} = 5/67 = \mathbf{0,074} ;$$

$$P_{S-5} = 3/67 = \mathbf{0,044} ; P_{S-6} = 2/67 = \mathbf{0,029} ; P_{S-7} = 18/67 = \mathbf{0,269} ; P_{S-8} = 1/67 = \mathbf{0,015}.$$

The meeting of one of these species does not exclude the meeting of the other in this plant.

The probability of the two most frequent species occurring meeting together on the mulberry plant would be: $P = (P_{S-1}) \times (P_{S-7}) = (0.403) \times (0.269) = \mathbf{0.1}$ or **1/10**.

Expressed graphically, this is shown in **Fig. 6**

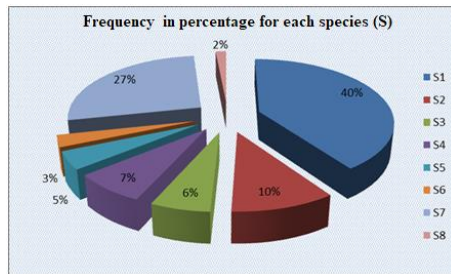


Fig. 6 - Graph of the expression of the frequency of meeting in percentage for each type.

The low frequency of meeting of these species is conditioned by the presence or not of the mulberry plant in those areas, since this plant is not massively cultivated. It is found simply as a family cultivar or as an ornamental plant. Therefore, in some control points, the non-contact of these species may have to do, among others, mostly with this fact.

The regions where each of the mentioned species is found is given in **Table 2**.

Table 2 - Regions and number of encounters for each species for each region.

Species name	Vlora Region	Tepelena Region	Përmeti Region	Gjirokastra Region	No. Regions
<i>1-C. pseudomagnoliarumKuw.</i>	---	---	---	+	1
<i>2-P. persicae F.</i>	---	---	---	+	1
<i>3-P. corni Bouche.</i>	---	+	---	---	1
<i>4-E. maliSchr.</i>	---	+	---	---	1
<i>5-E. rugulosum Arch.</i>	---	---	+	---	1
<i>6-P. bituberculatumTarg.</i>	---	+	---	---	1
<i>7-P. pentagonaTarg.</i>	+	---	+	---	2
<i>8-C. caruleiiTarg.</i>	+	---	---	---	1
Total for each region	2	3	2	2	—

Of the eight species in question, not all of them were found in all the points-of-meetings expressed in **Tab.2**. Thus, in the region of Vlora, we met only *P. pentagonaTarg.* and *C. caruleiiTarg.* - Toz.. In that of Tepelena we met *P. corniBouche.*, *E. maliSchr.* and *P. bituberculatumTarg.* In that of Përmet we met only *E. rugulosum Arch.* and *P. pentagonaTarg.*. In that of Gjirokastra we met only *C. pseudomagnoliarumKuw.* and *P. persicae F.*.Based on this table, among the regions most affected by these types of parasites is that of Tepelena, although the difference with other regions is not so significant. So, as a whole, these parasites are present in all four regions studied.

CONCLUSIONS:

1. Looking at the distribution of the point-meetings of the species in question, we can conclude that these parasites are ubiquitous in these regions.
2. Among the above species that frequent the mulberry plant the most are *CoccuspseudomagnoliarumKuw.* and *PseudaulecaspuspentagonaTarg.* and less frequent it *Carulaspiscaruleiitarg.- Toz.* and *PaleolecaniumbituberculatumTarg.*
- 3.*P. pentagon Targ.* is met in two extreme regions with each other. So this species has the widest spread in the analyzed territory. Also, supported by the data in the graph of **Fig. 6**, we can say that it should be considered as one of the most specific pests of the mulberry plant.
4. *C. pseudomagnoliarumKuw.* (0.403) and then *P. pentagonaTarg.*(0.269) have the highest meeting probability among these species.

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