

The Current State of *Iris hippolyti*'s (Vved.) Kamelin Population in Uzbekistan

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Abstract: *Iris hippolyti* (Vved.) Kamelin, as a singular endemic of Uzbekistan, is one of the species of subgenus *Scorpiris* Spach. It grows on gray-brown desert soils of island of the Kokchatau slides (Kyzylkum desert). A single coenopopulation of *Iris hippolyti* found in classical habitat after latest collection 40 years ago. Ontogenetic structure of coenopopulation is normal, but incomplete. An average density of species is low with value of 0.3 spc/ m². The studies of population were maximally concentrated on plants of the generative stage (57%). According to the classification of "delta-omega" studied coenopopulation is maturing.

Keywords: Uzbekistan, Kyzylkum desert, *Iris hippolyti*, ontogenesis, coenopopulation, endemic

Introduction

The Central Asia is one of the centers of junon irises (subgenus *Scorpiris* Spach) diversity. According to recent data subgenus *Scorpiris* in Central Asia flora is presented by no less than 31 species, representing over 57% of all Central Asian species of *Iris* genus (F.O.Khasanov & N. Rakhimova, 2012). These figures are not the latest one. An example is recently described new species of Chatkal ridge, Fergana Valley –*Iris austrotschatkalica* Tojibaev, F. Karim. et Turgunov (Tozhibaev et.al., 2014), *Iris khassanovii* Tojibaev et.Turgunov of Hissar ridge (Tojibaev et.al., 2014), two species (*Iris rudolphii* F.O.Khass., Esankulov et Achilova and *Iris victoris* F.O.Khass. U. Khuz. & N.Rakhimova) described by F.O.Khassanov et al. (2013) on the territory of Uzbekistan (Kelif Sherabad-ridge) and *Iris rodionenkoi* Lazkov et Naumenko-in Kyrgyzstan (Lazkov and Naumenko, 2014). Today, total number of species of the *Scorpiris* subgenus in Central Asia counts no less than 36 species. Considering these figures and based on Ikinci (2011) data, the species of *Scorpiris* subgenus in the world are estimated no more than 55 species. Data allow assuming the Central Asia is not only diversity, but also a center of origin of junon irises.

One is *Iris hippolyti* (Vved.) Kamelin (*Juno* (Tratt section.) Benth. Ex Benth. et Hook) (1) is a rare endemic of Uzbekistan (Figure 1 a). It grows on gray-brown desert soils of

Kokchatau's slides island, which are located on the Eastern part of one of the largest deserts in Asia - Kyzylkum. The area of this small hill is about 2.5 km², maximum height of 447 m above the sea level. The Kokchatau and all remnant side-hills (there are 16) are considered a continuation of the Western Tien Shan mountain system. Climate of this part of Uzbekistan is characterized by sharp fluctuations of daily and annual temperatures, strong insolation, scattered clouds, a low (100-120 mm per year) and uneven (mainly in winter and spring - a feature of the Mediterranean climate) precipitation. Constant winds are almost regular in Kyzylkum (mainly on northeast direction). This factor increases the evaporation from the soil surface, plants transpiration, and further boosts of the moisture deficit (Shomurodov et.al, 2014). The gray-brown desert soils are mainly pervasive on relic of Kyzylkum. The slopes of Kokchatau ridge are mostly rocky and stony (Shomurodov et.al 2015, 2021).

Rare and endemic plants distributed in arid regions of the republic, a lot of research on their coenopopulations (Saribaeva et al., 2017; Rakhimova et al., 2020; Shomurodov, H.F., Khasanov, F.O., 2014). The data obtained are posted on the world's international GBIF website (Delgado et al., 2020; Ovaskainen et al., 2020).

Materials and methods

Iris hippolyti until now is known only from classical habitat which is Kokchatau's slides island (Kyzylkum desert) (Figure 2). The species was described by A.I.Vvedenskiy (1941) and named after the scholar- Hippolyte Ivanovich Granitov. Until today in the Central Herbarium of Uzbekistan (TASH) preserved two herbarium specimens, including type sample collected in 1938 and second specimen was collected in 1964 by T.Adylov and E.Shorahimov. A subsequent numbers of research works were unsuccessful.

In spring 2015, the expedition to East Kyzylkum was organized within "Assessment of coenotic populations of rare and endangered species of the Kyzyl-Kum" project. During the expedition, along with other rare species, only coenotic population of *Iris hippolyti* was found on southern large-drop stone slopes of Kokchatau Mountain (Fig. 1 b). A population areal with no more than 300 plants covers approximately 2 hectares. The vegetation is dominated by *Zygophyllum atriplicoides* Fish. & C.A. Mey. and *Artemisia diffusa* Krasch. ex Poljakov. Along with dominant species other plants grows in different abundance, such as *Amygdalus spinosissima* Bunge, *Salsola arbuscula* Pall, *Acanthophyllum krascheninnikovii* Schischk., *Merendera robusta* Bunge, *Eremurus inderiensis* (Stev.) Regel, *Allium kysylkumii* Kamelin, *Tulipa micheliana* Hoog, *Ranunculus sewerzowii* Regel, *Dianthus tetralapis* Nevski, *Steptorhamphus crambifolius* Bunge, *Hypocoum pendulum* L., *Strigosella africana* (L.) Botsch., *Ceratocephala testiculata* (Crantz) Bess., *Arnebia decumbens* (Vent.) Coss. et M.

Kral., *Roemeria hybrida* (L.) DC. and others. During fieldwork, it was revealed that total grass cover does not exceed 10%. The species composition of the plant community consists of 38 species. Present study of ontogeny carried out by using straight methods and approaches (Rabotnov, 1950; Uranov 1975; Coenopopulation ..., 1976). The population structure was also studied by conventional methods (Uranov, 1975; The coenopopulation ..., 1976). Coenopopulation's ontogenetic structure was defined as the ratio of species at different ontogeny stage in coenopopulation. One species is taken as a measure unit. The studies of the population's structure were carried based on concept of typical ontogenetic spectrum (Zaugolnova, 1994). Coenopopulation described according to classification of A.A.Uranov and O.V.Smirnov (1969) and "delta-omega" L.A.Zhivotovsky (2001). The population density was calculated to 1 m² of habitat (Odum, 1986).

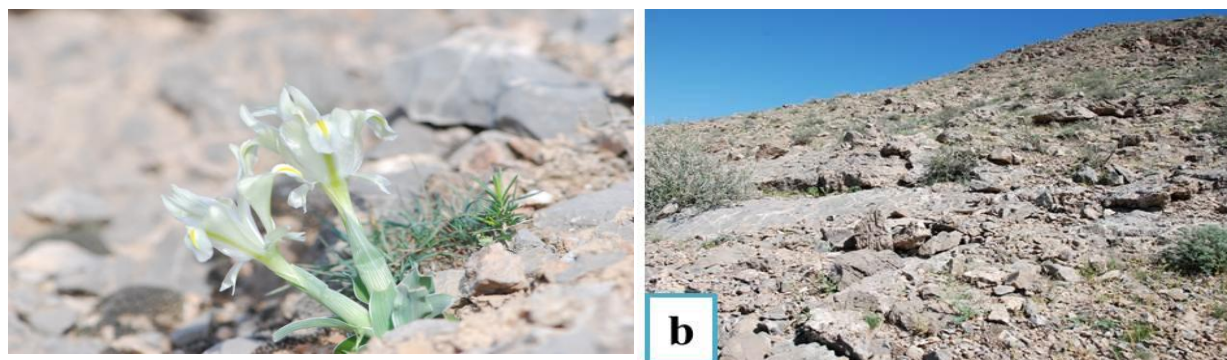


Figure 1. *I. hippolyti* (Vved.) Kamelin (on the left) and habitat (on the right)

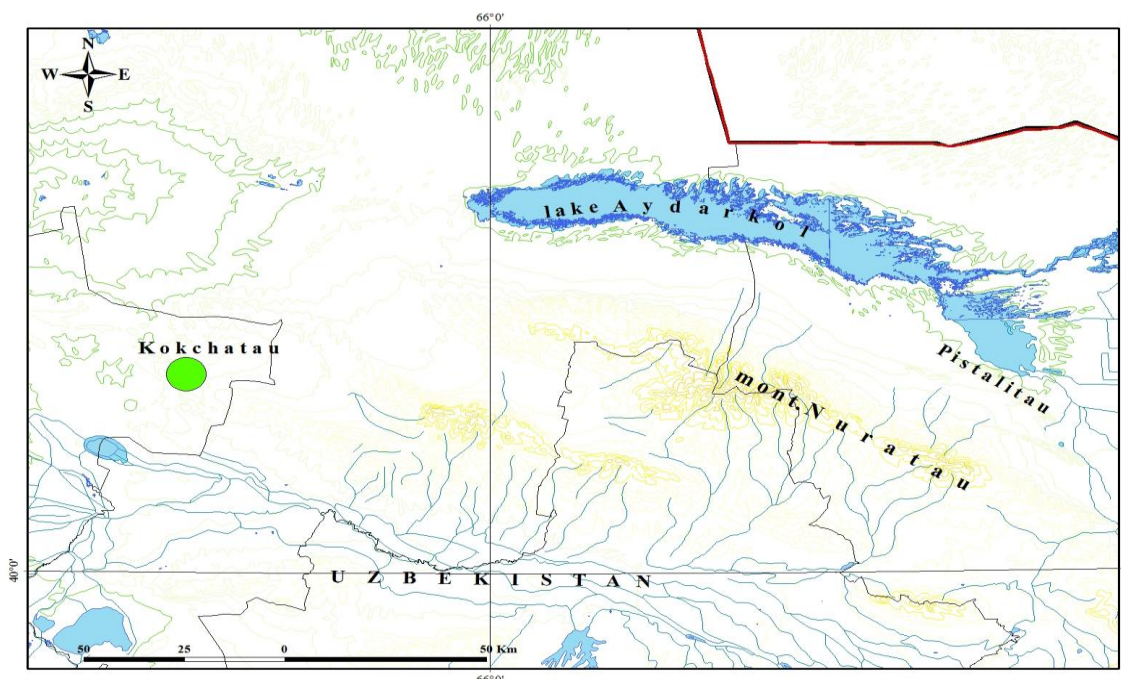


Figure 2. Map of *I. hippolyti* (Vved.) Kamelin distribution.

Results and discussion

I. hippolyti is a perennial, early vegetating grass-bulbous ephemeroid with rosette-like vertical shoots. In nature vegetation of *I. hippolyti* begins in mid-February - beginning of March. The ontogeny of the species described on herbarium materials collected in May 2015. The species at seedling and hydrocyanic stage not spotted during the study time.

The **juvenile plant** has one assimilating leaf up to 3.5 and 0.5 cm of width. Leaf is linear with induplicate axil. The taproot is forming rapidly during growing season and drying up at the end. The taproot is 4.8 cm long. Further bulbs are developing and plant enters into rest period. During the first-year plant has short-vegetating leaf and taproot (Fig. 3. j).

At **immature stage** species go to next year of vegetation. The growth is monopodial. Two laminas are forming (Fig. 3. im). The leaves wrapped with an open axil (by Fedorov et al., 1956). Plain lamina has a linear shape with 6.3-5.5 cm length and 0.2-0.4 cm width. Leaf arrangement (phyllotaxy) is an equitant. Leaf venation is of parallel type. The root system presented by one storage root thread like form root up to 2.1 cm length and active roots up to 4.5 cm in length. The bulb is 0.7 cm long and 0,3 cm wide. The bulbs consist of chaff, representing grassroots leaves modified into thick chaff scales that serve repository of the accumulated reserve of nutrients. Exhausted chaffs usually convert into protective one. Duration of immature state is 1-2 years.

The **virginal stage** (Fig. 3, v) is characterized by the presence of three (later four) light green linear leaves of 7.0-8.5 cm length and 0.3-0.4 cm width. The taproot is 8.5 cm long that is weakly branching up to second order, and 4-5 storage roots are 1.5-2.8 cm long. The bulb is covered by last year exhausted chaffs. Bulb grows up to 0.9 cm long and 0.5 cm wide. This ontogenetic state of plant lasts for 2-3 years.

According to A.A.Ahverdov et al. (1982) during the first year irises' build up reserves of nutrients by growing basilar leaves. This period lasts several years, and in each subsequent year, accumulation of nutrients exceeds previous one.

The plant enters into **generative stage** (4-5th year of vegetation) of development with formation of first flower and renewal buds. This period of plant vegetation is significant for the tissue differentiation into plant's organs, basilar leaves depriving of assimilating pallets and becoming the storage for nutrients. As noted by A.A.Ahverdov et al. (1982), during summer-autumn period on bulb's stem (sinus on upper scale) the germ of leafy floral axis and germs of two replacing bulbs (in the axils of the next two scales), that later repeat the development process of the mother bulb.

I. hippolyti generative plant consists of 5-7 leaves (Fig.3, g). Leaves are sickle-shaped, gradually tapering to the top, parallel venation. Leaves are 11-13 cm long, 1.0-2.3 cm wide. The generative bud opens in plagiotropic part of rosette-shape vegetative shoot. The height of monocyclic, rosette-shape generative shoot is up to 7.0 cm. Perianth is perfectly build of 6 unequal leaflets fused into a tube. The perianth's tube length is 3.9 cm. Outer leaves of tepals turned away with whole comb on a blade, internal strongly reduced and bent down. The length of outer tepals varies from 3.8 to 4.4 cm of width on the extended part is up to 2.0 cm, and internal leaves 1.4-1.7 cm and 0.4 cm respectively. Fruit - polyspermous, syncarpous box that opens at midrib of each of the three carpels. The box length is 2.6-2.9 cm, width - 1.2 cm. Seeds are oval, brown or dark brown. Seed length varies 3.5-4.6 mm, and width - 2.3-2.8 mm.

The root system consists of 5 till 8 storage roots cord form of 3.2 cm length and absorbing roots up to 4.4 cm long. Length of the bulb is 2.3 cm and width - 1.2 cm. Bulb underdeveloped and its major part built of 2-5 (rare more) half-closed, cataphyll. In this ontogenic state the plant remains not less than 15 years.

Thus, in the condition of the Kyzylkum desert ontogenesis of *I. hippolyti* lasts over 20 years. An absence of plants with senile stage in cenopopulation most likely related to rapid withering of species in generative stage. Data E.A.Kobozova (2010) shows that many bulbous plants end its vegetation in generative stage.

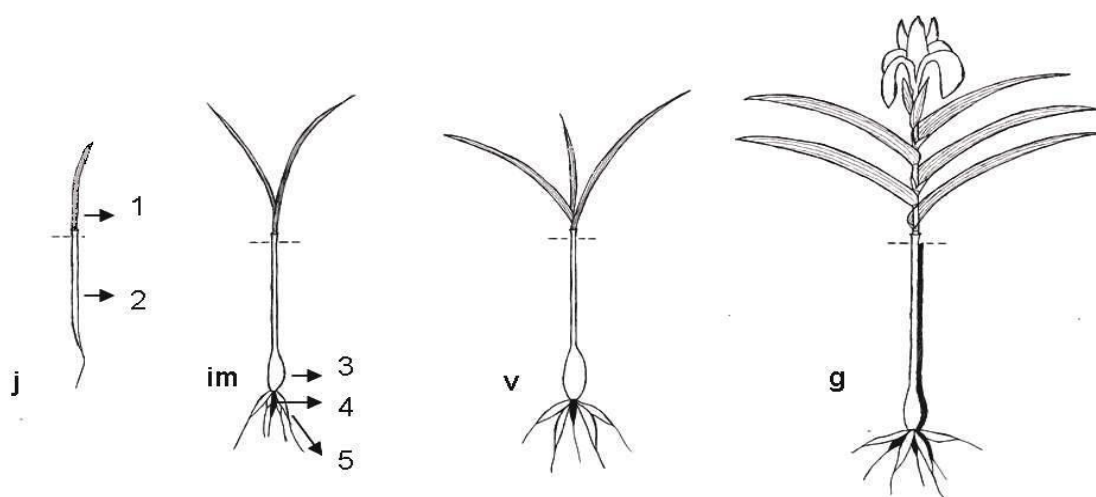


Figure 3. Ontogenesis of *Iris hippolyti*

Ontogenic stages of development: j - juvenile, im – immature, v- virginal g- generative.

Note: 1- leaf, 2- taproot, 3- bulb, 4- exhausted chaff, 5- storage root, 6- flower, 7- last year bulb

Previously the ontogenetic structure of coenopopulation of the *Iris hippolyti* never studied before. As per A.A.Uranov and O.B.Smirnov's (1969) classification studied coenopopulations of *Iris hippolyti* are normal, but lack senile stage.

Species' average density is low with value of 0.3 species/m². Based on peculiarities of species' biology (low germination ability of seeds, rapid transition to flower and slow pace of development of individuals in generative state), a characteristic spectrum of coenopopulation of *I. hippolyti* is centered type with the peak in the generative plants. Ontogenetic spectrum surveyed on coenopopulations is typical (fig. 4). It is centered with an absolute maximum on special generative state (57%). The number of individuals pre-generative age does not exceed 39% of total number of plants in coenopopulation. According to the classification of "delta-omega" studied coenopopulation is maturing (assessment of age (Δ) = 0,32 and efficiency (ω) = 0,66).

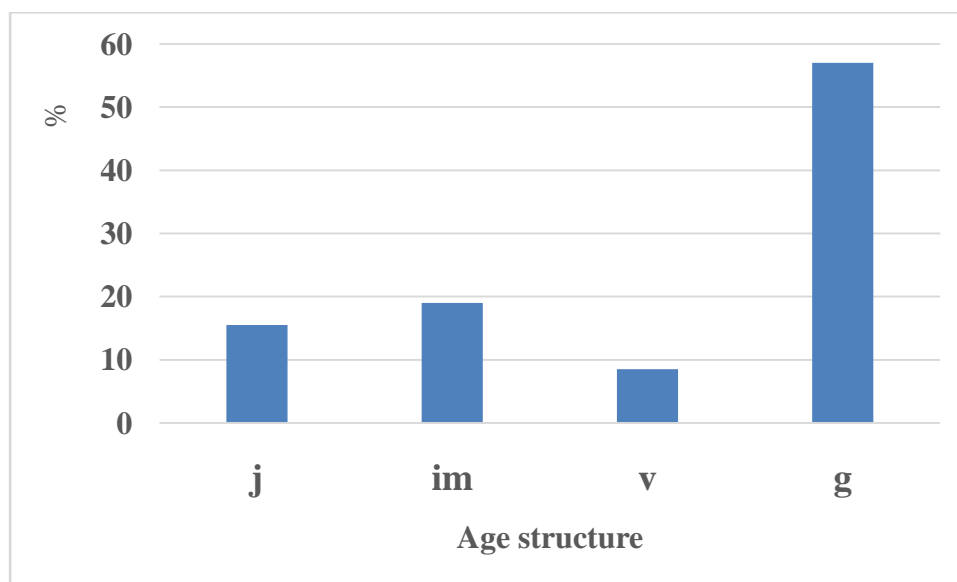


Figure 4. Ontogenetic spectrum of the *I. hippolyti*

Conclusion

After 40 years since the last collection a single population of *Iris hippolyti* was found in classic habitat. Considering probability for species growth on remnant low mountains the Eastern Kuldzhutau (70 km south-west of Kokchatau) Kazaklitau (65 km north) and the western part of Karatau (6 km east) were carefully studied in spring 2015. The highest probability of species detection was in the mountains of Karatau (Nurata Ridge), as the area is a nexus between habitat area *Iris hippolyti* and its closest allied species- *Iris willmottiana*, which was described in the Tashkent neighborhood (ridges Southwestern Tien

Shan). Unfortunately, the search was unsuccessful. As a result, we studied the ontogeny and structure of cenopopulation species from a single habitat - in Kokchatau mountains.

The ontogeny phases' duration depends on eco-phytocenotic and climate conditions. In the context of the Kyzylkum desert ontogeny *I. hippolyti* lasts for more than 20 years (5-6 pre-generative stage, not less than 15 years – generative). Studied single in nowadays cenopopulation of *I. hippolyti* is normal, but not complete. The ontogenetic peak falls on generative species. Proportion of species at this age group is 57.0% in coenopopulation. Ontogenetic spectrum studied coenopopulation is typical. According to Zhivotovskiy's classification ("delta-omega") studied coenopopulation is maturing. It is due to poor seed regeneration ability and significant anthropogenic pressure.

The population size is catastrophically low - no more than 300 individuals. *I. hippolyti* is unstable to grazing and recreational impact. Its population grows in 2-3 km away from Kokcha (where cattle breeding highly developed) and Zafarabad villages. Uncontrolled pasture use and collection of bouquets by local population largely threatens Kokchatau populations of rare and decorative plants such as *Iris hippolyti* (Vved.) Kamelin, *Tulipa micheliana* Hoog., *T. lehmanniana* Merckl., *Allium kyzylkumii* Kamelin and others. At such pace of anthropogenic pressure development, the Kokchatau' species populations, especially *Iris hippolyti*'s population, is advised to conserve by including Kokchatau mountains into Uzbekistan's protected areas network.

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