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SOIL RECLAMATION BY PLANTS AND PLANT INTRODUCTION AS METHODS OF REVEGETATION ON THE TERRITORY OF RIVER BASINS NEAR GANJA

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ФИТОМЕЛИОРАЦИЯ И ИНТРОДУКЦИЯ РАСТЕНИЙ КАК МЕТОДЫ ВОССТАНОВЛЕНИЯ РАСТИТЕЛЬНОСТИ НА ТЕРРИТОРИИ РЕЧНЫХ БАССЕЙНОВ В ОКРЕСТНОСТЯХ Г. ГЯНДЖИ

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Abstract. Negative factors caused to erosion and other natural and anthropogenic factors in the vegetation on the territory of river basins near Ganja have been mentioned in the article. Soil reclamation by plants measures have been advised for revegetation. It has been considered restoration of basically taproot system of trees, shrubs and herbaceous plants in degraded plots of land through reintroduction. For that, up to 60 plant seeds have been sown in 18 polluted and degraded plots of land.

Аннотация. В статье отмечены негативные факторы, вызванные эрозией и другими природными и антропогенными факторами в растительности на территории речных бассейнов в окрестностях г. Гянджи. Рекомендованы фитомелиоративные мероприятия для восстановления растительности. Рассмотрено восстановление в основном стержневой корневой системы деревьев, кустарников и травянистых растений на деградированных территориях путем реинтродукции. Для этого на 18 загрязненных и деградированных участках было посеяно до 60 семян растений.

Keywords: soil reclamation by plants, reintroduction, vegetation, revegetation, natural and anthropogenic factors.

Ключевые слова: фитомелиорация, реинтродукция, растительность, восстановление растительности, естественные и антропогенные факторы.

Introduction

Unequal distribution of rainfall according to seasons, dry summer, harsh winter, continental climate influences on formation of land and vegetation of the area. Arid climate in Ganja forms soils with simple structure that are result of physical and mechanical weathering of mountain rocks, and vegetation. In accordance with primarity of land and rocks, rough relief, weak constipation of plants, urbanization, rainfall, snow melting streams causes to erosion and flood. Subsequently soil formation process weakens and prevents development of plants and decreases productivity of soil. Moreover, deterioration of the river regime in the area and their tributaries damages agriculture and roads, buildings in residential areas. All of these restrict potential land use, vegetation period

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longersup to 8 months, increases sun radiation and it is required implementation of protective measures for prevention of erosion made by metal mine.

Thus, problems of prevention erosion and flood consist of complex measures. They are included forestation of mountain slopes. A number of investigations are carried out against erosion processes [1, 3].

Erosion processes, flood result with losing nutrients from soil and demolishing soil. These factors destroy productive condition where forest formations develop and make it difficult restoration of vegetation and cultivation of with supplementary and hydro technical mechanisms. So, restoration of vegetation that is always exposed to floods and phytomeliorative measures to develop them are important. Moreover, preventing of overloading of fodder areas near river basins, forestation of slopes are one of the main scientific-practical problems.

Materials and Method

The research was carried out in 2009–2015 near Ganja. The aim consists of the studing the phytomeliorative importance of river basins (Ganjachay, Turyanchay, Kurekchay and Aghsuchay). Geobotanical notes were carried out in areas in size of 10×10 m. Sample areas are chosen from every vegetation types being 1 m^2, then 5 m^2 and 10 m^2 in order to study plant resource and thickness [8].

Structure, composition, the number of species, and dominants and edificators, in one word, floristic-geobotanical indicators were studied and the richness of flora mentioned in Drude 5 graded measure [10-12].

Classical and modern botanical-floristical, systematic, environmental, aerological and statistical methods were used in the development of the herbarium materials from the basin [2, 4-7].

Experimental section

Before solving these problems it is necessary to take into account that formation of mesophyl forests in areas where xerophyte forests form is only possible in case of anthropogenic factors. The main factors are developing soil rocks and water regime. Instruction of hydrotechnical system in form of terrace will be able to solve the problem. Terraces cause to accumulating additional moisture as well as prevent soil washing. In most cases, it is possible to water phytomeliorants planted in strong inclinated slopes. It must be constructed stone walls, protection bans that keep water and canals in the process.

Construction of water sources in banks of Ganjachay, Aghsuchay, Turyanchay, Kurekchayrivers has great importance. Considering the prospectivety of agriculture and economics, overloading the river basins requires the installation of an artificial river water sources. As a result, the threat of flood decreases, irrigation of phytomeliorasion and reusage of agriculture lands were carried out.

Formation of terraces and forests in basin slopes should be organized according to lowland and highland mountainous parts which have suitable condition for trees and brushes. Measures that carried out in fodder areas should focused on their developing. It is recommended to select plants in order to develop the slopes in highland areas. Strong root system plants improve the top layer of the soil and prevent water wash and erosion. This type of grass are eaten by livestock. Therefore, their usage in agriculture is perspective. Accordingly against erosion of slopes, sowing of sod-forming grass seeds, carrying out engineering and technical and agrotechnical work, construction of hydrotechnical facilities, and so on, are very necessary measures.

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One of the important issues is to improve river bank soils and restore soil that exposed to erosion. Mines, stone-sand quarries, and so on are situated in Ganja and near regions, so it is common to see pollution more than 2 times. So, research that is conducted by us focused on vertical variation of the trees, bush, semi bush, perennial grasses. In addition, the root system of plants and growing properties within every zone were studied. Necessary to note that plants that form top layers are scattered and they are not common for all latitude zones. Only perennial grain crop *Festucas clerophylla* and *Poa bulbosa* grow mountain foot areas. 70–80 cm height and 15–20 cm root of these plants protects sharp slopes from washing. Thus, their roots that go through 30-40 cm depth penetrate rocks and form root system. These kinds grain crop protect slopes from washing.

Mountain-xerophyte *Thymus* species are plants with short bushes that laid on the ground. Mature plants cover 20–30 cm square, depth of roots are 1.5–2 m and protect slope.

Scorzenera species that is spread in Middle Mountain zone of river basins have thick root that goes through soil up to 30–50 cm. systematically and morphologically these species are different, however, root systems are similar and it is also good for protecting from erosion.

Achillea species give 2500 seeds and can grow by the vegetative way and form a lot of branches. They can develop well in less fertile soils and are tolerant for intensive grazing and are planted in areas where exposed to erosion.

Artemisia types are common in territory. They are generally found in in lowland zones and plains. Wormwood almost reproduces by the vegetative ways. They are used in restoration of eroded areas.

Jurinea types reproduce by vegetative way through the roots of the plants. *J. spectabilis* are found in rocks of Alp zones while others are found in lower and secondary mountainous zones. All of them are in height of 20-60 (70) cm that are perennial plants. The roots of these species can penetrate to a depth of 40-50 cm. *Jurinella subacaulis* is a plant that has no stems.

Above mentioned plants reproduce by root so it is used against erosion.

Plants that are deprived of such features can also live. The roots of plants are taproot, but adapted to moving substrat. Development of extensive root system is characteristic for them. Height of young *Eryngium* species belonging to the genus of the family *Apiaceae* is 2–5 cm, while their main root goes to depth of 20–25 cm. The main stem of the root reaches to a depth of 50-60 cm in mature plants, in 15–20 cm forms many lateral roots. They are considered the best fixator of soils. *Prangos ferulacea* and other types of family *Prangos acaulis, P. uloptera, P. lophoptera* are phytomeliorants thathavea strong taproot system.

Upper part of young *Oxytropis* is 3–5 cm and underground part is 10–15 cm. Strong developed roots of mature ones are covered with small roots going to 15–20 cm depth. Upper part of young Hedysarumf ormosumis 3–5 cm while underground part is not less than 10–15 cm. It can be used in actions against slope erosion as phytomeliorative.

All types of species of *Onobrychis* have a strong taproot system. O. *transcaucasica* has thick main root and goes to 10 cm of depth, 5-7 cm from the main root starts lateral roots in length of 20-25 cm. The main root of O. *hajastana* can reach to the deepest layers of soil and take up water,are tolerant for drought. All of these are the best fixator of weathered slopes.

Medicago species are perennial plants that spread in lower, middle, and high zones, have well developed taproot with many lateral roots. Roots of *M. caucasica* in the first year of vegetation can reach up to 60-80 cm and mature species can reach to depth of 10 m. *Medicago* species spread on the ground and fix substrate and preserv the soil disintigration to fine parts.

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In the high mountainous zone *Medicago* is replaced with *Trifolium* and *Amoria*. All species of *Trifolium* and *Amoria* have role in fixing the soil. Trifolium and Amoria may reproduct by seeds as well as vegetative ways and perennial plants.

Annual, perennial, and tragacant forms of Gavan species are common in the area. Root of annual gavansis weak while roots of perennial plants go to deep layers. Roots of tragacant forms can reach 2–3 m depth, 3–4 m width. For this reason, they are endurable to drought. Laterial roots developed well so, the plant is renewed by them. They can grow in all type of soil. They reproduce by seed, however, they grow weakly, so it needs to be sown in autumn.

Apart from above mentioned plants *Ononis, Lathyrus, Glycyrrhiza*and so on, also have these properties. It must be used grain crop such as *Elitrigia, Agrostis, Cynodon, Koeleria, Stipa* and others for phytomelioration.

There are 3 forms of the root system of *Salsola nodulosa*:

1. Spread on land surface;
2. highly developed taproot;
3. Poor developed taproot.

The main root of *Salsolan odulosa* is 2.2 cm length, goes to 6-25 cm depth. They form a number of first degree roots that grow horizontally. These side roots form second degree roots and width of the main root becomes 1-2 cm going to the depth of 3 cm is divided into 2 part. One of them grows vertically, another grows horizontally. Thus, *Salsola nodulosa* is used for preventing of soil erosion in lower mountainous zones.

Mespilus germanica is a plant in height of 3–4 (5) m that have strong developed root system that grows in slopes of bright colored forests. Its root system covers 15 $m^3$of land. They have taproot as well as lateral roots. *Mespilus germanica* is common in Tugay forests. Around Turyanchayis surrounded such forests.

Height of brushes of different individuals of *Rosa* species is 2–3 (4) m. They have slow growing root system. *Rosa* species reproduce by root and covers all zones of the basin.

As phytomeliorant *Paliurus spina-christi* growth on the south slopes and stony areas. Its height is 2-3 (5) m, has the strong root system.

Quercus macranther a forms weakly developed root system during first four years. Mature individuals develop strong root system. *Fraxinus excelsior* also has surface type of root system. It grows in high mountainous zones of the basin.

Atraphaxis reproduces both vegetative ways and by seeds such as *Atraphaxis spinosa, A. angustifolia* and they are initial fixator of slopes that are exposed to erosion.

Campanula, Dianthus, Nepeta, Teucrium, Scutellaria, Dracocephalum, Stachys, Salvia, and *Poa* species have properties to adopt and live on substrates that exposed to erosion.

Perennial Heracleum species that form endurable biomass in summer and perish in winter in middle and highland areas are the main components of proluvial — gravel sediments.

Thus, their large leavescover the land and prevent it of dryingand create condition for other plants. *Heracleum* both in proluvial and sediments reproduce by root, however, wild individuals are rather short. It is given areas within height zones that differ from each other according to physical — geographical conditions and is given meliorative measures scheme that is considered to carry out (Figure 1, 2).

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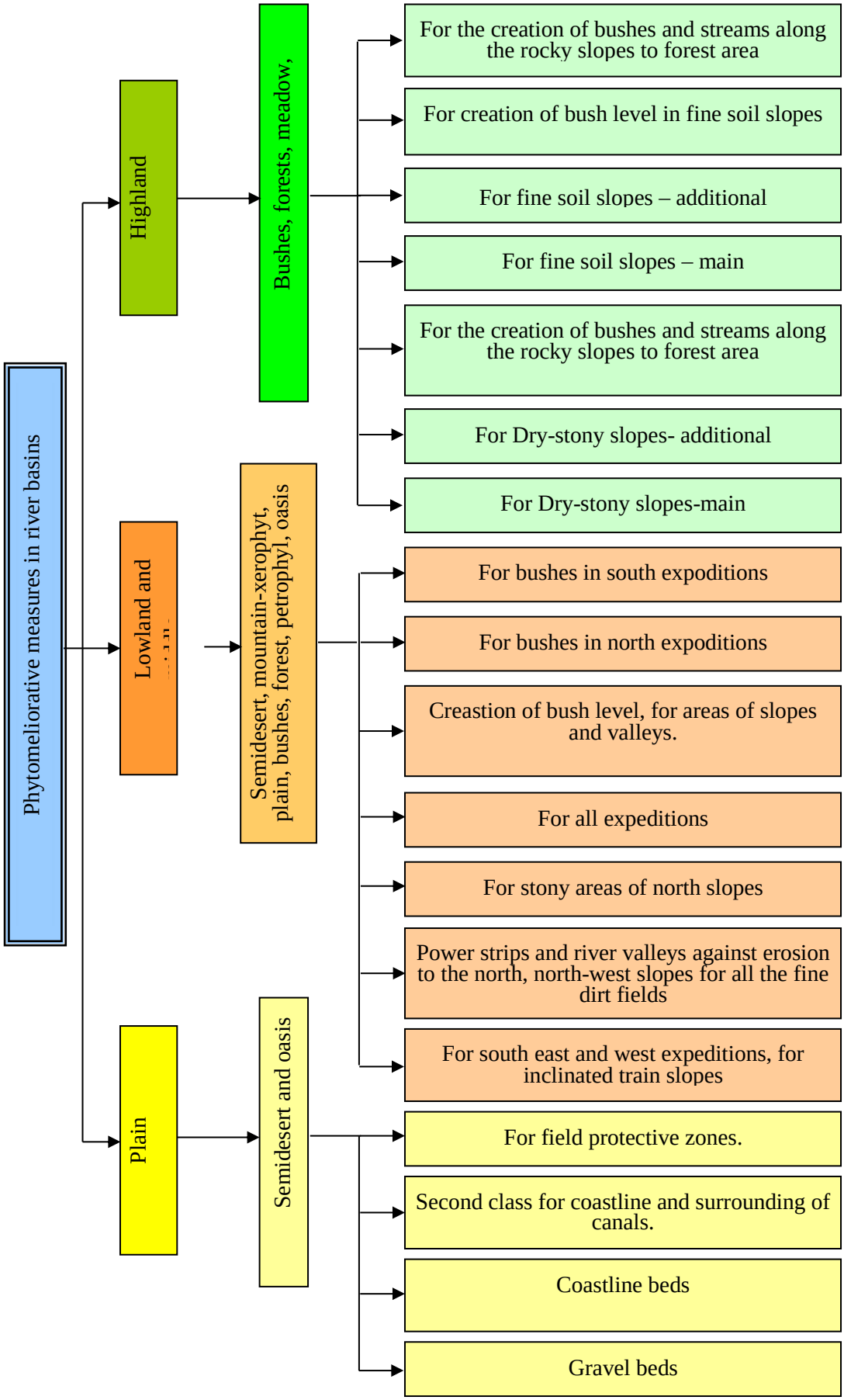

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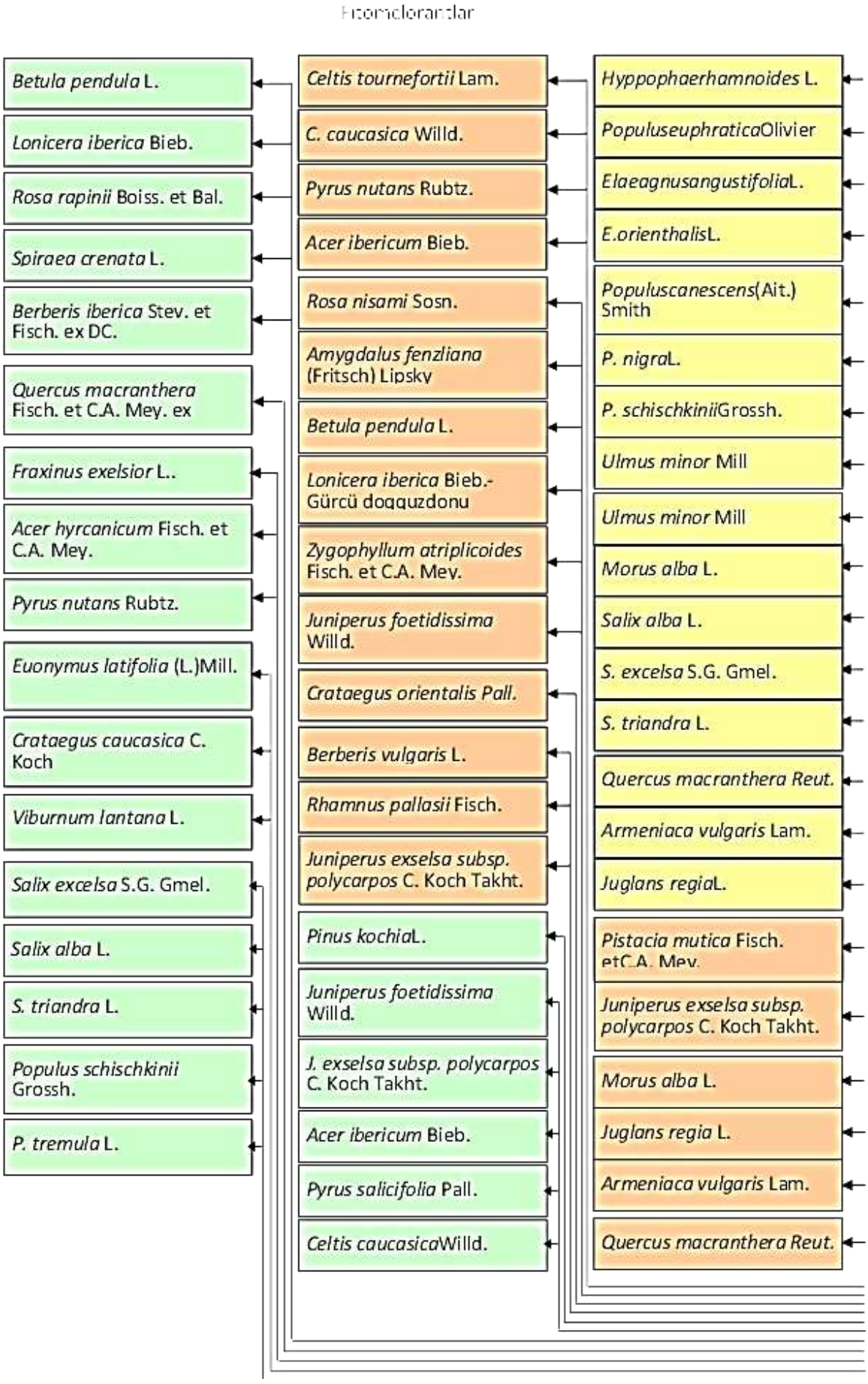

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