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PLANTS IN GLAREOPHYTON OF MOUNTAIN CRIMEA UPPER BELT AND THEIR SHOOT FORMATION TYPES

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Introduction

Scree formation, as an original form of mountain landscapes is a result of rocky surface weathering, denudation of the rocks with further shift and accumulation of fractions (colluvium) on adjoined slope. Scree is considered as a layer of loose colluviums, though such slopes include more or less sloping plots with a thin colluviums layer, but stony soil or rock outcrop. Instability of fractions is caused by excess of colluviums inclination over natural angle slope. Speed of fractions accumulation depends upon rock weathering [10].

Peculiar relief, special ecological regime and original vegetation of colluvium covers are generalized in "scree phenomenon" in Botany field. As a rule vegetation of screes consists of separate lighted groups and single plants. Mosaicism and nature of scree vegetation composition, presented by a few similar living forms, permit to consider these conditions extreme for formation of vegetation. Extreme ecological factors for vegetation of screes are marked out as follows: lifelessness and looseness of rocks, low-level fertility of buried fine earth, abnormal range of temperature indices in diurnal and annual seasonal cycles, distinctive illuminate, thermal and water regimes and etc. [6, 12, 13, 15, 17].

Nevertheless, it`s obviously scree area is occupied by plants capable to adapt to this special environment [14]. These plants are denoted as glareophytes, general definition for scree vegetation is "glareophyton" [14] or "unstable petrophyton" [4]. According to ecological habitat glareophytones are classified into facultative cultivars, spread out the screes and obligate – plants, capable to grow in unstable fraction covers only [14]. Facultative glareophytes are constant and sporadic elements of scree vegetation. These cultivars have different coenotic belonging and bioecological genesis: a huge number of plant diasporas from vegetation cenoses of belt types, petrophyte groups within the nearest rocks and rubbly slopes, occurs on heterogeneous by ecological conditions scree plots due to water, wind, animals and sliding down soil. As a result of ecological selection screes are inhabited by plants with special characteristics. Adaptive capacity of facultative glareophytes to scree environment lies in renewal ability after covering the overground organs by rubble, development of strong root systems or rhizome, drought-resistance [2, 6, 12, 14, 4, 15]. Adaptive characteristics of obligate glareophytes have never been studied before.

Objects and methods of the research

Research object is plants growing in colluviums covers on screes at piedmont of Shagan-Kaya rock (1436 m above the sea level), southeast slope of Gurzufskaya yaila, and at the bottom of Eklizi-Burun rock on southeast slope of Chatyr-Dag (1527 m above the sea level). During the life cycle of following plants-glareophytes, formation of root system, hypocotyl, shoot system, propagation way and dissemination were under observation: *Rumex scutatus* L. (*Polygonaceae*), *Sobolewskia sibirica* (Willd.) P.W. Ball (*Brassicaceae*), *Lamium glaberrimum* (K. Koch) Taliev (*Lamiaceae*) и *Viola oreades* Bieb. (*Violaceae*). Renewal buds were the ground to reveal appropriate functional zone of monaxonic shoots and plants in general, bud position relative to rubble surface was analyzed as well. Peculiarities of renewal zone of plant specimens were interpreted as an adaptive characteristic of definite cultivar

relative to unstable colluviums and buried fertile substrate. According to findings, key adaptive characteristics of glareophytes were determined, difference between facultative and obligate glareophytes were also indentified.

Results and discussion

A surface layer of colluvium is a barrel stony rubbly cover, 5-15 sm in deep, more or less fertile substrate (fine earth) is buried under it (Figure). Soil profile of fine earth making 15-20 sm is characterized by highly skeletal degree (90% of rubble), diffusivity of plant fertile and nutrition elements, water permeability, optimal aeration and thermal conductivity. Buried fine earth layer has a special hydrothermal regime. On the surface extreme contrast of temperature conditions and wind regime are caused by sharp difference of altitude (rock top - piedmont), inside the cover this factor is not so important. In frost-free season during the daylight colluviums surface is getting warm maximum, but at night it`s getting cold dramatically. It causes water condensation out of atmosphere. Percolating water through the fractions isn`t able to evaporate. That`s why in summer there is a special humid and cool environment inside the cover.

As to similar construction of inhabitant stages on unstable screes by various biomorphological plant groups, it`s taken into consideration "initial lifelessness" of colluviums covers [1, 6, 7, 12, 14, 15, 16, 17], cultivars with underground rhysome, hypogeogenic rhizome, are pioneer elements of glareophyton [3, 4, 6, 12, 16], [11]. In Mountain Crimea herbaceous perennial-microtherm *V. oreades* is characterized by such a kind of rhizome. At early phase of ontogenesis main root of V. oreades take hypocotyls and buds cotyledonary node in the ground, where rhizomatous axis with cataphyll, renewal buds and secondary root are formed [3] (Figure A).

Established in the soil or fine earth axis bring vegetative buds to the surface, which develop into overground shoots with green leaves and generative organs. Underground rhizome functions as renewal and vegetative colonization element. Low seed renewal caused by insect damage of fruitcases is compensated by extremely vegetative mobility. Having constant axis branch, a specimen quickly occupies an optimal for its growing area.

Mentioned type of rhizome favors *V. oreades* adaptation to conditions of stony soils and lighted vegetation cover, and being of its overground organs under any loose substrate. As a rule plants with underground rhizome belong to forest ecosystems [11]. *V. Oreades* plants of the upper belt of Mountain Crimea mainly develop on moisture and cool northeast slopes under *Pinus sylvestris L*. crown. *V. oreades* of Mountain Crimea isn`t in a group of glareophytes.

One more biomorphological type of glareophyton plants is perennial with deep scape and root system. In Mountain Crimea this group is presented by *R. scutatus*, evergreen plant with seed propagation. Ripened in summer fruits fall off around the maternal plant and get through the rubble into fine earth layer. Seeds sprout in spring. Plantlets have hypocotyl of 10 sm and more which brings the main shoot on the rubble layer level. The primary shoot system is formed, the main cone-shaped root grows vertically into fine earth. Plant shoots are extremely lengthened (till 40 sm), creeping with rising tops. By winter lengthened parts with generative and vegetative shoots die, but basal shortened parts with numerous accessory buds stay on the rubble surface. In time plagiotropic parts of shoots form caudex. Scape and root system of adult plants consists of a strong main root and a number of lateral roots, thickened hypocotyl gets through the rubble layer, caudex with renewal buds are situated at rubble surface, wintering shoot parts are on the rubble level (Figure B). During the plant life ground zone of renewal keeps a stable position relative to colluvium surface.

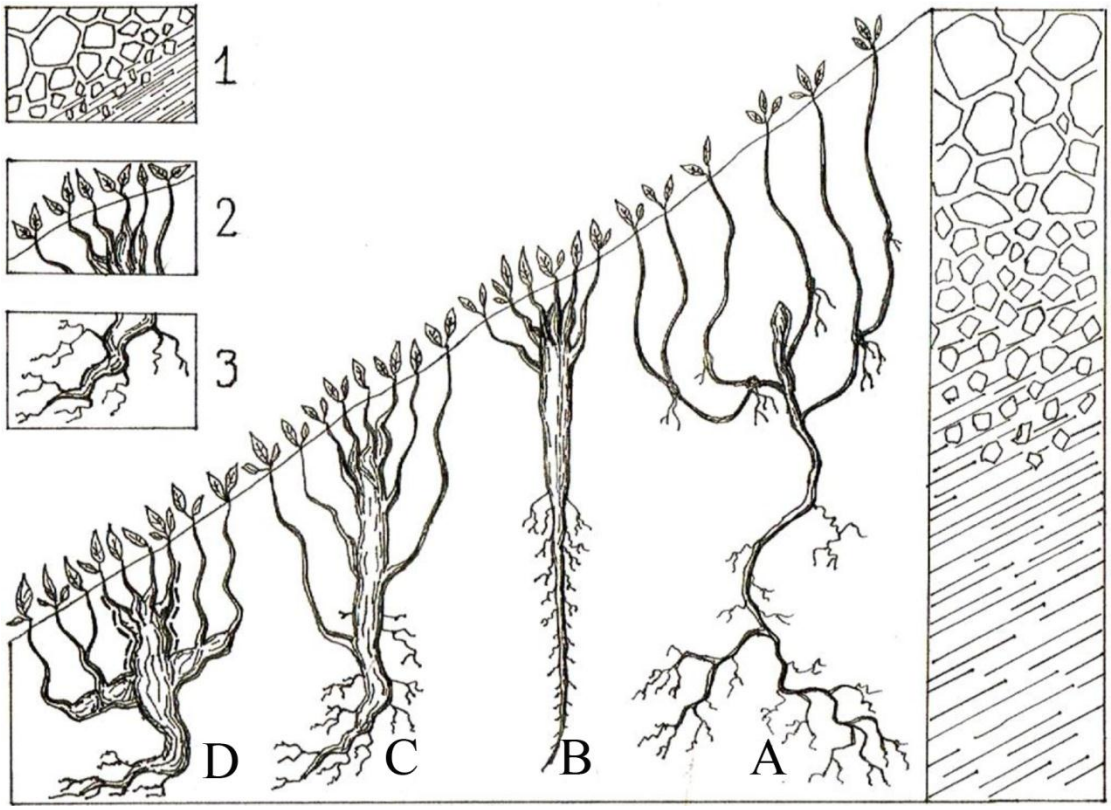
Adaptive characteristics of perennial plants belonged to this type, favor their colonization not only on buried under rubble fine earth, but any other more or less fertile and

moistened in summer, aerated loose solid substrates with deep profile. Fruit of *R. scutatus* is alate. Due to aerodynamic features dried on rubble or on the shoots fruits are shifted by wind within different distances as inside the screes as on the stony-rubbly and rocky ecotopes, non-typical habitat for this cultivar. According to complex of bioecological characteristics *R. scutatus* genetically is not connected with either screes (though it`s often found here), or stony habitat in general. This species belongs to rather facultative petrophytes, consequently to facultative glareophytes.

Plant cultivars, found only on scree areas are of particular interest; their characteristics reveal a special bioecological nature of obligate glareophytes.

Fruits of herbaceous biennial-monocarpic *S. sibirica* at the second year of a living cycle – one-month silicles – fall off around maternal plants and get through rubble into the fine earth. Seeds sprout in spring. Plantlets have hypocotyl of 10 sm and more which brings the main shoot on the rubble layer level. The main root grows vertically into fine earth 7 sm deep. Some strong lateral roots spread along horizontal plane. Primary shoot system consists of ground and overground rosellate vegetative shoots: main shoot and laterals out of accessory buds. Shoot development keeps out of hypocotyls adventitious buds and root system [8]. Renewal zone of this glareophyte living cycle consists of ground-overground and underground components (Figure B).

Unstable covers of colluviums are the ground for herbaceous plant with short-life cycle *L. glaberrimum*. Nut-shaped erems of *L. glaberrimum* fall off in summer, seeds sprout next spring. Plantlets have hypocotyl of 10 sm and more which doesn`t get through the rubble layer yet and doesn`t bring the main shoot on its surface. The main root grows vertically into fine earth 5 sm deep. Primary system of overground organs consists of the main and two monaxonic laterals, growing out of cotyledonary node buds [9]. At the first year of living cycle plant renewal zone is on the rubble level and limited by nodes of lower shortened internodes of the first shoots. In the end of the first season in its living cycle after dying of shoot parts 30 sm by length, established in the fine earth main root involves survived shoot parts with renewal buds into rubble layer. In spring the second generation of monaxonic shoots develops out of renewal buds. Their lengthened deceleration area gets through buried cool in summer rubble layer, enrichment zone is close to maximum warmed in a daylight surface. Length of parakladii increases in basipetal order, that`s why all of them get through the rubble layer and bring lateral inflorescences above its surface. In the living cycle of *L. glaberrimum* renewal zone changes its position relative to rubble surface: its function includes primary near-surface and secondary deeper phases (Figure D). Mesophilia and quickly lengthened organs (hypocotyls, monocarpic shoots, underground rhizomatous axis) are main distinctive features of facultative glareophytes. Original characteristics of glareophytes are following: short living cycle, short scape and root system, spreading flexibility in the renewal zone relative to rubble layer due to adventitious renewal buds or renewal zone involving into substrate. This complex of features is able to adapt study plants to fine earth, buried under unstable rubble. Due to these properties obligate glareophytes develop in spite of fraction accumulation speed and their regular crumbling. Ecological connection of obligate glareophytes with scree covers is revealed by the only way of propagation – dissemination and the only way of dissemination – barochory: fruits and seeds falling off close to the maternal plant.



Facultative glareophytes, gradually occupying unstable scree, are able to change dynamic and other landscaping parameters dramatically, even transform it into stable rubble slope with soil and meadow vegetation [1, 6, 7, 12, 14, 15, 16, 17]. Obviously, paucity and rarefaction of scree vegetation completely exclude any biotical effects on this landscape. Vegetation effect is not comparative with geomorphological processes. Obligate glareophytes, particular plant group by its genesis and bioecological nature are not considered in these schemes.

S. sibirica is wide spread on Chatyr-Dag scree, but screes at Shagan-Kaya piedmont are not occupied by this cultivar; *L. glaberrimum* populations are found on all large screes of Mountain Crimea. Accordingly, most likely isolation of obligate glareophytes happened simultaneously with Crimean mountains orogenesis and formation of scree landscapes here. Theoretical transformation of unstable colluviums covers (the only possible ecological environment for obligate glareophytes development) into stable slopes with developed vegetation cover would cause extinction of dedicated obligate glareophyte groups.

Conclusions

Therefore obligate glareophytes have genetic, ecological and biomorphological distinctions in comparison with other petrophyte groups being a part of glareophyton.
Biological complex of obligate glareophyte characteristics completely corresponds to environmental conditions of their development. Unstable colluviums covers are eternal as an ecological niche for development of obligate glareophyte populations.

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The screes vegetation, various according to its bioecological nature and coenotic value, is glareophyton. Glareophyton mainly consists of facultative petrophytes, which get on screes from phytocenosis of zonal types and rock aggregations, so-called facultative glareophytes. Besides it glareophyton contains plants ecologically belonged to unstable debris covers – obligate glareophytes. Obligate glareophytes, petrophytes and other ecological origin types have quite a number of biomorphological distinctive features. These distinctions take place due to complex of genetic characteristics and environment where plants of diverse ecological group grow. If unstable debris covers are the only habitat for obligate glareophytes, for petrophytes these conditions are extreme.

Key words: *Mountain Crimea, scree, glareophytes, life form*.