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Ecological analysis fauna of *Vespa crabro* L. (Hymenoptera, Vespidae) in conditions of Nakhchivan autonomous republic

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Abstract
Based on the research which was held in the Nakhchivan Autonomous Republic in 2014-2017, it was found out that the *Vespa crabro* L. scaly wasp appears in late April and early May when an average daily temperature is 20 ºC. From the third decade of May, the wasp begins to lay eggs, and the first larvae appear at the end of the third decade of May. Their development continues approximately 14 days. Young worker wasps start their foraging activities a few days after they leave the pupa. Going outside they move around the nest for a few minutes and fly away. Hornets mainly feed their larvae by bees. According to our information their mass appearance starts on the third decade of June and continues until the first ten days of September.

Keywords: Vespoid wasp, hornet, fold-winged wasps, *Vespa crabro* L

Introduction
The subfamily of the fold-winged wasps-vespid is Vespinae the largest in the family of Vespidae. It includes about 9,000 species from more than 200 types [1]. Intensive human economic activity and climatic conditions have left a characteristic imprint on the fauna, biology and ecology of the folded winged species. Recently there has been a catastrophic decline in the population of wasps, caused by intense pollution of the environment. In addition, a significant contribution to the reduction of species diversity and numbers is caused by the destruction of their nesting sites (plants and shoots with a hollow and soft core are cut and burned, plots of land with wasp colonies are plowed), and their deprivation of food resources. Reducing the diversity of species of this group of insects leads to a depletion and degradation of natural plant communities, a decrease in the yields of various types of agricultural crops.
One of the most important practical issues in the field of plant protection is the development of a biological method for the control of pests of crops, based on the use of entomophagous. But the development of these methods is impossible without studying biology, ecology, fauna and the importance of local entomophagous.
In spite of the important role played by weight-crops in natural processes as entomophagous and as pollinators of flowering plants, their faunal composition, ecology, distribution and importance in the Nakhchivan Autonomous Republic are still poorly examined. Therefore, the questions of revealing the species composition of the fauna of entomophagous, studying their biology, geographical distribution, ecological features are of great theoretical and practical importance.
Moreover, insufficient information on these issues shows that there are practically no works devoted to local fauna of wasps including also the fauna of wasps from the superfamily Vespoidea in the Nakhchivan AR. The main purpose of this research was to investigate some of the bioecological features of *Vespa crabro* in Nakhchivan AR and to identify the phenology of this species.

Material and methods
Collection of material (adults) was carried out in different landscapes and biotopes (gardens, cultural fields, forest, heath, forest-heath, subalpine and alpine meadows, etc.). The treatment of faunal material was carried out according to the generally accepted methodology [2, 3, 4]. The most common and widespread method of collecting insects was mowing with entomological net in various plant associations with subsequent sampling.

The collection was conducted on flowers, bushes, tree branches and other tiers of vegetation. For 5-10 strokes of the net, a sufficient amount of material was collected on a flowering shrub. We used both a stationary method of research (collections on plants) and a route method, which consisted of examining the site and catching all the vespoid wasps appeared within 15-20 minutes. Easily recognizable species were recorded without catching. For a more accurate explanation of their species, a part of the larvae and pupa were grown and developed to an adult state.

Results and discussion

Vespa crabro widespread type. The largest (up to 30 mm) and the most poisonous representative of the public wasps – a hornet, most of the active period consists of one female founder (uterus) and several dozen worker species. The head of this species is yellow or yellow-red, the breast is black, and the back of the head and the spot around the eyes are black. Pronotum from above, sometimes scutellum and two longitudinal strips on the mid-stripe yellowish-red, abdomen in the back half is yellow, with black spots (Pic 1. (a, b)).

a b

Pic 1(a, b): *Vespa crabro* L. (Hymenoptera, Vespidae)

According to our observations, overwintered female hornets appear at the end of April and at the beginning of May at an average daily temperature of 20 ºC, that is, when the temperature becomes stably warm.

Each female founder at first feeds on the nectar of the first honey-bearers (foalfoot, willow, etc.). At this time they are looking for a place to nest. During this period, they can be found everywhere: in meadows, slopes of gullies, in the forest, in the garden, on the south side of the walls of houses, sheds and other structures.

The horn of the nest hangs to the branches of trees and bushes, as well as under the attics of houses. The favorite place is the tree hollows. The shell of the nest is fragile, because the material is rotting stumps, twigs of a young dog rose. Hornets of hornets have a yellowish-brown, brown color. The female founder starts to build the nest herself. The honeycomb is attached to the substrate with a foot. The laying of eggs in the study zones has been observed since the end of the third decade of May. Studies have shown that the female lays about 12-13 eggs and at the same time it continues to build a nest, and also engaged in foraging activities.

Under good conditions (in favorable climate and in abundance of food), the number of hornets can increase to the end of the second period of the development cycle (from July to August) by 100-150 individuals.

From the phenological table it can be seen that the female founder appears approximately at the end of April - in early May. From the third decade of May, the wasp begins to lay eggs. After 6-7 days, that is, at the end of the third decade of May, the first larvae appear. From the first decade of June, the hornet's larva begins to weave a cocoon. Their development lasts approximately 14 days and from the second decade of June, infertile female workers, who take care of all further care for the family, appear. Young workers start their foraging activities a few days after they leave the pupa.

Table 1: The phenological calendar of the *Vespa crabro* L. in the conditions of Nakhchivan AR (2014-2017)

Period	Months and decades																					
	April			May			June			July	August					September			October			November
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
I period			(♀)	(♀)	(♀)	♀ o □	o □ ◯	o □ ◯	o □ ◯	o □ ◯	o □ ◯	o □ ◯	o □ ◯	o □ ◯								
II period								+	+ o ▬ ◯ ┼	+ o ▬ ◯ ┼	+ o ▬ ◯ ┼	+ o ▬ ◯ ┼	+ o ▬ ◯ ┼	+ o ▬ ◯ ┼	o ▬ ◯ ┼							wintering
III period								o □ ◯ +	o □ ◯ +	o □ ◯ +	o □ ◯ +	o □ ◯ +	o □ ◯ +	o □ ◯ +	□ +	+	+	♀♂	♀♂	┼┼	(♀)	

(♀) – wintering female founder

◯ - mass appearance of pupa

♂ - males

○ - eggs

□ – larvae

◯ - pupa

▬ - mass appearance of larvae

┼ - mass fly of worker wasps

┼┼ - mating

\+ - worker wasps

Going outside they move around the nest for a few minutes and then fly away. Their larvae are fed by insects, mainly bees. In the nests of hornets, the maximum number of eggs (60-70% of the general quantity) is observed from the third decade of June to the first ten days of September. Mass appearance of larvae can be traced from the third decade of June to the first decade of September. The number of adults varies by months. Mass appearance of them according to our data happens on the third decade of June, which continues until the first decade of September. Observations showed that foraging workers in the first days in the nest do not have nectar, and then they begin to bring insects (most honey bees) and other protein foods of animal origin necessary for larvae.

According to Kadymov a hornet can kill per a day 25-30 bees, causing great harm to beekeeping in Lankaran district [5, 6]. The author notes that, the hornet, having made several circles over the hives, sits near the tap and begins to lie waiting for the victim. Grabbing the bee, he kills it and sucks the nectar from the honey crab. Then he takes off to the nearest tree or plant and, clinging to the branch with his back legs, hanging upside down, nibbles his head, legs, antennae and abdomen of the victim. All of this is performed by the hornet for 2-3 minutes.

The relationship between a hornet and a honey bee is the relationship of a predator and a victim. According to our observations in the conditions of Nakhchivan AR, hunting of bees by hornets begins at 9 a.m., and more is exterminated from 11 a.m. to 13 p.m. and from 16 p.m. to 19-20 p.m.

By the autumn, from the third decade of September, a young generation of males and females appears in the nest. They fly away and from the second decade of October start pairing. Males, after fertilization of females, perish, and young females climb into secluded places for the winter and fall into winter torpor. Founder of the nest, working individuals die, the colony disintegrates. In the spring, the female fertilized in the autumn starts to create its own family.

The daily dynamics of summer showed that hornets are active from 9:00 to 13:00 hours. After the fall of heat, the activity of the wasps rises and ends by 20:00 hours. Observations on the behavior of vespoid wasps have shown how they are located at some distance from each other and synchronously vibrate with wings. This activity lasts about five minutes. It is established that by this they produce ventilation in the nest.

It is believed that all workers in the nests, at least once in their life participate in the ventilation of the nest. Sometimes young queens participate in it, but males never do [7].

Many insects become victims of hornets; they are able to kill their victims by stinging or simply with jaw. Adult hornets are fed with honey, fruit and plant juice, flies, cicadas, etc. Larvae are nourished with protein food, consisting of flesh of insects. Catch various Coleoptera, Orthoptera, Dragonfly, Hymenoptera species, in particular bees; German hornets often become victims of hornets.

As a result of researches it was revealed that, *Vespa crabro* sometimes damages beekeeping, but the role of this species is great in biodiversity.

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