Atalanta **48** (1-4): 170-173, Marktleuthen (1. September 2017), ISSN 0171-0079

Notes on the biology of the Arctic Apollo *Parnassius arcticus* (Eisner, 1968) in Yakutia

(Lepidoptera, Papilionidae)

by

Yuri Bakhaev

received 6.IV.2017

Abstract: This article presents information on the life history of the Arctic Apollo *Parnassius arcticus* (Eisner, 1968) in the Suntar-Khayata Mountains of Yakutia. Included are descriptions of the imago phenotype, its biotopes, phenology and flight hours at day, also observations of the nectaring resources of the imago and the hostplants of the larvae are made. Images of the preimaginal stages (eggs, larvae, cocoon, pupae) are pictured. The Arctic Apollo has winter diapause in the pupal stage. The author observed obvious influence of global warming on the populations of that species. Some suggestions how to protect this species, and to increase its numbers are given as well.

The Arctic Apollo was described in 1968 by the German lepidopterist Curt Eisner (1890-1981) by two specimens of this butterfly from Yakutia, labeled as „East Werhnosensk“ - an unknown location, apparently, East of Verkhoyansk town. Then, in 1984, the local biologist Lilia Popova caught more specimens of this species in Yakutia in the Verkhoyansk Range, and again in 1989 in the Suntar-Khayata Mountains. In the following years, the Arctic Apollo was collected on those mountains by other entomologists. In 1995, one ♀ of this species was caught by Vitalyi Baglikov, near Yablonevyi pass of Kolyma highlands of Magadan district. There is no reliable information about the presence of Arctic Apollo in other areas. Biology of this species has been unknown either. The author succeeded to study the Arctic Apollo during his tourist and entomological expeditions to Suntar-Khayata Mountains in 1991, 2007, 2010, 2014 and 2015. The article presents the most interesting observations of the author's studies.

The biotopes of the species: The typical habitat of Arctic Apollo is represented on photo 1. This is a wall of black tile-shaped stones on the southern, south-western and south-eastern mountain slopes at heights of 1200 - 1700 m.

Butterflies appearance: Most ♂♂ resemble the figured individuals on the photos 2 and 5 (left), and the ♀♀ look like the specimens on the photos 3 and 4, but yellow spots of the latter are more narrow and smaller. Mated ♀♀ have a small outgrowth (sphragis) at the end of the abdomen. The size of the ♂♂ and the ♀♀ is about the same, with the length of the fore wing 1,7 - 2,4 cm. At higher altitudes the sizes of the Arctic Apollo are smaller, most probably due to the climatic conditions: higher elevations are colder and have more poor conditions for the larvae growth.

Flight period and time: Usually observed from early June to the beginning of July. In years with an early and very warm spring, the Arctic Apollo starts its flight-time in late May and it ends at the end of June. In late spring years the flight-time begins in the middle of June and ends in the second decade of July. The butterflies are only on the wings when the weather is sunny, from 9-10 am to 6-7 pm. If the sun heats the wall and the air above strongly, the butterflies hide under flat stones. In cooler weather, the specis is active all day. The ♀♀ are living more hidden as the ♂♂, and are rarely met with in the late afternoon.

Imago feeding: Recorded on flowers of *Gorodkovia jacutica* (photo 6). The Arctic Apollos ignores other nectar flowers when frequented by local butterflies. The reason may be in a too short length of their proboscis. It corresponds to that of the receptacle of *Gorodkovia jacutica* , making its nectar available to them, while the receptacles of other flowers are longer and butterflies of this species cannot reach their nectar.

Mating behavior: The ♂♂ patrol over the screes looking for the ♀♀. Mating occurs most often in the morning, on the stones (photo 5), usually in the warmer hollows covered from the wind. The ♀♀ lay the eggs on the stones near the hostplants of larvae - *Corydalis gorodkovii* (photo 7), one, two or more eggs (photo 8) and sometimes at the bottom of its stem (photo 9). Preference is given to places with groups of hostplants, and especially their seedlings (photo 10: seedling with eaten leaves by the larvae of the Arctic Apollo).

Preimaginal stages: After 3-4 days of egg stage, the larvae hatch. They eat leaves of the hostplants, and in more mature stage, eat stems and flowers as well (photo 11). Larvae feed only on sunny days, several times a day. Each time after feeding, larvae go down to the ground, near the plant, and rest for a long time on the stones or under them. Grown larvae crawl from plant to plant, making up to 20 meters at one time. In captivity they coexist peacefully with other larvae in one box (photo 12). Larvae full growing time takes about two weeks in the warm weather, and up to a month in cold weather, then they weave dense cocoons under the stones (photo 13, up) and pupate there (the same photo, below).

Diapause: The species diapauses in the pupal stage. This was proved when I reared six pupae from collected larvae in the field, all went into diapause. They were kept until the spring under the snow at the countryside lodge. In March, they were placed in the rearing box again and kept at a temperature of + 25°C. One butterfly emerged and only partly spread its wings, while all the others continued to diapause. Unfortunately, by my own mistake, the pupae died. So I was unable to finalize the experiment. However previously I carried out a similar test with the close related species of *Parnassius tenedius* Eversmann, 1851. With the same rearing temperature butterflies hatched out of 8% of all pupae and the remaining hibernated again. When I increased the temperature to + 30-32°C to the other pupae after winter period, about 80% of them hatched. This can be observed in the Arctic Apollo as well. Both species may stay up to three years in diapause.

Ecology of the species: The Arctic Apollos are observed mainly on Suntar-Khayata Mountains, so, this species can be determined as a very local endemic taxon. The single and local populations in the studied areas are all isolated and separated by many miles. The number of individuals is low. The density of each population depends mainly on the amount of the species' hostplant *Gorodkovia jacutica*, on which they are nectaring. In the areas, suitable for the Arctic Apollo where having abundant hostplants for the larvae but no plants for the imago to feed on, they were absent, and vice versa, with small numbers of the first and large numbers of imago feeding plants they are usually well observed.
The Arctic Apollo is threatened by the global warming. The climate at Suntar-Khayata Mountains in the past 35 years became significantly warmer. Hostplants of larvae and imago of this species in low-mountainous habitats don²t withstand temperature increase and may disappear. There is also progression of plants of the lower-level woodland changing its habitats. As a result, the number of most of the populations of the Arctic Apollo, known to me, is diminishing, and in some of them it has disappeared. Its ecological optimum line gradually shifted to higher mountain localities, but the relatively low range does not have much of them. Further climate warming can lead to this kind of localization on a very limited territory of Suntar-Khayata highlands and then to its complete disappearance from this range.
To save and increase the number of Arctic Apollo I would recommend planting the hostplants of this species for imagines and larvae, especially in the highlands: *Gorodkovia jakutica* and *Corydalis gorodkovii*.

Acknowledgement: Thanks are due to Alexander Krivoshapkin, a Yakutian biologist, for the photo 1 (photos 2-13 were taken by the author) and to Andrey Timchenko for translating the Russian text into the English language.

Literature

Eisner, C. (1968): Parnassiana Nova XLIII. Subsequent observations on the revision of the subfamily Parnassiinae (continuation 16). - Zoologische Mededelingen **43** (2): 9-17, 2 pl., Leiden.

Vinokurov, N. N. & A. D. Stepanov (2007): On population density of *Parnassius arcticus ammosovi* Korsh. (Lepidoptera, Papilionidae) in Suntar-Khayata Mountains. Diversity of insects and spiders at the specially protected territories in Yakutia. Collection of scientific papers: 65-69. - Yakutsk, IBPK (in Russian).

Lvovskyi, A. L. & A. D. Stepanov (2008): To the fauna of butterflies (Lepidoptera, Rhopalocera) of Suntar-Khayata Resourse Reserve. Study of Arthropod Animals of Yakutia. A Collection of Articles: 65-67. - Yakutsk (in Russian).

Address of the author

Yuri Bakhaev
12, 21-a Telman Street
Lipetsk 398 002, Russia
e-mail: butterflies@mail.ru

Explanation in the text.

Explanation in the text.