

INTERNATIONAL ENVIRONMENT PROJECT OLYMPIAD

**BIOECOLOGICAL PECULIARITIES  
OF REPRESENTATIVES OF *ORCHIDACEAE* FAMILY  
IN A CATCHMENT BASIN OF THE RIVER CHERNAYA (CRIMEA)**

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## 1. INTRODUCTION

Protection of rare kinds of plants is one of the basic directions of preservation of a biological variety of nature as a whole. An increasing anthropogenous influence on natural ecosystems puts on a verge of disappearance not only separate species, but also genera and even families of plants. The largest family of floral plants, the orchid family (*Orchidaceae*), is completely included in the Appendix II of Convention on international trade in species of wild fauna and flora, being under the threat of disappearance.

Protection should be understood as preservation of all species, subspecies, and also types and forms of plants as complex system of macro- and micropopulations, i.e. preservation of all unique variety and riches of a genofund of natural flora.

The original geographical position of Crimea and the developed climatic conditions promoted formation of a unique flora. Heterogeneity of conditions of the habitats together with a mountainous relief and a climate of the Southern coast of Crimea provide an opportunity of growth here for 47 species of family *Orchidaceae* that puts Crimea, alongside with the Carpathians, in a line with the largest centers of a specific variety of orchids in Ukraine. Number of many orchids' species is now being reduced. One of the main reasons of reduction of number of these plants is the use of their rhizomes as medicinal raw material. Not lesser harm is caused by the injurious gathering of decorative flowers in bouquets. Now existing nature protection measures cannot provide the complete safety of orchids in Crimea. The analysis of the reasons of reduction of populations of species of *Orchidaceae* family shows that it is possible to provide their high-grade protection only in reserves, preserves, botanical gardens and other protected territories. Orchids can be found in all reserves of Crimea, however borders of reserves cover a small part of their natural habitat. Many rare species of orchids remain behind their limits, in places with intensive anthropogenous

influence where the organization of some botanical reservoir-preserves is necessary. In addition to the protection of orchids in natural conditions it is advisable to model and reconstruct natural ecosystems, create genetic banks and regional collections of orchids in botanical gardens.

## 2. URGENCY

In Crimea there are about 47 species of orchids according to the latest available information, all of them are brought in the Red book of Ukraine. Orchids differ from the majority of other floral plants by the complexity of system of pollination. The majority of the Crimean orchids are non-nectarous. Their pollination and, hence, reproduction depends on a lot of factors from which the influence of spatial structure of populations is less studied.

The modern condition of rare plants of Crimea demands the complex approach to the problem of their protection as not only the quantity of species is being reduced, but also the whole natural complexes are collapsing.

During the process of their development orchids form complex biological relations with other plants, therefore their studying demands a systematic approach.

### **3. PURPOSE AND OBJECTIVES**

#### **Purpose:**

**The purpose of the present work is studying dynamics of an ecological condition of orchids in a catchment basin of the river Chernaya.**

#### **Objectives:**

- 1. Planning and organization of forwarding works in a catchment basin of the river Chernaya (the Western Crimea).**
- 2. Characteristics of natural complexes with the use of a geobotanical material.**
- 3. Drawing up of a map-scheme of *Orchidaceae* distribution in the area of research.**
- 4. Laying of the trial platforms, definition of a specific belonging.**
- 5. Obtaining of population characteristics.**
- 6. Gathering carvings' tests of assimilating bodies of *Orchidaceae* representatives, calculation of quantity of flowers in inflorescences of the plants growing in meadow and shrubby communities.**
- 7. The physiologic-biochemical analysis of tests of *Orchidaceae* representatives on the basis of different levels of light exposure. Definition of concentration of pigments and level of ATPase activity.**
- 8. Characteristics of bio-ecological condition of *Orchidaceae* in a catchment basin of the river Chernaya during the period from the year 2005 up to the year 2006.**

#### **4. APPROBATION**

Fragments of the given work have been presented at the international youth conference «FROM THE RIVERS TO THE SEAS» which took place on September 18-22th, 2006 in Sevastopol under the patronage of the National Academy of sciences of Ukraine and the International Institute of Ocean. Work has won **1st place** in the section of the environment preservation. On materials of the conference the collection «Ecology: problems, decisions. Youth vision» was edited where my article (Shulika, 2006) was published.

Also fragments of the given work have been presented at a national stage of the competition «Intel - Eco Ukraine 2007» of the International competition of scientific and technical works of school students Intel® ISEF 2007 which took place in Kiev on March, 2-4nd. Work has taken **2nd place** in the section "Botany".

Fragments of the given work have been presented on XXV All-Ukrainian students' Olympiad in biology and ecology which took place on March, 25-30th in Kherson. The work has taken **2nd place**.

## 5. REVIEW OF PREVIOUS RESEARCH

The Orchids family (*Orchidaceae*) is the largest among monocotyledonous families, with about 750 genera and from 20,000 to 25,000 species. According to some data [10], it includes up to 800 genera and 35,000 species.

Nature has generously presented this family with extraordinary beauty and a variety of flowers.



*Figure 1.* Comparison of parts of an orchid flower (on the left) and radial-symmetric flower (on the right).

«Lip» is a modified petal forming a platform for pollinators

Orchids are cosmopolitan. They are found almost in every regions liveable for plants, from Switzerland and Alaska in the North to Tierra del Fuego and subantarctic Macquarie Island in the South .

However, their majority of them are concentrated in tropical latitudes, especially in tropical America and Southeast Asia.

Orchids grow everywhere: from slopes of the highest mountains to wood open spaces of plains, from bogs and reservoirs to dry steppes and deserted oases. In Colombia some orchids grow in non-melting snows of the mountains, in Australia they grow under the ground. The great variety of their species is observed in damp mountain woods, especially in the woods of clouds and fogs zone.

The majority of orchids do not grow above 2000 m above sea level, nevertheless, some of them are found at the top border of wood and their allocation can even reach the height of 5000 m above sea level.

In the moderate areas orchids are terrestrial plants with subterranean rhizomes or tubers, usually with not striking flowers. Some orchids of torrid and temperate zone belong to general genera and are similar among themselves on shape. However, the majority of tropical kinds are poorly similar to the modest types from the moderate zone, because, first of all, their significant part is epiphyte.

Epiphyte existence leads to the isolation of the population. Sometimes this population is the unique representative of the species, which can be found nowhere else. Therefore cutting down of woods, especially rainforests, can lead to destruction of many kinds of unique plants [12].

Complexity of pollination system distinguishes orchids from other flowering plants. For instance, several species of world flora orchids do not secrete nectar and attract pollinators with the help of different deceitful ways,

i.e. they appear to be insect parasites in the function of fertilization. The majority of Crimean orchids are not nectariferous. Their fertilization and, consequently, family reproduction depend on a number of factors. The least investigated of them is the influence of population spatial pattern.

During the long period of time it has been the process of conjugate evolution of orchids and their pollinators. In the process of evolution, mutually beneficial accessories have been developed: insects have adjusted to pollen transportation and the orchids have transformed their flower morphologically the way it is fit for pollination of certain species of insects. For instance, one of the most widespread non-nectariferous Crimean orchids is *Orchis picta Loisei* (Orchis painted). This kind is pollinated by bees because of its similarity to nectariferous plants [13].

The majority of terrestrial and epiphyte orchids are autotrophic plants with green leaves in which photosynthesis carries out. In some epiphyte orchids the process of photosynthesis takes place in green stems, flowers and air roots.

However, among the terrestrial and epiphyte orchids there are a certain number of species that completely lost the ability for photosynthesis and became mycotrophic. Symbiosis with endophytic fungus is typical for all orchids at the early stage of development. Nevertheless, only some of them completely depend on the funguses during their whole life time. Such orchids which lost their green leaves grow on rotten remains. Even though the orchids are not able to assimilate them, they use funguses to extract essential substances. Fungus hyphas penetrate into living cells of roots and rhizomes and are partly digested by the plant. Orchids assimilate carbohydrates from them [12].

## 6. Materials

### 6.1. *Orchis picta*

Perennial, rather small plant of 15 - 30 cm in height with numerous oblong dark green leaves in the radical rosette. An inflorescence is short and friable; painting of flowers varies from light- up to dark-violet tones, mesopetalum is whitish with dark specks. Blossoms in April - May. It can be found almost across all mountainous Crimea, grows on meadows, open wood glades.

The general distribution: Crimea, Caucasus, the Mediterranean.



#### MATERIALS OF FIELD RESEARCHES

Height of sprouting systems of plants  
on trial platforms:

**Platform №1 (12 specimen):**

22; 15; 27; 24; 15; 19; 24; 22; 22; 15; 18; 10

**Platform №2 (13 specimen):**

20; 15; 13; 12; 12; 8; 14; 18; 16; 16; 17; 20; 17

**Platform №3 (14 specimen):**

18; 18; 19; 18; 15; 18; 20; 23; 15;

16; 12; 14; 21; 11

**Platform №4 (19 specimen):**

6; 13; 25; 14; 17; 14; 15; 13; 14;

7; 8; 15; 14; 13; 15; 15; 16; 14; 13

**Platform №5 (12 specimen):**

22; 16; 21; 27; 18; 22; 14; 21; 21; 16; 24; 19

## 6.2. *Orchis purpurea*

Perennial, the largest among Crimean orchids plant up to 80 cm in height. Leaves are wide and bright green in dense radical rosette. An inflorescence is dense with the length of 20 cm. Flowers are numerous with red-purple helmet and light pink mesopetalum covered with dark spots. Different plants have a great variability of flower paintings and mesopetalum patterns. Flowers have delicate vanilla aroma. Blossoms at the end of April-May, fructifies in July.

It can be found across all mountainous Crimea, grows in thickets of bushes, on meadows, open wood glades. Though this species has not been called rare yet, the danger of sharp decrease of its quantity has become obvious. This plant should be included into culture as a spectacular ornamental flower. It was put under protection in 1971 according to the resolution of the Yalta Executive Committee. It was brought in the Red book of Ukraine. The general distribution: the south of European part of Russia, Mediterranean, Crimea.



### MATERIALS OF FIELD RESEARCHES

Height of sprouting systems of plants on  
trial platforms:

**Platform №1 (11 specimen):**

12; 18; 12; 8; 9; 19; 13; 10; 43; 38; 43

**Platform №2 (11 specimen):**

18; 16; 13; 14; 13; 17; 18; 12; 49; 45; 32

**Platform №3 (4 specimen):**

13; 14; 13; 37

**Platform №4 (8 specimen):**

15; 14; 20; 13; 14; 13; 40; 28

**Platform №5 (7 specimen):**

13; 12; 14; 12; 34; 45; 35

### 6.3. *Orchis simia*

Perennial plant up to 40-45 cm in height. Leaves are rather wide and dove-coloured green in radical rosette. An inflorescence is short and dense; flowers are light, greyish-pink, mesopetalum has long curved narrow purple blades, with a slight resemblance to the paws of a tiny monkey. Blossoms in April, fructifies in June-July. It can be found across all mountainous Crimea, grows on meadows, open wood glades, in thickets of bushes. The plant can be met rather often, but it is actively destroyed by the flower pickers. It was put under protection in 1971 according to the resolution of the Yalta Executive Committee. It was brought in the Red book of Ukraine. The general distribution: Crimea, Caucasus, mountainous Turkmenistan, the Atlantic coast of Europe, the Mediterranean, Iran.



#### MATERIALS OF FIELD RESEARCHES

Height of sprouting systems of plants

on trial platforms:

**Platform №1 (4 specimen):**

18; 23; 21; 16

**Platform №2 (5 specimen):**

18; 24; 26; 18; 21

**Platform №3 (4 specimen):**

**пл. №3 (4 экземпляра):**

16; 32; 26; 25

**Platform №4 (6 specimen):**

25; 27; 21; 31; 30; 28;

**Platform №5 (6 specimen):**

27; 25; 22; 25; 30; 28

#### 6.4. *Orchis tridentata*

Perennial grassy plant of 15 - 25 cm in height with the rosette of small linear elliptic greyish-green leaves and several pedicellate leaf vaginas. An inflorescence is very dense, oval or almost globe-shaped. Flowers are rather small, greyish-pink with purple lanceolate pointed bracts; mesopetalum is also light pink with reddish spots; middle blade of mesopetalum has denticle. Spur is short, rather shorter than ovary, thin obtuse and slightly curved. Blossoms in May-June, fructifies in July. In Crimea it grows in deciduous and mixed woods, on the border of a forest and open wood glades, in thickets of bushes, sometimes in thick grass on heavy clay rocky soil. It was brought in the Red book of Ukraine. It was put under protection in 1971 according to the resolution of the Yalta Executive Committee.

The general distribution: Crimea, Caucasus, Middle Europe, the Mediterranean.



#### MATERIALS OF FIELD RESEARCHES

Height of sprouting systems of plants  
on trial platforms:

**Platform №1 (11 specimen):**

18; 20; 13; 20; 25; 30; 23; 20; 21; 20;  
19

**Platform №2 (7 specimen):**

20; 18; 20; 25; 27; 28; 23

**Platform №3 (9 specimen):**

22; 17; 16; 19; 21; 18; 13; 23; 24

**Platform №4 (5 specimen):**

25; 19; 21; 23; 22

**Platform №5 (2 specimen):**

### 6.5. *Orchis punctulata*

Perennial, large enough, grassy plant up to 30-35 cm in height. Leaves are bright green, shining, large, spear-shaped, in the radical rosette. An inflorescence is multifloral, cylindrical and dense. Flowers are yellow-greenish, with delicate aroma. Petal-shaped sepals are oblong and egg-shaped, with lilac-tinged-reddish specks within, petals are linear; mesopetalum is yellowish-green with the long middle blade shortly bisected, with the rounded off lobes and serration between them. Spur is short, twice shorter than ovary. Blossoms in May-June, fructifies in August.

In Crimea it grows on wood clearings, in thickets of bushes - on the Southern coast of Crimea, also sometimes grows on the northern slope of the Main ridge of Crimean mountains. It can be found rarely, it is mostly solitary. Sometimes forms natural hybrids with other orchids. It was brought in the Red book of Ukraine.

The general distribution: Crimea, the Western Transcaucasia, East Mediterranean, Iran.



#### MATERIALS OF FIELD RESEARCHES

Height of sprouting systems of plants on  
trial platforms:

**Platform №1 (1 specimen):**

43

**Platform №2 (3 specimen):**

29; 27; 32

**Platform №3 (2 specimen):**

38; 40

This kind is for the first time described by us for the Western Crimea

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### 6.6. *Ophrys oestrifera*

Flowers are very peculiar and resemble to bee-looking insects with velvety back, protuberant abdomen and hairy legs. It is desirable to include this plant in the culture, especially with a purpose of species preserving and repatriation them into the previous habitat which is destroyed nowadays. Cultivation is possible only with the help of seeds sowing and growing of seedlings. It grows across submountainous and mountainous Crimea, on rocky soil in light juniper and oak-juniper woods. It can be found rather rarely, in small groups.

The general distribution: Crimea, Caucasus, the Middle and Western Europe, Iran, the Mediterranean, Asia.



#### MATERIALS OF FIELD RESEARCHES

Height of sprouting systems of plants on  
trial platforms:

**Platform №1 (1 specimen):**

35

**Platform №2 (2specimen):**

37; 32

**Platform №3 (1 specimen):**

30

### 6.7. *Ophrys taurica*

Perennial, rather small, grassy plant up to 20-30 cm in height with several dove-coloured green leaves in radical rosette, some pedicellate vaginas and low-flower delicate inflorescence. Blossoms in April-May, grows across sub-mountainous and mountainous Crimea (except mountain pastures), on rocky soil, in light juniper woods.

The general distribution: Crimea, Caucasus, the Middle and Western Europe, Iran, the Mediterranean, Asia.



#### MATERIALS OF FIELD RESEARCHES

Height of sprouting systems of  
plants on  
trial platforms:

**Platform №1 (1 specimen):**

**37**

**Platform №2 (3 specimen):**

**37; 56; 50**

**Platform №3 (3 specimen):**

**30; 27; 30**

**Platform №4 (2 specimen):**

**32; 22**

**Platform №5 (1 specimen):**

**41**

**18**

### **6.8. *Ophrys apifera***

It blossoms a bit later than other ophryses, in May-June. In Crimea it grows only on the Southern Coast in light oak-juniper wood, deciduous wood, on the border of a forest and in thickets of bushes, across low belt of mountains, usually on limestone soil. It can be found mostly solitary. Reproduction with the help of seeds, the ability to self-fertilization is proved. It can be found rarely and has a tendency to reduction of its habitat.

The general distribution: Crimea, Caucasus, the Middle and Western Europe, Iran, the Mediterranean.



**MATERIALS OF FIELD RESEARCHES**

Height of sprouting systems of plants on  
trial platforms:

**Platform №1 (1 specimen):**

**31**

**Platform №2 (2 specimen):**

**27; 23**

This species was described for the Western Crimea for the first time in this research

### 6.9. *Anacamptis pyramidalis*

Perennial plant up to 60-65 cm in height with numerous narrow, generally radical leaves. An inflorescence is multiflorous, dense and ovoid-pyramidal. Flowers are purple-red, more seldom pink and white, rather little.

Blossoms in June-July later than most of Crimean orchids. It grows in woods, in thickets of bushes, wood clearings. It is rather typical for mountainous Crimea.

It was brought in the Red book of Ukraine. It was put under protection in 1971 according to the resolution of the Yalta Executive Committee.

It has been destroyed actively as an ornamental plant nowadays. It is desirable to include it in the culture, the cultivation is recommended only with the help of seed sowing.

The general distribution: the western part of forest-steppe region of Ukraine, Crimea, Caucasus, the South and Middle Europe, the Mediterranean.



#### MATERIALS OF FIELD RESEARCHES

Height of sprouting systems of plants on trial platforms:

**Platform №1 (6 specimen):**

**35; 28; 27; 30; 43; 39**

**Platform №2 (3 specimen):**

**60; 50; 39**

**Platform №3 (4 specimen):**

**37; 37; 34; 35**

**Platform №4 (3 specimen):**

### **6.10. *Cephalanthera damasonium***

Perennial rhizome plant of 20 - 60 cm in height with small elliptic leaves all over stem. Flowers are white, up to 2 cm in length, gathered in rare inflorescence.

Blossoms in May-June, fructifies in July-August.

It typically grows in deciduous woods of sub-mountainous and mountainous Crimea. It is destroyed by the flower pickers. It was brought in the Red book of Ukraine and Russia.

The general distribution: almost all parts of Europe, Crimea, Caucasus, the Mediterranean.



#### MATERIALS OF FILED RESEARCHES

Height of sprouting systems of plants on  
trial platforms:

**Platform №1 (1 specimen):**

32

**Platform №2 (1 specimen):**

32

**Platform №3 (3 specimen):**

35; 30; 31

**Platform №4 (3 specimen):**

### 6.11. *Cephalanthera longifolia*

Perennial rhizome plant of 20 - 60 cm in height with linear spear-shaped pedicellate leaves and friable inflorescence. Flowers are white, up to 2 cm in length. Blossoms in May-June, fructifies in July-August. It grows in deciduous woods, more seldom in coniferous wood in mountainous Crimea. It is destroyed by the flower pickers. It was brought in the Red book of Ukraine.

The general distribution: Crimea, Caucasus, mountains of Asia, almost all parts of Europe, Asia Minor, Iran, the Himalayas, the Mediterranean.



#### MATERIALS OF FILED RESEARCHES

Height of sprouting systems of plants on  
trial platforms:

**Platform №1 (3 specimen):**

42; 37; 50

**Platform №2 (2 specimen):**

39; 45

**Platform №3 (1 specimen):**

51

**Platform №4 (2 specimen):**

### 6.12. *Cephalanthera rubra*

Perennial rhizome plant of 25 - 60 cm in height with a leaved stem and bluish grey spear-shaped leaves. An inflorescence is friable. Flowers are elegant, large, lilac-pink, up to 2.5 cm in length. Blossoms in June-July, fructifies in August-September.

It usually grows in coniferous and beech woods across mountainous Crimea. It is not a rare plant yet, although the population of it is destroyed because of beautiful flowers. It was brought in the Red book of Ukraine.

The general distribution: almost all parts of Europe, Crimea, Caucasus, Asia Minor.



MATERIALS OF FILED

RESEARCHES

Height of sprouting systems of  
plants on  
trial platforms:

**Platform №1 (3 specimen):**

**5; 40; 31**

**Platform №2 (4 specimen):**

33; 46; 50; 37

**Platform №3 (2 specimen):**

39; 51

**Platform №4 (3 specimen):**

48; 53; 39

**Platform №5 (3 specimen):**

47; 52; 50

23

### 6.13. *Epictis helleborine*

Perennial grassy plant with creeping short-cut rhizome. Stems are tall, up to 100 cm in height with regular large greyish-green leaves. Clusters of inflorescences are up to 40 cm in length, friable, multiflorous, upright. Flowers are greenish-purple with different coloring power. Blossoms in May-June, fructifies in August. It is an ornamental plant.

It grows almost everywhere across mountainous Crimea, on the borders of a forest and open wood glades, less often in mixed wood. It can be found rarely. It was brought in the Red book of Ukraine.



MATERIALS OF FILED RESEARCHES

Height of sprouting systems of plants on  
trial platforms:

**Platform №1 (2 specimen):**

35; 30

**Platform №2 (7 specimen):**

28; 18; 27; 40; 26; 35; 36

**Platform №3 (2 specimen):**

30; 23

**Platform №4 (4 specimen):**

26; 23; 17; 28

**Platform №5 (2 specimen):**

32; 33

24

#### 6.14. *Platanthera chloranta*

Perennial plant of 30-60 cm in height with two (less often - three) wide elliptic leaves located in the bottom part, and with greenish-blue flowers without a smell, collected in a friable cylindrical inflorescence. Blossoms in May-June, fructifies in July-August.



It can often be found in woods among bushes across all mountainous Crimea. It is brought in the Red book of Ukraine.

The general distribution: almost all Europe, including the European part of Russia; Caucasus.

MATERIALS OF FIELD RESEARCHES

Height of sprouting systems of plants

on trial platforms:

**Platform №1 (3 specimen):**

**55; 40; 43**

**Platform №2 (4 specimen):**

**56; 42; 39; 40**

**Platform №3 (2 specimen):**

**50; 55**

**Platform №4 (2 specimen):**

**45; 51**

**Platform №5 (2specimen):**

**47; 52**

**25**

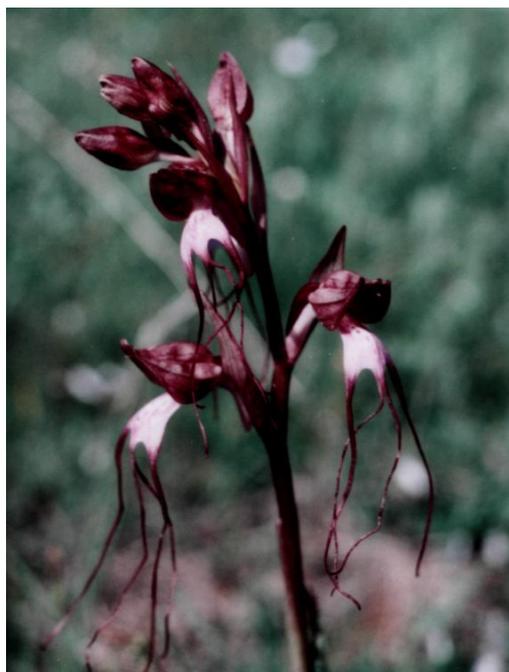
### **6.15. *Comperia comperana***

Perennial plant up to 40-50 cm in height with three-four bluish-green leaves, mostly found in the radical rosette. An inflorescence is usually not multifloral. Flowers are large, of the original form: mesopetalum has three blades, the top blade is bisected, all blades pass into the long threadlike endings. The general length of flowers with such threadlike endings reaches 8-9 cm. Blossoms in May-June, fructifies in July-August.

Grows in juniper woods of the western part of the Southern coast of Crimea, less often - in deciduous woods of the western foothills. It can be seldom found and, as a rule, is solitary; its distribution is being noticeably reduced. It was put under protection in 1971 according to the resolution of the Yalta Executive Committee. It was brought in the Red book of Ukraine. This ornamental plant is desirable for entering into culture, especially with the purpose of preservation of a kind and repatriation in places where this orchid grew earlier,

and now has disappeared. Its cultivation is difficult; it can be carried out only by sowing of seeds in special conditions.

The general distribution: Crimea, Asia Minor.



#### MATERIALS OF FIELD RESEARCHES

Height of sprouting systems of plants on trial platforms:

**Platform №1 (4 specimen):**

**31; 40; 36; 30**

**Platform № 2 (3 specimen):**

**29; 34; 42**

**Platform №3 (3 specimen):**

**30; 36; 43**

**Platform №4 (2 specimen):**

**35; 46**

**Platform №5 (2 specimen):**

**43; 41**

**26**

### **6.16. *Himantoglossum caprinum***

Large perennial plant up to 50-70 cm in height; bluish-green leaves of a greater part are situated in the radical rosette. An inflorescence is long, multifloral and rare; flowers are greenish-white, a helmet and partly mesopetalum are with purple armilla. In this flower the form of armilla is unusual: the middle blade in it is long (4-6 cm), lorate, obliquely downwards directed, deeply dissected in two shares. Blossoms at the beginning of July, fructifies in August-September.

It can often be found in light woods among bushes. Its area in Crimea is being noticeably reduced, especially in regions where tourist routes run. According to our observations, it suffers greatly not only because of its original shape that draws attention of tourists, but also for the natural reasons: blossoming plants do not always set, and besides, in cold years leaves freeze. It was put under protection in 1971 according to the resolution of the Yalta Executive Committee. It was brought in the

Red book of Ukraine. Its introduction into culture with the purpose of preservation of a kind and repatriation (replanting of young plants in those natural boundaries of Crimea where this plant grew earlier, but now has disappeared) is desirable.

The general distribution: Crimea, the Western Transcaucasia.



#### MATERIALS OF FIELD RESEARCHES

Height of sprouting systems of plants on trial platforms:

**Platform №1 (1 specimen):**

37

**Platform №2 (3 specimen):**

29; 27; 22

**Platform №3 (3 specimen):**

30; 42; 24

**Platform №4 (1 specimen):**

34

**Platform №5 (1specimen):**

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*FABRICS FROM MEADOW AND BUSH COMMUNITIES*

27

*ARE TAKEN (CHAPTER 8.3)*

### **6.17. *Limodorum abortivum***

Perennial leafless saprophytic plant up to 40-80 cm in height; with a fragile coral-like rhizome without roots. It has a greenish-violet stem with flowers.

Flowers are few in number, large (up to 2 cm), light violet, sometimes pink. Bolls are greenish-violet. Blossoms in May-June, fructifies in July-August.

It grows in light conifer (pine), pine-oak and juniper woods across mountainous Crimea, on the Southern coast of Crime. It can be found rather rarely. It is an ornamental plant.

If, being in blossom, it is pulled out of the soil, rhizome is easily damaged that leads to the plant death.

It was put under protection in 1971 according to the resolution of the Yalta Executive Committee. It was brought in the Red book of Ukraine.

It can be when being in blossom it is pulled out of the soil

The general distribution: Crimea, Caucasus, the south of Middle Europe, the Mediterranean.



#### MATERIALS OF FIELD RESEARCHES

Height of sprouting systems of plants on trial platforms:

**Platform №1 (5 specimen):**

**50; 40; 37; 32; 17**

**Platform №2 (5 specimen):**

**30; 25; 40; 29; 18**

**Platform №3 (2 specimen):**

**28; 20**

**Platform №4 (1 specimen):**

**43**

**Platform №5 (1 specimen):**

**13**

**28**

## 7. METHODS

For achievement of the goal the following methods have been used:

7.1. A method of the trial areas (Odum, 1986)

7.2. Methods of definition of physicomechanical characteristics of the soil  
(State Standart - 5180-84)

7.3. Methods of definition of the maintenance of pigments in cuttings which  
assimilate the organs of plants (Gavrilenko, etc., 1975)

7.4. Methods of definition of level ATPase activity in cuttings assimilating  
the plants organs (Polevoy, Maksimov, 1978)

In figures 2-4 the application of the methods indicated is shown

## 7.5. Methods of biological statistics (Lakin, 1973)



Figure 2. The method of test areas.



Figure 3. A method of definition of the maintenance of the pigments in cuttings assimilating plants organs.



Figure 4.a



Figure 4.b

Figure 4.a - 4.б. A method of definition of ATPase activity in cuttings of assimilating plants organs.

## 8. RESULTS AND DISCUSSION

### 8.1. Characteristic of area of research.

The research was carried out in a submountain area of the Western Crimea, in a catchment basin of the river Chernaya. A series of expeditions has been carried out during the term of vegetation of orchidaceous during the period from the year 2005 up to the year 2006 for studying natural complexes to which this or that species is dated for, the collecting of samples of soil in order to get the population characteristics, and also taking samples of cutting for the further biochemical analysis.

The basin of the river Chernaya is characterized by complex geomorphological structure. Valleys are replaced by rocky outputs which being closed, form a natural memorial - The Small Chernorechenskiy Canyon which is a geological reserve and occupies 150 hectares. In connection with a complex landscape the river forms meanders that influence the distribution of the precipitations. The area of research is characterized by a complex structure and the great speed of changes in the sphere of the top-soil and vegetation [11]. Grassland steppes are replaced by bushes, deciduous and mixed forests. Among shrubs bushes of sloe, a dogrose, and also hornbeam and blackberries prevail. In the woods hornbeam, oak and juniper prevail. According to the character of the landscape we have singled out such natural complexes:

- a) Wood glades;
- b) Meadows;
- c) Bushy thickets;
- d) Deciduous woods;
- e) Mixed forests;
- f) Juniper thickets;
- h) Meadows with a high recreational load.

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In each of the above-mentioned complexes various kinds of orchids may be found, which have symbiotic mutual relations with the certain herbage, bushes and trees. Thus, 7 sample areas have been laid, conforming to the above mentioned complexes on which the samples of the soil have been taken with the help of the method of an envelope.

In the hermetically sealed, preliminary weighed bottles the samples were delivered to Institute of Biology of the Southern Seas of the National Academy of Sciences of Ukraine for further analysis. The received results are listed in table 1.

**Tab. 1. Some physicochemical operation factors of soil samples in a catchment basin of the river Chernaya.**

Natural complex	Density gr/sm <sup>3</sup>	Humidity, %			The maintainace of the organic matter, %
		Absolute	Hydroscopic	Cellular	
a	0,85	5,7±0,4	3,0±0,2	3,2±0,1	21,0±1,7
b	0,88	7,4±0,5	2,7±0,1	3,7±0,2	20,4±0,9
c	0,82	6,2±0,4	2,5±0,1	3,0±0,1	18,9±0,6
d	0,81	7,7±0,6	3,2±0,2	3,1±0,2	22,4±1,3
e	0,81	7,3±0,5	2,4±0,1	3,2±0,2	22,8±0,7
f	0,87	4,8±0,2	2,2±0,1	2,1±0,1	15,3±0,6
g	0,92	2,1±0,1	1,8±0,1	1,9±0,2	5,4±0,7

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According to the results, the most favourable edaphic conditions are developed in the areas dated for wood phytocenoses, whereas the glades used for public rest are characterized by the compression of the soil, loss of moisture and significant decrease of the contents of the organic matter. Such operation facts testify to the degradation of soil, that entails also the degradation of plant communities. On such fields orchidaceous now can not be met, whereas 10 years ago, before the increase of the anthropogenic press, hundreds of species of orchids [7] could be found.

The relative abundance of moisture and organic chemistry in the soil of Chernorechya and the variety of lighting conditions and symbiotes in this area stimulate the growth of nearly of 20 kinds of orchids.

The statistical processing of the results of the investigation of soils shows that hard data of differences in parameters exist only between juniper woods and all the other fields, and also between recreationally loaded and the others.

There were no hard data in differences revealed between the value of physicommechanical characteristics of wood soils, of bush and meadow biocenoses.

## EXPOSITION OF AREA OF RESEARCHES



Figure. 5. *Chernorechye, the Western Crimea* (a catchment basin of the river Chernaya)

## 8.2. Population characteristics of representatives of orchidaceous.

During the expeditionary works of years 2005-2006 which were held out in a catchment basin of the river Chernaya, about 150 sample areas have been laid 2 square meters each. The density of populations of representatives of the orchidaceous were calculated on these areas, also the distance between the species, the height of their shoot systems. With the help of a routing method the distance between the groups of orchidaceous of the given kind were defined, also the total registration of the quantity was carried out, especially of the rare kinds. The category of a rarity was found with the help of reference books [6]. Some data received by A.Ivashkova [4] were used when studying the dynamics of the density of the populations. The high emphasis was placed on the analysis of character of change of the quantity of all the studied orchid species since exactly the data of the dynamics give some general views about the ecological state of species.

The results submitted in table 2 show that the maximum of density is typical for the *Orchis picta*, *Orchis purpurea* and *Anacamptis pyramidalis* (8-13 species/m<sup>2</sup>) whereas for *Orchis punctulata*, *Ophrys oestriifera* and *Ophrys taurica*, *Cephalanthera longifolia* and *Cephalanthera rubra*, *Comperia comperana*, *Himantoglossum caprinum* this index does not exceed 2 species/m<sup>2</sup>, and *Ophrys apifera* met in 2005 were very few. The most dense groups are the plants of such kinds, as *Orchis picta* and *Orchis purpurea*. The distance between the species is 16-18 cm, and *Orchis punctulata* - 51 cm. Also *Orchis simia* and *Limodorum abortivum* can be related to the plants with a group dispersion.

*Orchis picta* and *Anacamptis pyramidalis* (1-4 м) are characterised by the greatest density of groupings, whereas *Epipactis helleborine* (79 м) are most separated. *Ophrys apifera* (Ist category) can be referred to the most rare ones.

Some from the species submitted in the work are described only for the Southern Coast of Crimea. For the Western Crimea their population characteristics and allocation were investigated for the first time (e.g. *Orchis punctulata* and *Ophrys apifera*).

In the process of the analysis of the received data, it was established that in the investigated area *Anacamptis pyramidalis* and *Orchis tridentata* are achieved in the biggest quantities, whereas *Epipactis helleborine* are very few.

The investigation of density and number of populations of the orchidaceuos are necessary for forecasting their state, which is confirmed by the data found out by V.V. Tyagniryadko [13] which claim that the character of pollinating is determined by the set of factors, from which spatial structure of population and coenotic conditions of growth are the most important.

According to the table 2, 12 kinds of orchids, out of 17 investigated species, had increased the density in 2006 in comparison with the year 2005, 2 kinds had stable index, and 3 had their values of density decreased.

Taking into account the fact that the occupied area for last years wasn't reduced (except for glade of Junior Academy of Science), it is possible to think that the general ecological state of the plant of family of *Orchidaceae* in a catchment basin of the river Chernaya is satisfactory.

Besides population characteristics of orchids natural complexes, characteristic for this or that kind were investigated. These data are submitted in table 2.

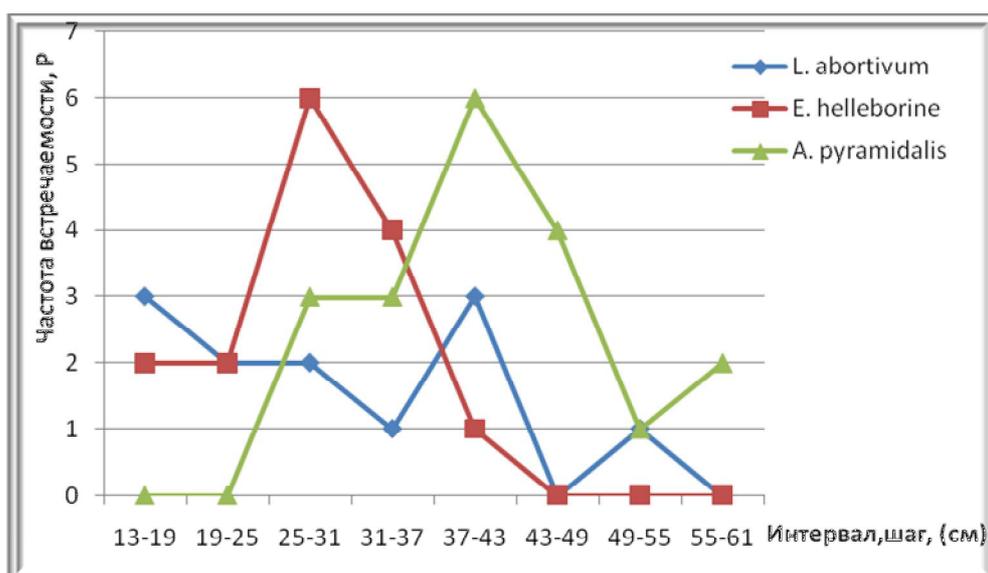
During field researches on the test areas dimensional structure of all kinds of orchids was determined. The received data are submitted in tables 3-6 and variational curves (fig. 6-9).

From the data it follows that normal allocation in dimensional structure, and also to the maximum conformity between frequency of occurrence and average value of height of sprout systems corresponds to the *A. pyramidalis* (tab. 3, fig. 6), *C. comperana* (tab. 4, fig. 7), *C. longifolia* and *C. rubra* (tab. 6, fig. 9), and also *O. simia* and *O. punctulata*. The volume of sample for creating curves make up from 50 up to 100 species. It gives the basis to assume, that the conditions of a catchment basin of the river Chernaya for the listed species are optimal.

Tab. 3. Initial data and the average values of the height of the shooting systems *Limodorum abortivum*, *Epipactis helleborine*, *Anacamptis pyramidalis*

Interval	The frequency of the object popularity		
	<i>L. abortivum</i>	<i>E. helleborine</i>	<i>A. pyramidalis</i>
13-19	3	2	0
19-25	2	2	0
25-31	2	6	3
31-37	1	4	3
37-43	3	1	6
43-49	0	0	4
49-55	1	0	1
55-61	0	0	2
The average height of the stalk, sm	27,57	24,35	40,35

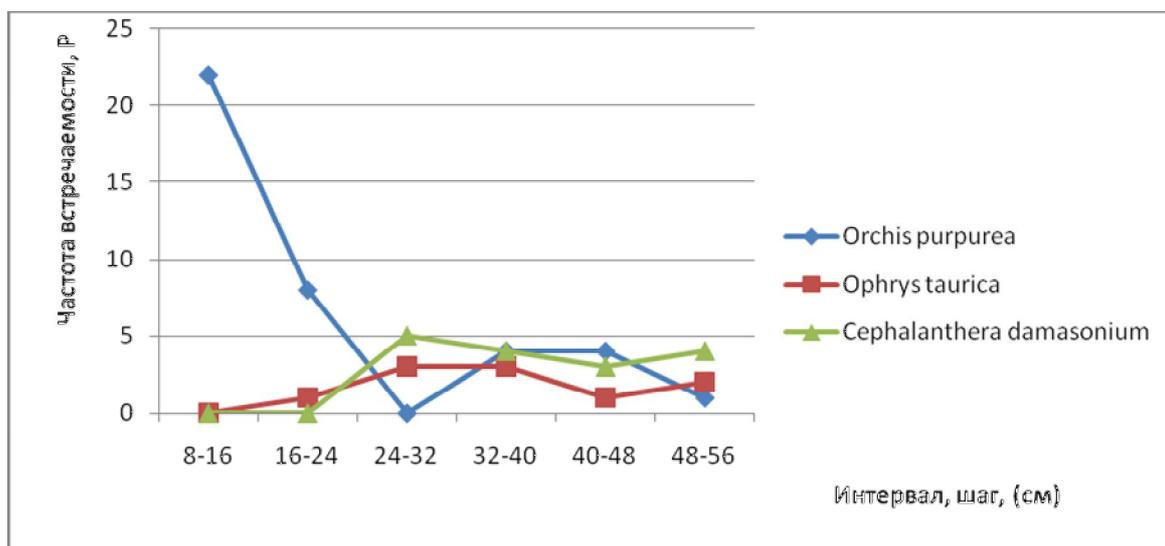
Fig. 6: Variational curve heights of the shooting systems *Limodorum abortivum*, *Epipactis helleborine*, *Anacamptis pyramidalis*



Tab. 5. Final data and the average values of the shooting systems *Orchis purpurea*, *Ophrys taurica*, *Cephalanthera damasonium*

Interval	The frequency of the object popularity		
	<i>Orchis purpurea</i>	<i>Ophrys taurica</i>	<i>Cephalanthera damasonium</i>
8-16	22	0	0
16-24	8	1	0
24-32	0	3	5
32-40	4	3	4
40-48	4	1	3
48-56	1	2	4
The average height of the stalk, sm	20,86	36,2	31,4

Fig. 8. Variational curve heights of the shooting systems *Orchis purpurea*, *Ophrys taurica*, *Cephalanthera damasonium*



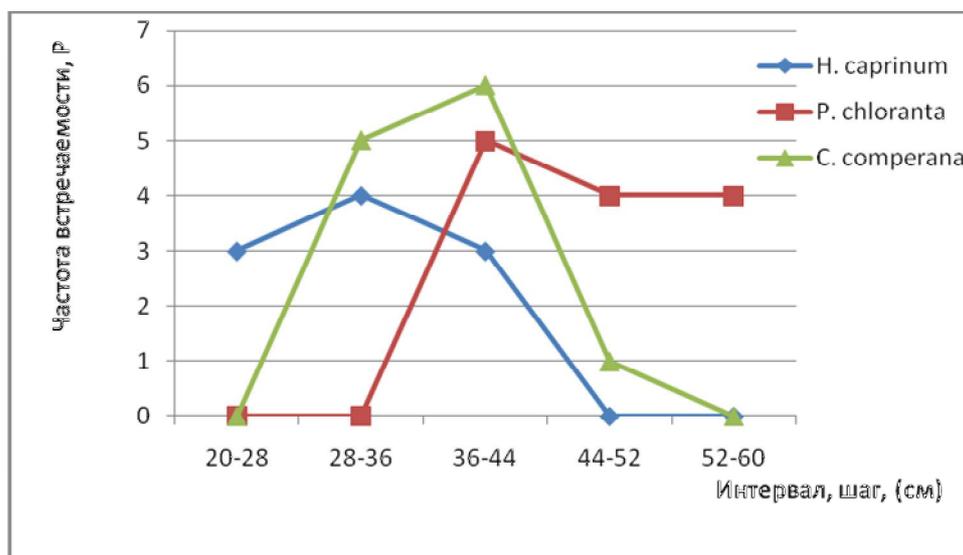
Tab. 4. Initial data ant the average values of the height of the systems  
*Himantoglossum caprinum*, *Platanthera chloranta*, *Comperia comperana*

Interval	The frequency of the object popularity		
	H. caprinum	P. chloranta	C. comperana
20-28	3	0	0
28-36	4	0	5
36-44	3	5	6
44-52	0	4	1
52-60	0	4	0
The average height of the stalk, sm	32	47,30	36,86

Fig. 7.

**Variational curve of heights of the shooting systems**

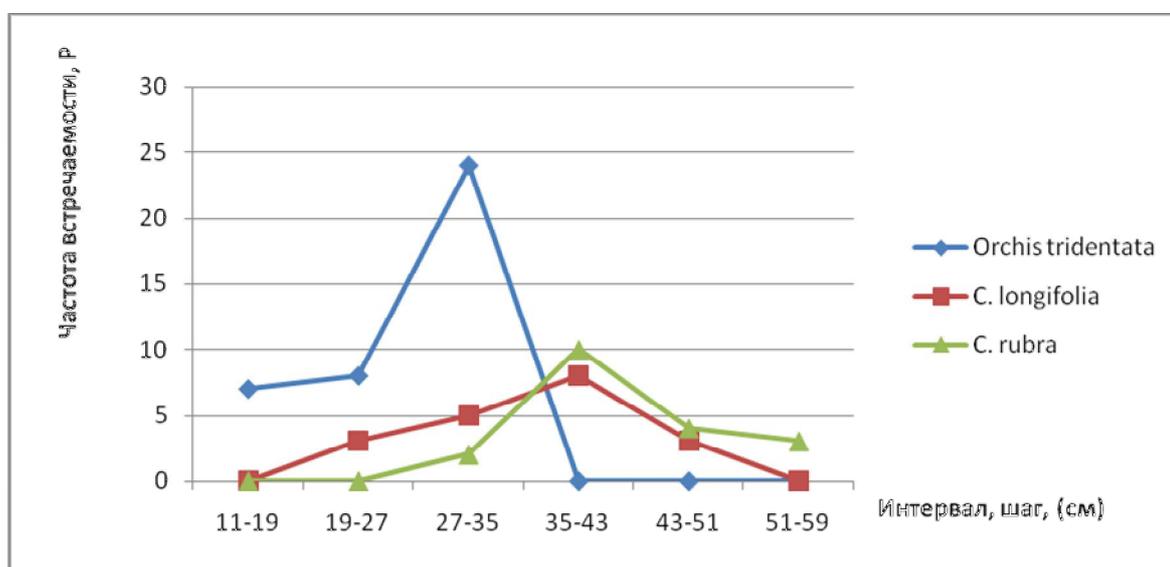
***Systems Himantoglossum caprinum, Platanthera chloranta, Comperia Comperana***



Tab. 6 Initial data ant the average values of the height of the systems *Orchis tridentata*, *Cephalanthera longifolia*, *Cephalanthera rubra*

Interval	The frequency of the object popularity		
	<i>O. tridentata</i>	<i>C. longifolia</i>	<i>C. rubra</i>
11-19	7	0	0
19-27	8	3	0
27-35	24	5	2
35-43	0	8	10
43-51	0	3	4
The average height of the stalk, sm	21,17	41	43,41

Fig. 9. Variational curve heights of the shooting systems *Orchis tridentata*, *Cephalanthera longifolia*, *Cephalanthera rubra*



### 8.3 Physiologic-biochemical characteristics of orchids representatives.

For the definition of a physiological condition of the orchids growing on a meadow (conditionally - "light") and in a bush in conditions of shading (conditionally - "shadow") we have collected carvings of vegetative bodies *H. Caprinum* and *A. pyramidalis*. For the definition of a universal parameter of a power condition - ATPase activity, tests were placed in a thermos with ice, and the further analysis was made in laboratory. The first phase of the analysis was directed on the maximal activation of activity of enzyme of ATPase (addition of salts K, Na, Mg, and also ATP and incubation of tests at  $t^{\circ}=37^{\circ}$ ). In the second phase we achieved the color reaction on the segregated by enzyme of ATPase from ATP phosphorus. Color reaction developed at addition in the test of molybdate ammonium and an ascorbic acid. The level of ATPase activity was found regarding a standard solution of phosphorus on density of painting of tests on the photoelectrocolorimeter. All analyses were carried out in fivefold frequency. It was established that vegetative bodies of representatives of the orchids sprouting in blackout are characterized by smaller values of ATPase activity in comparison with the plants of well shined habitats. It is obvious that replacement of orchids from meadow biotopes into marginal tree belts due to the significant recreational loading renders negative influence not only on habitual, but also on physiological characteristics.

The second major component in definition of a physiological condition of plants is definition of concentration of pigments (Tab. 7).

For this purpose the tests of carvings of vegetative bodies of the same representatives

of orchids were fixed in 80 % acetone in field conditions. Tests were placed in lightproof packages and delivered in the laboratory for the further research. During the spectral analysis it was established that the relation of a chlorophyll "a" to a chlorophyll "b" considerably decreases (Tab. 8, рис.10). It can be explained by the fact that in conditions of shading the amount of a chlorophyll "b" which is active at reduction of the length of light waves decreases whereas the contents of a chlorophyll "a" does not change considerably. It leads to the increase of total concentration of chlorophylls. Such kind of reaction can be considered as indemnification of decrease in a level of the light exposure, directed on stabilization of physiological activity of plants [1].

Decrease in concentration of carotinoids in fabrics of vegetative bodies of both kinds of the plants growing in a bush in comparison with those growing on a meadow was registered.

It is known that carotinoids provide adaptive reactions of an organism [2].

Proceeding from the received materials it is possible to assume that in shadow habitats both representatives of orchids have a reorganization in work of the physiologic-biochemical mechanisms directed on stabilization of physiological activity.

It was noted that the amount of flowers in inflorescence *H. Caprinum* on a meadow reaches on the average 13 whereas in shading - 9, in *A. Pyramidalis* on a meadow - 45 and in shading - 38.

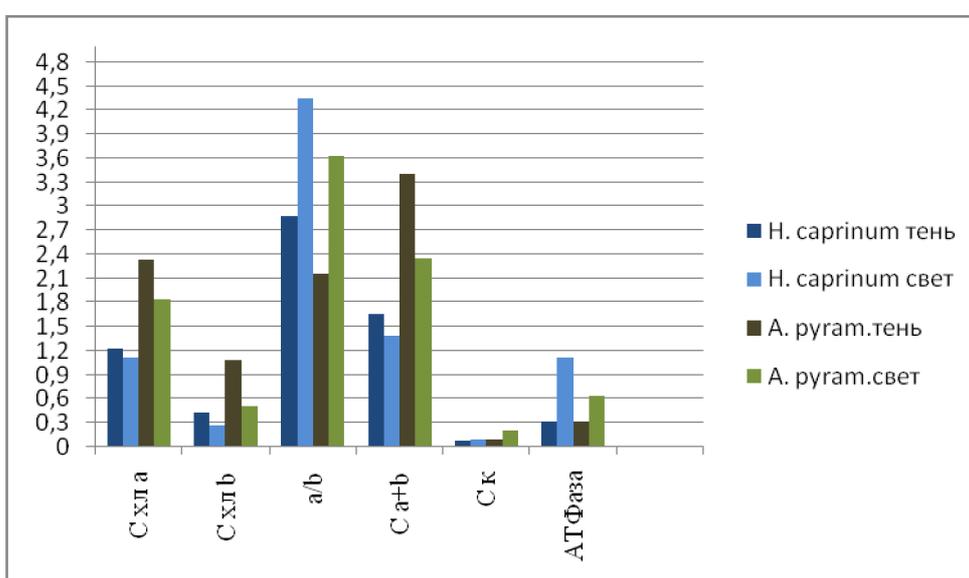
Decrease in amount of flowers in inflorescences of the orchids growing in a shadow up to 30 % speaks about reduction of generative opportunities of plants.

**Tab.7 Pigments**

№ n/n	Species	E <sub>415</sub> (Carotin)	E <sub>720</sub> (Chlorine)	m raw material mg	U electr. ml
1	H. caprinum (shadow)	0,19	0,08	306	13,5
2	A. pyramidalis (shadow)	0,4	0,225	210	11,2
3	H. caprinum (light)	0,27	0,1	610	19,6
4	A. pyramidalis (light)	0,14	0,075	174	10,8

**Tab. 8 Contents of chlorophylls a (C a, %), b (C b, %), their sums (C a+b, %), the relation of (a/b) carotinoids (C κ, %) and ATPase activity (мкг Р-мин г fiber) in carvings of leaves of H. caprinum and A. pyramidalis from different areas depending on a level of light exposure**

Species	The Level is lighted.	C Chl a	C Chl b	a/b	C a+b	C κ	ATPase
H. caprinum	shadow	1,23	0,43	2,88	1,66	0,08	0,32
H. caprinum	light	1,12	0,26	4,34	1,38	0,09	1,12
A. pyram.	shadow	2,33	1,08	2,16	3,41	0,09	0,32
A. pyram.	light	1,83	0,51	3,62	2,34	0,20	0,64



## 9. CONCLUSIONS

1. The results of biochemical analyses of carvings of vegetative bodies of orchid's representatives testify significant decrease in their physiological activity at replacement from meadow into marginal tree belt habitats.
2. For the first time the population characteristics of *Ophrys apifera* and *Orchis punctulata* are described, earlier registered only for the Southern coast of Crimea.
3. It is noted that for the last two years the general ecological condition of area of researches has a little improved. It has rendered beneficial influence on number of every species, even the most rare kinds (*H. caprinum* and *O. punctulata*).
4. Decrease in amount of flowers in inflorescences of orchids growing in a shadow up to 30 % speaks about reduction of generative opportunities of plants.
5. It is evident from received populational characteristics that from 17 studied kinds in 2006 in comparison with 2005 12 kinds have increased their density, 2 kinds have stable parameters, and the values of density of 3 kinds have a little decreased.
6. It is possible to conclude that exactly these 3 kinds - *O. simia*, *A. pyramidalis* and *C. rubra* require special protection.

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