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Biocomplex of diseases and pests, typical for interspecific hybrids of Lavandula with various number of genomes was investigated in course of the research. Susceptibility of Lavandula and Lavandin specimens, cultivated in greenhouse were compared as well. Principal measurements of plant protection, necessary for improvement of Lavandin indoors were also determined.

Key words: *oil-bearing crops; plant protection; signs of susceptibility; phytopatogens; Lavandin; nematode.*

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POLLINATION FEATURES OF *ALLIUM SICULUM* SUBSP. *DIOSCORIDIS* WITHIN CRIMEA NATURAL PRESERVE

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Introduction

As traditional nature conservation measurements, aimed at preserve and renewal of biodiversity, study of pollination and seed formation (especially rare cultivars) with the help of insects-pollinators in nature preserves are of great importance. Especially protected natural territories is a special study model of exist historically developed, balanced concervative ties

in system palt-animal. One of the most rare and poorly studied cultivars of East Europe flora is *Allium siculum* Lindl. subsp. *dioscoridis* (Sm.) K. Richt.[1] (*Amaryllidaceae*).

A. siculum subsp. *dioscoridis (Nectaroscordum bulgaricum* Janka) is a relict cultivar growing on north-east border of Crimean- Balkan-Asia Minor habitat [3, 4]. Only the Crimea presents localities of its growing in Russia (about 10 localities). It enters the Red Data Book of Moldova (category – Endangered) [6], the Red Data Book of Ukraine (category – rare) [5], the Red Data Book of the Republic of Crimea (category – rare). It is highly ornamental, in some countries of Balkan Peninsula seeds of this plant are commonly used as seasoning.

Objects and methods of the research

Study object is a coenopopulation of *A. siculum* subsp. *dioscoridis (Nectaroscordum bulgaricum* Janka) growing on territory of the Crimean natural preserve (mountain range Konyok massif Babugan of Main range of the Crimean Mountains).

Long-term dynamics of blooming and fruit-bearing is presented according to data "Nature records of the Crimean natural preserve" for 1986-2014 [3] and field authors` observation. Pollination efficiency was determined applying the following method: a part of inflorescence was isolated from insect effect by caproic caps to identify self-pollination capacity, in the end of blooming allowing for parameters of fruiting and seed formation of the same specimen in the coenopopulation we analyzed efficiency of open and isolated inflorescences.

To investigate species composition of visitors on *A. siculum* subsp. *Dioscoridis* flowers, we captured insects during blooming, mainly from 9:30-12:00 in spite of weather conditions. They were put into cupping glass with fixator. Totally there were 100 insect specimens. Capture was sample as some of them belong to dominants and possible to identify without it.

Results and discussion

Study coenopopulation locates on north macroslope of the main range of the Crimean Mountains in mixed forests on the pass Kebit-Bogaz 525 m above the sea level on 25° slope within coenosis *Fraxinus excelsior* subsp. *excelsior* + *Acer hyrcanum* subsp. *stevenii* – *Allium siculum* subsp. *dioscoridis*. At the same time 34 cultivars of 17 families can be found in here. Soils are brown of mountain-forest type. The first layer is 10 m high, the second – 5, maximum herbaceous layer height is 102 m above the sea level and minimum – 12 sm. The total projective surface makes 40%.

A. siculum subsp. *Dioscoridis* belongs to polycyclic monocarpic plants with perennial life cycle [4]. Average vegetation density of coenopopulation makes 19,1 specimens per m^2. Age range is sinistral, absolute maximum is fixed for virginal individuals. Population of generative specimens (g) ranges from some specimens to 2000 [4, 5]. In terms of coenopopulation area of 800 m^2 is fenced off for long-term *A. siculum* subsp. *Dioscoridis* observation (constant sample plot – CSP). Investigating population dynamics of generative specimens of *A. siculum* subsp. *Dioscoridis* and its fruiting on CSP "Kebit-Bogaz" the principal peaks of its generative specimens population were registered (maximum population) in 1992, 1995, 2000, 2005, 2011; recession (minimum population) – 1991, 1994, 1997, 2001, 2004, 2008, 2014. The main fruiting peaks happened in 1994, 1999, 2002, 2011 and 2014, recession – 1995, 2000, 2013, 2015 (fig.1).

[1] Taxon name corresponds to annotate checque-list of the Crimean vascular plants: Yena A.V. Natural flora of the Crimean peninsula: monograph – Simferopol: N.Oreanda, 2012. – 232 s. [1].

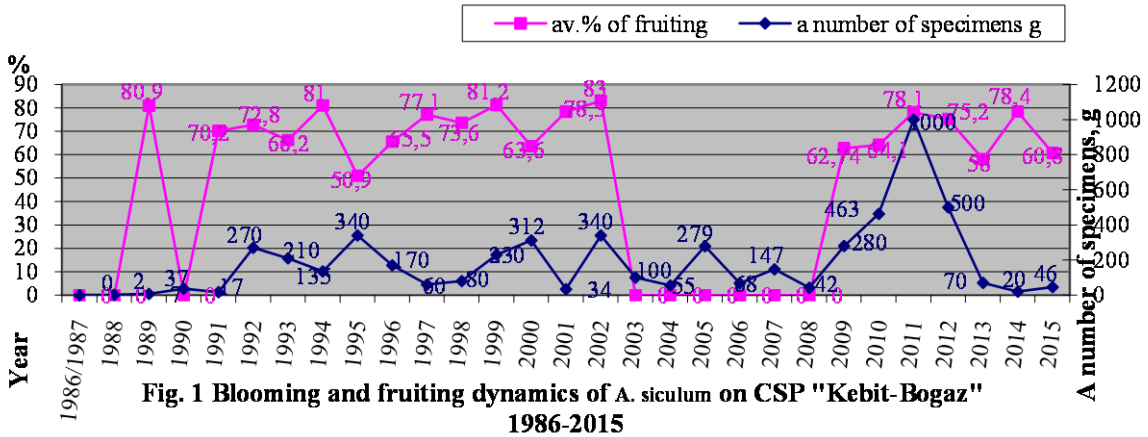

Fig. 1 Blooming and fruiting dynamics of A. siculum on CSP "Kebit-Bogaz" 1986-2015

Fruiting data for period 2003-2007 is absent. In this way peaks/recessions of generative specimens population and fruiting don`t indicate exact periodicity and range from 3 to 7 years. At the same time there is no dependence between average percent of fruiting and increase the number of generative specimens on the site (fig.1). Maximum number of generative specimens on the area was fixed in 2011 and made 1000 specimens, minimum – the third year after fencing (1988) and made only 2 specimens. Fruiting rate within coenopopulation ranges from 50,9 to 83% (fig.1) what is rather high. In this way according to our long-term observations some individuals in the coenopopulation have fruiting rate about 40% and no more than 88% in case of open pollination.

Blooming of *A. siculum* subsp. *Dioscoridis* coincides with period of +15° average air temperature, it lasted 22-35 days depending upon weather [4, 5]. Inflorescence is a multiflowered friable umble, bundled and drooping, that has got 1045 greenish and white large (12-15 mm) flowers on long pedicles (up to 60 mm), widening like a disk to the point of flower attachment. Floral envelope consists of pulpy pearl petals with 3-7 petals, colored with white greenish and pink touch. Color, intensive fragrance and a lot of nectar attract insects. Anthers are not covered, pollen is easy to move away and insects landing on flowers contact it in this or that way. Open pollination is typical for *Allium*, where pollen agents could be different insect species, mainly hymenopterous like bumblebees, bees; but if pollen gets stigma out of inside stamen anthers self-pollination is possible [2].

We could investigated *A. siculum* subsp. *Dioscoridis* level, efficiency and types of self-pollination applying inflorescence isolation from pollen agents in natural conditions. In case of isolated flower-bearing stems regular inflorescences with flowers could form, their fruiting parameter ranged from 34,0 til 66,7%, and on average it made 52%. Therefore autogamy level is rather high what provides regeneration of this species even under unfavorable conditions. Besides, geitonogamy is an often phenomena when representatives of Diptera – *Empis livida* L. are quite active pollen agents from one flower onto stigma of another one (fig.2).

Fig.2 *Empis livida* on inflorescence of *A. siculum* subsp. *dioscoridis* (photo by rudenko M.)

In general, Diptera that better prefers more humid and shadowed locations mainly *E.livida* can be found on inflorescences whether it`s cloudy or sunny, and not-moving if to disturb. Males and females have equal rate on flowers. On average one representative of *Empididae* approximately 5 flowers per one flight, creeping the whole inflorescence. Specimens of this species make mass landing on *Smirnium perfoliatum* L. (Apiacea) flowers and some other cultivars growing withing and out of *A. siculum* subsp. *Dioscoridis* coenopopulation. At the same time geitonogamy involves representatives of Hymenoptera, that is genus *Bombus, Andrena, Halictus, Dolichovespula, Paravespula. Bombus haematurus* Kriech with single visit of about 4 flowers in the inflorescence, *Dolichovespula sylvestris* Scop. and *Paravespula vulgaris* L. – 1-3 flowers, *Andrena nitida* Mull. and *Halictus* sp. – 2–3 flowers.

Based on these findings we can conclude that insects-pollinators are necessary for better fruiting and higher level of pollination. Otherwise we have got decrease of species seed productivity with difference of average parameters of fruiting in isolated and opened inflorescences makes: av. .$\%_{min}$=16,9; av.$\%_{max}$=16,3 (table 1).

Table 1

Average fruiting parameters of isolated and open inflorescences of *A. siculum* subsp. *Dioscoridis*

Parameter, %	Autogamy	Open pollination	Parameters difference
Average minimum (cp.$\%_{min}$)	34,0	50,9	16,9
Average maximum (cp.$\%_{max}$)	66,7	83,0	16,3
Average perennial	52,0	71,4	19,4

Insects taken on flowers of *A. siculum* subsp. *Dioscoridis* during field period of 2010-2015 belong to 16 species 10 genera 6 families and 2 orders - Diptera: Empididae and Hymenoptera: Vespidae, Andrenidae, Halictidae, Anthophorida, Apidae. Species composition of *A. siculum* subsp. *Dioscoridis* pollinators and their food chains are presented in table 2.

Table 2

Species composition of *A. Siculum* visitors on Konek (2010-2015)

№	Species	Frequency rate (visual)	Food ties
1	2	3	4
1.	*Dolichovespula sylvestris* Scop.	often specimens g > 400	Predator (*Andrena*, *Halictus*, *Empis* amd etc.), nectare consumer, pollinator
2.	*D. media* F.	single	Predator (*Andrena*, *Halictus*, *Empis* and etc.), nectare consumer, pollinator
3.	*Paravespula vulgaris* L.	often specimens g > 400	Predator (*Andrena*, *Halictus*, *Empis* and etc.), nectare consumer, pollinator
4.	*P. germanica* F.	single	Predator (*Apis*, *Andrena*, *Halictus*, *Empis* and etc.), nectare consumer, pollinator
5.	*Vespa crabro* L.	single	Predator (*Andrena*, *Halictus*, *Empis* and etc.) nectare consumer, pollinator
6.	*Andrena haemorrhoa* F.	single	Nectare consumer, pollinator
7.	*A. nitida* Mull.	Mass landing	Nectare consumer, pollinator
8.	*Nomada goodeniana* Kirby	single	Nectare consumer, kleptoparasite *Andrena nitida*, accidental pollinator.
9.	*N. ruficornis* L.	single	Nectare consumer, kleptoparasite *Andrena haemorrhoa*, accidental pollinator
10.	*Anthophora plumipes* Pall.	often specimens g > 400	Nectare consumer, pollinator
11.	*Apis mellifera* L.	mass specimens g > 400	Nectare consumer, pollinator
12.	*Bombus haematurus* Kriech.	mass	Nectare consumer, pollinator
13.	*B. terrestris* L.	single	Nectare consumer, pollinator
14.	*B. hortorum* L.	single	Nectare consumer, pollinator
15.	*Halictus* sp.	mass specimens g > 400	Nectare consumer, pollinator
16.	*Empis livida L.*	mass	Nectare consumer, pollinator

According to conducted observations we found out that species composition and dynamics of insects visiting within coenopopulation range depending upon number of *A. siculum* subsp. *Dioscoridis* generative specimens – more flowers-more insects – more insect variety.

Since 2010 till 2012 a number of generative specimens made more than 400 (g specimens .> 400) on the experimental area all species pointed in the table 1 were found out. Visually analyzing the following species were fixed on flowers: *Apis mellifera*, *Bombus haematurus, Andrena nitida, Paravespula vulgaris*, *Dolichovespula sylvestris, Empis livida.*

Dynamics of insect visiting the inflorescences per 1 hour:

Hymenoptera: Apidae, the highest rate of visiting – 54%,

Vespidae – 17%,

Andrenidae – 12%,

Halictidae – 3%,

Anthophorida – 1%;

Diptera: Empididae – 13% (fig.3, A).

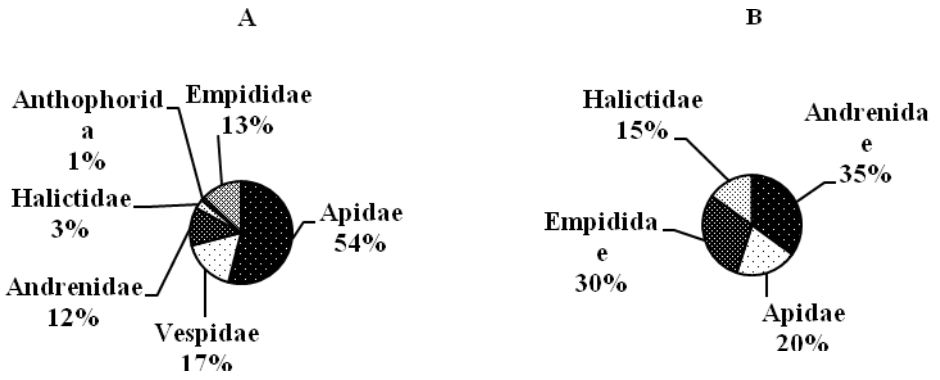

Fig. 3 Dynamics of insects from different families visiting the *A. siculum* subsp. *Dioscoridis* per 1 hour observation, specimens g > 400 (A) and g specimens < 100 (B)

Insect visiting of one inflorescence is much more intensive – up to 74 landings per hour (visit frequency wasn`t considered). Workers of *Apis mellifera, Bombus haematurus* and *Empis livida* were found as the most mass species-pollinators.

Having decreased a number of inflorescences less than 100 specimens in 2013-2015 caused abrupt reduction of inflorescence visitors – no more than 3-4 visits per hour. Predators Vespidae, kleoparasites and pollinators Anthophorida weren`t fixed on experimental area at all. The most mass pollinator *Apis mellifera* wasn`t found as well. *Bombus haematurus, Andrena nitida, Halictus* sp. and *Empis livida L.*, while *Andrena haemorrhoa* had single landing, and *Bombus terrestris* was fixed on *Smirnium perfoliatum* growing next experimental area (fig.3B).

Conclusions

As a study result *A. siculum* subsp. *dioscoridis* belongs to antecological complex of the forest entomophilous plants with a wide range of pollinators and possible way of self-pollination (autogamy and geitonogamy). In case of autogamy fruiting rate can reach 67%, but open pollination – 83%, what proves high efficiency of pollination. Insects as pollen agents in case of geitonogamy and open pollination play rather important role. The most effective pollinators are *Bombus haematurus, Andrena nitida, Halictus* sp., *Apis mellifera u Empis livida.*

Findings could be useful for development of preservation and renewal strategies concerning *A. siculum* subsp. *Dioscoridis* as a component of natural biotope. Recommendations in introduction of this rare and ornamental plant are also based on study results.

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The article covers analysis of long-term blooming and fruiting dynamics, and correlation between these processes of a rare protected *Allium siculum* cultivar, subspecies Dioscorida. Type of pollination and its efficiency in case of mutual work with insects and without were discussed within research as well. This work presents long-term dynamics of insect attendance at various families of *Allium siculum* inflorescence allowing for maximum and minimum number of generative specimens. For the first time a list of insects which pollinate just this very cultivar and their food chains were annotated in here.

Key words: *insects-pollinators; Allium siculum subsp. Dioscoridis; Crimea Nature Preserve.*