Floristic characteristics of some synanthropic plant communities of the Kobuleti lowland (Adjara, Georgia)

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Abstract

The materials of the field research of synanthropic vegetation in the territory of the Kobuleti in the 2016–2020 years are provided. In particular, 134 taxa belonging to 49 families and 97 genera were revealed in the three different plant communities (Cryptomerietum japonicae, Eucalyptetum-viminali-globulo-cinerei, and Cinnamomo glanduliferae-Cryptomerietum japonicae) in the Kobuleti lowland. The community Cryptomerietum japonicae comprises 66 taxa, 33 of which are native, and 33 have an alien origin. Woody plants in Cryptomerietum japonicae are represented by 15 taxa. The community Eucalyptetum-viminali-globulo-cinerei comprises 91 taxa, 36 of which are native and 55 are alien. Woody plants in Eucalyptetum-viminali-globulo-cinerei are represented with 17 taxa, while the rest 74 taxa are herbaceous. In Cinnamomo glanduliferae-Cryptomerietum japonicae there are discovered 49 plant taxa, including 25 native and 24 aliens. In this community, 16 taxa are represented by woody plants and 33 taxa – by herbaceous ones.

Therefore, in the investigated region, 60 taxa (44.77 %) were found to be native and 74 taxa (55.23 %) alien. Among aliens, 31 taxa have East Asian origin, 16 taxa are from the Mediterranean, 13 taxa originated from Europe, ten taxa originated from North American, and four – originated from Australia.

Despite cuttings and artificial planting of alien representatives, some indigenous woody species (i.e., Corylus avellana, Frangula alnus, Vaccinium arctostaphylos, Smilax excelsa, Quercus hartwissiana, Carpinus caucasica, Castanea sativa, and Hedera colchica) still occur in this territory. Both native and alien taxa participate in the formation of the described landscape structure. Successional events have started in the Kolkheti Lowland in ancient times. It is a long-term process, which is still ongoing, as our observations confirmed it.

Keywords: synanthropic vegetation, native flora, alien flora, invasion, Adjara, Georgia

Authors' contributions: All four authors participated in expeditions and field studies. Irakli Mikeladze & Nani Gvarishvili performed plant descriptions, species identification, and detection of plant communities. Aleksandre Sharabidze took plant samples, prepared herbarium vouchers, and captured the photos. Gogita Shainidze worked on GIS and mapping. All authors discussed the results and contributed to the final manuscript. Irakli Mikeladze is the corresponding author; he wrote the manuscript in consultation with all four authors.

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Introduction

The transformation of the flora and vegetation is one of the significant challenges in the modern world related to human activity. The human disruption impact on the ecosystems promotes their response through the secondary autogenic succession. Such successions vary depending on specific anthropogenic influence on ecosystem and allow plant species with foreign origin invade and inhabit local plant communities (Kornaś, 1990; Richardson & Pyšek, 2006; Fudali, 2009; Opálková & Cimalová, 2012; Solomakha et al., 2012; Ziaja & Wójcik, 2015; Mikeladze, 2015; Kostryukova et al., 2017).

The influence of anthropogenic factors, irrational use of natural sources, and careless and abandoned agricultural lands have led to a remarkable transformation of flora and vegetation. Such transformation is reflected in the invasion of alien plant species in the disturbed habitats and syngeneic succession. This is a result of anthropogenic-induced invasion processes in the florogenesis that oppressed indigenous species, in particular, those ‘shelters’ (refugia) of which were destroyed (Ginkul, 1936; Mazurenko & Khokhriakov, 1972; Davitadze, 1980, 2001, 2002; Richardson et al., 2000; Richardson & Pyšek, 2006; Simberloff, 2013).

Active phytoinvasion is also an actual problem for the South Kolkhis (Adjara). Investigation of the transformed vegetation in the coastal Adjara lowland and foothills considered the principal targets for phytoinvasion in Kolkhis is highly relevant. To predict and monitor local vegetation transformations, it is essential to survey exiting plant communities in terms of restorative succession (consistent) change.

Material and methods

The research was carried in 2016–2020 in the Kobuleti lowland. The study territory is located in Georgia, in the floristic region of the Western Georgia-Kolkheti Lowland (Fig. 1). The object within the phytogeographical division belongs to the ancient Mediterranean and sub-Mediterranean regions (Gagnidze & Davitadze, 2000). The humid subtropical climate strongly determines local vegetation. The average annual temperature is 13.5°C. The average temperature in January is 4.8°C, and in July – 22.4°C. Absolute minimum is –14°C, and absolute maximum is +41°C. The average precipitation is 2500–3000 mm per year. Autumn and winter are distinguished here by abundance.

In total, three plant communities were selected during the field expeditions using the route method. GPS coordinates were captured at the selected plots. Laboratory analysis, identification, and herbarization were carried at the the Institute of Phytopathology and Biodiversity in Kobuleti, Batumi Shota Rustaveli State University.

Both alien and native plants were surveyed within the selected plant communities. Different published sources were applied for the plant identification, including the identification manual of the Adjara flora (Dmitrieva, 1960, 1967, 1990), identification manuals of the Georgian flora (Keckhoveli, 1971–1984; Kutateladze, 1985; Gagnidze, 1987–2007; Gagnidze & Davitadze, 2000; Tarkhnishvili & Chaladze, 2013; Fischer et al., 2018) and recent contributions to the alien flora of Adjara (Davitadze, 2001, 2002; Kikodze et al., 2010; Sharabidze et al., 2018; Mikeladze et al., 2019). The taxonomy was verified following the online databases POWO (2021).

The vegetation descriptions (relevés) were made following the Braun-Blanquet approach (Mueller-Dombois & Elenberg, 1925; Poore, 1955; Müller & Schmetterer, 1974; Minnesota Department of Natural Resources, 2013). On the experimental plots, the relevés were made with fixed intervals. The constancy of all species was calculated as a percentage overall and separately for each relevé. Surveyed area size varied depending on the plant cover. In the case of tree plants, it was 400–500 m², while in case of mosses – 0.25–0.5 m². The projective cover was determined for each plant species in all areas using the seven-grade Braun-Blanquet scale: 5 – the species has 75–100 % projective cover, 4 – 50–75 %, 3 – 25–50 %, 2 – 5–25 %, 1 – 1–5 %, + – <5 % (sporadic or few individuals occur), r – single individual appears. The International Code of Phytosociological Nomenclature (Weber et al., 2000; Theurillat et al., 2020) and Sorensen’s similarity index (Sørensen, 1948).
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were applied for the formal naming of the investigated plant communities.

Results and discussion

In the immediate historical past, mixed subtropical and mixed broadleaf forests with the predominance of Castanea sativa Mill., Fagus orientalis Lipsky, Quercus hartvisiana Stev., Tilia dasystyla Steven subsp. caucasica (V. Engl.) Pigott, Pterocarya fraxinifolia (Poir.) Spach, and Diospyros lotus L. were common for Kolkhis Lowland. However, at the end of the XIX century and the beginning of the XX century, many drainage channels were constructed, and mentioned plants were cut down and replaced by artificial Eucalyptus, Cryptomeria, and Cinnamomum plantations. Eucalyptus was introduced for cultivation in swampy areas in coastal Adjara as a remedy against swamps and malaria mosquitoes. In particular, Eucalyptus globulus Labill. was introduced in 1895, E. viminalis Labill. – in 1900, and E. cinerea F. Muell. ex Benth. – in 1912. Cryptomeria japonica was introduced in coastal Adjara at the beginning of the XX century. After that, it has undergone complete acclimatization, and today these plants actively bloom, produce fruits and self-seedlings. Cinnamomum glanduliferum (Wall.) Meisn. was introduced as an ornamental plant in 1900.

At the end of the XX century, plantations on the investigated territories were cut down again due to different reasons. In these degraded, empty, and abandoned areas, competition between the native and alien plant taxa started in certain plant groups, characterized by lower stability.

Considering the formation history, three formal plant communities were selected in the Kobuleti lowland for the investigation – Cryptomerietum japonicae, Eucalyptetum-viminali-globulo-cinerei, and Cinnamomo glanduliferae-Cryptomerietum japonicae.
1. **Cryptomerietum japonicae**

The mentioned territory is located in the Kobuleti lowland, at 17–29 m a.s.l., between 37T 733176 m E, 4633084 m N; 37T 733460 m E, 4633233 m, N; 37T 733557 m E, 4633070 m N. Exposition is flatland with poorly developed soil (Figs. 1 & 2).

Sixty-six plant taxa were observed in the *Cryptomeria japonica* community, including 33 native and 33 aliens (Appendix). Woody plants are represented here by 15 taxa.

The main tree layer of the community is differentiated into sub-layers. The specimens of *Cryptomeria japonica* that survived deforestation dominate in the first sub-layer and reach 20–25 m of height. The second sub-layer is outlined with self-cropped undergrowth specimens and root sprouts located on the cut logs of *Cryptomeria japonica*, *Eucalyptus*, and *Cinamomum*.

*Smilax excelsa* L., *Lonicera japonica* Thunb., and *Hedera colchica* (K. Koch) K. Koch stand out among the vines, forming the second sub-forest layer.

The third, herbaceous, layer is poorly developed. The projective cover of grasses is about 30–35%. Among the leading species here are *Hydrocotyle ramiflora* Maxim., *Poa annua* L., *Kummerowia striata* (Thunb.) Schindl., *Trifolium diffusum* Ehrh., *Viola prionantha* Bunge, *V. reichenbachiana* Jord. ex Boreau, *Setaria faberi* R.A.W. Herrm., *Fragaria vesca* L., *Euphorbia falcata* L., *E. peplus* L., and *E. stricta* L. The fern *Pteridium tauricum* V.I. Krecz. ex Grossh. (= *Pteridium aquilinum* (L.) Kuhn) was also abundantly present here.

The soil surface is covered with different mosses, including *Calliergonella cuspidata* (Hedw.) Loeske, *Odontoschisma denudatum* (Mart.) Dumort., and *Polytrichum strictum* Menzies ex Brid.

Eight species (*Cryptomeria japonica*, *Frangula alnus* Mill., *Hedera colchica*, *Lespedeza bicolor* Turcz., *Lonicera japonica*, *Hydrocotyle ramiflora*, *H. vulgaris* L., and *Smilax excelsa*) are naturally renewed and engaged in the formation of the basic layer of the given plant community. The local flora elements (i.e., *Quercus hartwissiana* Steven, *Carpinus caucasica* Grossh. (= *Carpinus betulus* L.), and *Vaccinium arctostaphylos* L.) are represented by very few units due to shadowing created by...
the main canopy on the one hand, and grazing by livestock animals on the other. Similarly, such alien species as *Cinnamomum camphora* (L.) J. Presl and *Ailanthus altissima* (Mill.) Swingle are poorly presented too. The appearance of *Carpinus caucasica*, *Alnus glutinosa* (L.) Gaertn., *Corylus avellana* L., *Hedera colchica*, *Frangula alnus*, *Smilax excelsa*, and *Vaccinium arctostaphylos* characterizing the primary phytocoenoses, allows assuming that participation of these and many other native species will increase in the future.

2. *Eucalyptetum-viminali-globulo-cinerei*

The research area is flatland, within 9–18 m a.s.l. elevation, located between 37T 732624 m E, 4632886 m N; 37T 732849 m E, 4632974 m N; 37T 732687 m E, 4632801 m N; 37T 732882 m E, 4632843 m N. The inventory revealed vegetation with a dominance of *Eucalyptus viminalis*, *E. globulus*, and *E. cinerea* (Figs. 1 & 3). Taxonomic composition of this plant community differs from the community with the predominance of the *Cryptomeria japonica*. According to the survey, there are 91 taxa in this community, including 36 native and 55 alien. Woody plants are represented there by 17 taxa, while the rest 74 taxa are herbaceous (Appendix).

The main vegetation layer of this community is differentiated into two sub-layers. The first sub-layer is formed by 20–30-meter-high *Eucalyptus cinerea*, *E. globulus*, and *E. viminalis*, which survived during the cuttings and dominate. *Cryptomeria japonica*, *Eucalyptus cinerea*, *E. globulus*, *E. viminalis*, *Cinnamomum glanduliferum*, *C. tenuifolium* (Makino) Sugim., *Vernicia fordii* (Hemsl.) Airy Shaw, *Frangula alnus* Mill., and *Acacia dealbata* Link are distributed in the second sub-layer. Only a few specimens of the indigenous species *Castanea sativa* are present there. The canopy of the main layer is dense, and this defines the specific composition and structure of underlying vegetation.

The second layer is presented by vines *Smilax excelsa*, *Lonicera japonica*, *Hedera colchica*, and *Persicaria perfoliata* (L.) H. Gross.

In this community, herbaceous cover (the third layer) is distributed quite unevenly. It is
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developed in open places, where it makes the high projective cover. Its composition is colorful with numerous indigenous and alien species. There occur *Paspalum thunbergia* Kunth, *P. distichum* L., *Persicaria thunbergii* (Siebold & Zucc.) H. Gross, *Cyperus esculentus* L., *C. longus* L. subsp. *longus*, *C. longus* subsp. *badius* (Desf) Bonnier & Layens, *C. brevifoliioides* Thieret & Delahouss., *Solidago virgaurea* L., *Ranunculus muricatus* L., *R. sceleratus* L. and many other taxa.

The soil surface is more or less covered with three species of mosses (*Calliergonella cuspidata*, *Odontoschisma denudatum*, and *Polytrichum strictum*) and the channels – with *Sphagnum cuspidatum* Ehrh. ex Hoffm.

Species creating the main cover in *Eucalyptetum-viminali-globulo-cinerei* community have weak natural renewal capacity. Their reproduction is mainly realized through self-seeding and root sprouts.

3. **Cinnamomo glanduliferae-Cryptomerietum japonicae**

The research area is flatland located at 13–15 m a.s.l. elevation, between 37 T 732694 m E, 4633007 m N; 37 T 732742 m E, 4633241 m N; 37 T 732976 m E, 4633108 m N. The vegetation composition is not rich, with poorly developed herbaceous cover (Figs. 1 & 4). On the research plot, there are located drainage channels with developed cover of *Sphagnum palustre* L., various *Polygonum* species, *Microstegium vimineum* (Trin.) A. Camus, and *Juncus effusus* L.

Forty-nine plant taxa were registered in this community, including 25 native and 24 aliens. Among them, 16 taxa are represented by woody plants and 33 taxa – by herbaceous ones. In contrast to the mentioned above communities, here we observed native *Rhododendron ponticum* L. and invasive *Andropogon virginicus* L. (Appendix).

This plant community is differentiated into layers and sublayers. In the first layer, the 20–30-meter trees of *Eucalyptus cinerea* and *E. viminalis* form the first sub-layer. The second sub-layer is outlined at 10–20 m height and formed by *Cryptomeria japonica* and *Cinnamomum glanduliferum*. The third sub-layer is represented by the 4–8-meter-
high root sprouts of Cryptomeria japonica, Cinnamomum glanduliferum, Alnus glutinosa, and Eucalyptus sp.

The second, sub-forestal, layer is unevenly developed, represented by shrubs of Corylus avellana, Rhododendron ponticum, Frangula alnus Mill. and other. Among the vines, here we observed Smilax excelsa, Lonicera japonica, and Hedera colchica.

Herbaceous cover (the third layer) is weakly developed, with poor species composition due to solid shadowing. Both indigenous and alien species were observed here.

Like in the previous community, the soil surface is more or less covered with mosses Calliergonella cuspidata, Odontoschisma denudatum, Polytrichum strictum, and Sphagnum palustre. Ferns are poorly represented by few units of Thelypteris palustris Schott, Thelypteris limbosperma (All.) H.P. Fuchs, and Pteridium tauricum (= Pteridium aquilinum (L.) Kuhn), which created unfordable groups.

The natural renewal of the trees creating the main cover is weak, and reproduction is realized chiefly through self-seeding and root sprouts.

In total, 134 plant taxa distributed among 49 families and 97 genera were registered during the investigation. The most represented families by the taxa number are Asteraceae (19 taxa), Poaceae (15), Fabaceae (8), Polygonaceae (7), Rosaceae (7), Lamiaceae (5), Euphorbiaceae (5). Hence, these leading families comprise 72 taxa, which represent 53.73% of the total observed.

Therophytes have a dominant position and are represented by 45 taxa (33.58%). The second place belongs to phanerophytes with 29 taxa (21.64 %). Cryptophytes include 27 taxa (20.14%), hemicryptophytes – 24 taxa (17.91%), and chamaephytes – nine taxa (6.71%).

Among the explored taxa, 60 (44.77%) are native and 74 (55.23%) alien. Among the aliens, 26 taxa (43.33%) represent the moist meadows, so the study area corresponds to their natural habitat. Other 16 taxa (26.66%) originated from forest habitats, 11 taxa (18.33%) represent the ecological group of lowland sandy beaches, grasslands and shrub communities, and seven more taxa (11.66%) belong to the ruderal and segetal ecological groups.

Conclusions

Described plant communities Cryptomerietum japonicae, Eucalyptetum-viminali-globulo-cinerei, and Cinnamomo glanduliferae-Cryptomerietum japonicae differ by taxonomic composition and number of native and alien taxa. In total, 134 plant taxa belonging to 49 families and 97 genera were registered in the research area. Among them, 60 (44.77%) taxa are native, and 74 (55.23%) – are aliens.

Because of the disposition of Eucalyptus leaves, in Eucalyptetum-viminali-globulo-cinerei community, the shadow is lower. This results in a higher number of taxa (36 native and...
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There are unfavorable conditions for plants spread in two other communities; hence their number is much lower (33 native and 33 alien taxa in Cryptomerietum japonicae, and 25 native and 22 alien taxa in Cinnamomo glanduliferae-Cryptomerietum japonicae).

Despite cuttings and artificial planting of alien representatives, some indigenous woody species (i.e., Corylus avellana, Frangula alnus, Vaccinium arctostaphylos, Smilax excelsa, Quercus hartwissiana, Carpinus caucasica, Castanea sativa, Hedera colchica, etc.) still occur in this territory. Both native and alien taxa participate in the formation of the described landscape structure. In all three communities, the Lonicera japonica wraps trees and shrubs, significantly inhibiting their development. Herbaceous vegetation mainly developed under the trees canopy and is induced by it. In glades, we observed Miscanthus sinensis, which restricts the penetration and growth of other competitors.

Successional events have started in the Kolkheti Lowland in ancient times. It is a long-term process, which is still ongoing, as our observations confirmed it. Not only woody plants take part in the creation of the secondary communities in this region. Here we also found secondary meadows and some other secondary communities that will be reported in further researches.

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**Appendix.** Taxonomic composition and projective cover in the studied plant communities. Taxa are provided following POWO (2021) database, indicating some widely applied synonyms in the brackets after the equals sign. Indices of the projective cover follow the seven-grade Braun-Blanquet scale (see Material and Methods section for details).

| Nr | Taxon                   | Family      | Origin         | Indices of the projective cover at the investigated areas |
|----|-------------------------|-------------|----------------|--------------------------------------------------------|
| 1  | **Acacia dealbata** Link| Fabaceae    | Australia      | 1                                                      |
| 2  | **Acalypha australis** L.| Euphorbiaceae | East Asia      | +                                                      |
| 3  | **Ailanthus altissima** (Mill.) Swingle | Simaroubaceae | East Asia      | 1                                                      |
| 4  | **Aira elegans** Wild. ex Roem. & Schult. | Poaceae     | Mediterranean  | +                                                      |
| 5  | **Alisma plantago-aquatica** L. | Alismataceae | native         | +                                                      |
| 6  | **Alnus glutinosa** (L.) Gaertn. | Betulaceae  | native         | 1                                                      |
| 7  | **Ambrosia artemisiifolia** L. | Asteraceae  | North America  | 1                                                      |
| 8  | **Andropogon virginicus** L. | Poaceae     | North America  | +                                                      |
| 9  | **Artemisia vulgaris** L. | Asteraceae  | Mediterranean  | 1                                                      |
| 10 | **Bellis perennis** L.   | Asteraceae  | Atl. Europe    | +                                                      |
| 11 | **Blechnum spicant** (L.) Roth. | Aspleniaceae | native         | +                                                      |
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#### Appendix. Continued.

| Nr | Taxon | Family | Origin | Indices of the projective cover at the investigated areas |
|----|-------|--------|--------|----------------------------------------------------------|
|    |       |        |        | 1 | 2 | 3 |
| 12 | Brucea javanica (L.) Merr. (= Rhus javanica L.) | Simaroubaceae | East Asia | + |
| 13 | Calliergonella cuspidata (Hedw.) Loeske | Hypnaceae | native | 2 | 2 | 2 |
| 14 | Capsella bursa-pastoris (L.) Medik. | Brassicaceae | native | + |
| 15 | Cardamine hirsuta L. | Brassicaceae | Atl. Europe | + |
| 16 | Carex remota L. | Cyperaceae | native | + |
| 17 | Carex riparia Curt. | Cyperaceae | native | + |
| 18 | Carpinus caucasica Grossh (= Carpinus betulus L.) | Betulaceae | native | + |
| 19 | Castanea sativa Mill. | Fagaceae | native | r |
| 20 | Centaurium tenuiflorum (Hoffmanns. & Link) Fritsch | Gentianaceae | native | + |
| 21 | Cichorium intybus L. | Asteraceae | native | + |
| 22 | Cinnamomum camphora (L.) J. Presl | Lauraceae | East Asia | + |
| 23 | Cinnamomum glanduliferum (Wall.) Meisn. | Lauraceae | East Asia | 1 | 1 | 3 |
| 24 | Cinnamomum tenuifolium (Makino) Sugim. (= Cinnamomum japonicum Siebold ex Nakai) | Lauraceae | East Asia | + | + |
| 25 | Commelina communis L. | Commelinaceae | East Asia | 1 | 1 |
| 26 | Corylus avellana L. | Betulaceae | native | + | r | r |
| 27 | Crepis setosa Haller f. | Asteraceae | Mediterranean | + |
| 28 | Cryptomeria japonica (Thunb. ex L. f.) D. Don. | Cupressaceae | East Asia | 5 | 1 | 2 |
| 29 | Cyperus brevifoliioides Thieret & Delahouss. (= Kyllinga gracillima Miq.) | Cyperaceae | East Asia | + |
| 30 | Cyperus esculentus L. | Cyperaceae | Mediterranean | + |
| 31 | Cyperus longus L. subsp. longus | Cyperaceae | native | + |
| 32 | Cyperus longus L. subsp. badius (Desf.) Bonnier & Layens (= Cyperus badius Desf.) | Cyperaceae | Mediterranean | + |
| 33 | Dauca carota L. | Apiaceae | Atl. Europe | r |
| 34 | Erigeron annuus (L.) Pers. | Asteraceae | North America | + | + | + |
| 35 | Erigeron bonariensis L. | Asteraceae | North America | + |
| 36 | Erigeron canadensis L. | Asteraceae | North America | + | + | + |
| 37 | Eucalyptus cinerea F. Muell. ex Benth. | Myrtaceae | Australia | 2 | 3 |
| 38 | Eucalyptus globulus Labill. | Myrtaceae | Australia | 2 | 1 |
| 39 | Eucalyptus viminalis Labill. | Myrtaceae | Australia | 1 | 2 | 3 |
| 40 | Euphorbia falcata L. | Euphorbiaceae | native | + |
| 41 | Euphorbia peplus L. | Euphorbiaceae | Mediterranean | + |
| Nr | Taxon                                      | Family        | Origin            | Indices of the projective cover at the investigated areas |
|----|-------------------------------------------|---------------|-------------------|----------------------------------------------------------|
| 42 | Euphorbia stricta L.                     | Euphorbiaceae | Mediterranean     | +                                                        |
| 43 | Filago arvensis L.                       | Asteraceae    | native            | +                                                        |
| 44 | Fragaria vesca L.                        | Rosaceae      | native            | +                                                        |
| 45 | Frangula alnus Mill.                     | Rhamnaceae    | native            | 1 + +                                                     |
| 46 | Galinsoga parviflora Cav.                | Asteraceae    | North America     | +                                                        |
| 47 | Galinsoga quadriradiata Ruiz & Pav. (= Galinsoga ciliata (Raf.) S.F. Blake) | Asteraceae    | North America     | +                                                        |
| 48 | Hedera colchica (K. Koch) K. Koch.       | Araliaceae    | native            | + +                                                      |
| 49 | Helichrysum luteoalbum (L.) Rchb. (= Gnaphalium luteoalbum L.) | Asteraceae | East Asia         | +                                                        |
| 50 | Hydrangea febrifuga (Lour.) Y. De Smet & Granados (= Dichroa febrifuga Lour.) | Hydrangeaceae | East Asia         | +                                                        |
| 51 | Hydrocotyle ramiﬂora Maxim.             | Araliaceae    | East Asia         | 1 1 +                                                      |
| 52 | Hydrocotyle vulgaris L.                  | Araliaceae    | Europe            | 2 1 +                                                     |
| 53 | Hypericum androsaemum L.                | Hypericaceae  | native            | +                                                        |
| 54 | Hypochaeris radicata L. (= Hypochaeris radiata Falk.) | Asteraceae | native            | +                                                        |
| 55 | Juncus effusus L.                       | Juncaceae     | native            | 1 + +                                                      |
| 56 | Juncus tenuis Willd.                     | Juncaceae     | native            | 1 +                                                        |
| 57 | Kummerowia striata (Thunb.) Schindl. (= Lespedeza striata (Thunb.) Hook. & Arn.) | Fabaceae     | East Asia         | 1 1                                                       |
| 58 | Lamium purpureum L.                     | Lamiaceae     | Europe            | +                                                        |
| 59 | Leontodon hispidus L.                   | Asteraceae    | native            | +                                                        |
| 60 | Lepidium campestre (L.) W.T. Aiton      | Brassicaceae  | Mediterranean     | +                                                        |
| 61 | Lespedeza bicolor Turcz.                | Fabaceae      | East Asia         | +                                                        |
| 62 | Leucojum aestivum L.                    | Amaryllidaceae| native            | +                                                        |
| 63 | Lobelia urens L.                        | Campanulaceae | Europe            | r                                                        |
| 64 | Logfia gallica (L.) Coss. & Germ. (= Filago gallica L.) | Asteraeceae | Europe            | +                                                        |
| 65 | Lolium perenne L.                       | Poaceae       | Europe            | +                                                        |
| 66 | Lolium rigidum Gaudin.                  | Poaceae       | Mediterranean     | +                                                        |
| 67 | Lonicera japonica Thunb.                | Caprifoliaceae| East Asia         | + + +                                                      |
| 68 | Lotus palustris Willd.                  | Fabaceae      | Mediterranean     | +                                                        |
| 69 | Lysimachia japonica Thunb.              | Primulaceae   | East Asia         | +                                                        |
| 70 | Lythrum salicaria L.                    | Lythraceae    | native            | +                                                        |
| 71 | Mentha aquatica L.                      | Lamiaceae     | native            | +                                                        |
| 72 | Mentha pulegium L.                      | Lamiaceae     | native            | +                                                        |
### Floristic characteristics of some synanthropic plant communities of the Kobuleti lowland

#### Appendix. Continued.

| Nr | Taxon                                                                 | Family             | Origin          | Indices of the projective cover at the investigated areas |
|----|----------------------------------------------------------------------|--------------------|-----------------|----------------------------------------------------------|
| 73 | Microsteg vimineum (Trin.) A. Camus (= Microstegium imberbe (Nees ex Steud.) Tzvelev) | Poaceae            | East Asia       | 1 1 +                                                    |
| 74 | Microstegium japonicum (Miq.) Koidz.                                 | Poaceae            | East Asia       | 1 1                                                      |
| 75 | Miscanthus sinensis Andersson                                       | Poaceae            | East Asia       | 1 1 +                                                    |
| 76 | Myosotis scorpioides L. (= Myosotis palustris (L.) Nathh.)            | Boraginaceae       | native          | +                                                        |
| 77 | Nasturtium officinale (L) R. Br.                                    | Brassicaceae       | native          | +                                                        |
| 78 | Nymphaea candida C. Presl.                                          | Nymphaeaceae       | North America   | r                                                        |
| 79 | Odontoschisma denudatum (Nees) Dumort.                               | Cephaloziaaceae    | native          | 2 2 2                                                    |
| 80 | Osmunda regalis L.                                                   | Osmundaceae        | native          | + r                                                      |
| 81 | Oxalis corniculata L.                                                | Oxalidaceae        | North America   | + +                                                      |
| 82 | Paspalum distichum L. (= Paspalum paspalodes (Michx.) Scribn.)       | Poaceae            | East Asia       | +                                                        |
| 83 | Paspalum thunbergii Kunth                                            | Poaceae            | East Asia       | +                                                        |
| 84 | Perilla frutescens (L.) Britton var. crispa (Thunb.) H. Deane (= Perilla nankinensis (Lour.) Decne.) | Lamiaceae          | East Asia       | +                                                        |
| 85 | Persicaria hydropiper (L.) Delarbre (= Polygonum hydropiper L.)       | Polygonaceae       | native          | + +                                                      |
| 86 | Persicaria maculosa Gray. (= Polygonum persicaria L.)                 | Polygonaceae       | native          | +                                                        |
| 87 | Persicaria perfoliata (L.) H. Gross (= Polygonum perfoliatum L.)      | Polygonaceae       | East Asia       | + 1                                                      |
| 88 | Persicaria thunbergii (Siebold & Zucc.) H. Gross (= Polygonum thunbergii Siebold & Zucc.) | Polygonaceae       | East Asia       | 1 +                                                      |
| 89 | Plantago major L.                                                    | Plantaginaceae     | native          | + + +                                                    |
| 90 | Poa annua L.                                                         | Poaceae            | Europe          | 1 1 1                                                    |
| 91 | Poa compressa L.                                                    | Poaceae            | Europe          | 1                                                        |
| 92 | Poa pratensis L.                                                    | Poaceae            | native          | + 1                                                      |
| 93 | Polytrichum strictum Menzies ex Brid.                               | Polytrichaceae     | native          | + + +                                                    |
| 94 | Potentilla indica (Andrews) Th. Wolf (Duchesnea indica (Andrews) Teschem.) | Rosaceae           | East Asia       | +                                                        |
| 95 | Prunella vulgaris L.                                                 | Lamiaceae          | native          | + +                                                      |
| 96 | Pseudognaphalium affine (D. Don) Anderb. (= Gnaphalium affine D. Don.) | Asteraceae         | East Asia       | +                                                        |
| 97 | Pteridium aquilinum (L.) Kuhn (= Pteridium tauricum V.I. Krecz. ex Grossh.) | Dennstaedtiaceae  | native          | 1 1 1                                                    |
## Appendix. Continued.

| Nr  | Taxon                              | Family          | Origin         | Indices of the projective cover at the investigated areas |
|-----|------------------------------------|-----------------|----------------|----------------------------------------------------------|
| 98  | *Pteris cretica* L.                | Pteridaceae     | native         | +                                                        |
| 99  | *Quercus hartwissiana* Steven.     | Fagaceae        | native         | +                                                        |
| 100 | *Ranunculus muricatus* L.          | Ranunculaceae   | Mediterranean  | +                                                        |
| 101 | *Ranunculus sceleratus* L.         | Ranunculaceae   | Europe         | +                                                        |
| 102 | *Rhododendron luteum* Sweet.      | Ericaceae       | native         | r            r                                          |
| 103 | *Rhododendron ponticum* L.        | Ericaceae       | native         | r                                                        |
| 104 | *Rubus caesius* L.                | Rosaceae        | native         | +                                                        |
| 105 | *Rubus creticus* Tourn. ex L. (= *Rubus sanguineus* Friv.) | Rosaceae        | native         | +            +                                          |
| 106 | *Rubus hirtus* Waldst. & Kit.     | Rosaceae        | native         | +            +                                          |
| 107 | *Rubus serpens* Weihe ex Lej. & Courtois | Rosaceae        | native         | +                                                        |
| 108 | *Rumex acerosella* L.             | Polygonaceae    | native         | +                                                        |
| 109 | *Rumex acerosella* L. subsp. aceroselloides (Balansa) Den Nijs (= *Rumex aceroselloides* Balansa) | Polygonaceae    | native         | +                                                        |
| 110 | *Rumex pulcher* L.                | Polygonaceae    | native         | +                                                        |
| 111 | *Sambucus ebulus* L.              | Adoxaceae       | native         | +                                                        |
| 112 | *Senecio sylvaticus* L.           | Asteraceae      | native         | +                                                        |
| 113 | *Senecio vulgaris* L.             | Asteraceae      | Europe         | +            +            +                               |
| 114 | *Setaria faberi* R.A.W. Herrm     | Poaceae         | Mediterranean  | +                                                        |
| 115 | *Setaria intermedia* Roem. & Schult. | Poaceae         | East Asia      | +            +                                          |
| 116 | *Sisyrinchium septentrionale* E.P. Bicknell | Iridaceae      | North America  | +                                                        |
| 117 | *Smilax excelsa* L.               | Smilacaceae     | native         | 1            +            +                               |
| 118 | *Sphagnum cuspidatum* Ehrh. ex Hoffm. | Sphagnaceae    | native         | 1                                                        |
| 119 | *Sphagnum palustre* L.            | Sphagnaceae     | native         | +                                                        |
| 120 | *Spiraea japonica* L. f.          | Rosaceae        | East Asia      | 1            1            +                               |
| 121 | *Sporobolus fertilis* (Steud.) Clayton | Poaceae         | East Asia      | +                                                        |
| 122 | *Symphyotrichum graminifolium* (Spreng.) G.L. Nesom. (= *Conyzaanthus graminifolius* (Spreng.) Tamamsch.) | Asteraceae      | Mediterranean  | +                                                        |
| 123 | *Thelypteris limbosperma* (All.) H.P. Fuchs (= *Thelypteris oreopteris* (Sw.) Sloss.) | Aspleniaceae    | native         | +            +                                          |
| 124 | *Thelypteris palustris* Schott.   | Aspleniaceae    | native         | +                                                        |
| 125 | *Trifolium diffusum* Ehrh.        | Fabaceae        | Mediterranean  | +                                                        |
| 126 | *Trifolium echinatum* Bieb.       | Fabaceae        | Mediterranean  | +                                                        |
| 127 | *Typha angustifolia* L.           | Typhaceae       | native         | +                                                        |
Floristic characteristics of some synanthropic plant communities of the Kobuleti lowland

Appendix. Continued.

| Nr | Taxon                            | Family         | Origin       | Indices of the projective cover at the investigated areas |
|----|----------------------------------|----------------|--------------|----------------------------------------------------------|
| 128| Vaccinium arctostaphylos L.     | Ericaceae      | native       | + r r                                                    |
| 129| Verbascum blattaria L.          | Scrophulariaceae| native       | +                                                       |
| 130| Vernicia fordii (Hems.) Airy Shaw (= Aleurites fordii Hems.) | Euphorbiaceae | East Asia    | +                                                       |
| 131| Vicia lathyroides L.            | Fabaceae       | Mediterranean| +                                                       |
| 132| Vicia sativa L.                 | Fabaceae       | Europe       | +                                                       |
| 133| Viola prionantha Bunge.         | Violaceae      | East Asia    | +                                                       |
| 134| Viola reichenbachiana Jord. ex Boreau. | Violaceae | native       | + +                                                     |

Представлено матеріали польових досліджень синантропної рослинності на території Кобулеті, що здійснювалися протягом 2016–2020 років. Зокрема, на території низовини Кобулеті, в межах трьох різних рослинних угруповань (Cryptomerietum japonicae, Eucalyptetum-viminali-globulo-cinerei та Cinnamomo glanduliferae-Cryptomerietum japonicae) було виявлено 134 таксони, що належать до 49 родин і 97 родів. Рослинне угруповання Cryptomerietum japonicae налічує 66 таксонів, з-посеред яких 33 є місцевими, а інші 33 – адвентивними. Деревні рослини в угрупованні Cryptomerietum japonicae представлені 15 таксонами. Рослинне угруповання Eucalyptetum-viminali-globulo-cinerei налічує 91 таксон, з-посеред яких 36 є місцевими і 55 мають адвентивне походження. Деревні рослини у складі угруповання Eucalyptetum-viminali-globulo-cinerei представлені 17 таксонами, в той час як решта 74 таксони представляють трав'яни рослини. В угрупованні Cinnamomo glanduliferae-Cryptomerietum japonicae виявлено 49 таксонів рослин, включаючи 25 місцевих і 24 адвентивних. При цьому, в рослинному угрупованні Cinnamomo glanduliferae-Cryptomerietum japonicae 16 таксонів представлено деревними рослинами і 33 таксони – трав'яними.

Таким чином, було виявлено, що на досліджений території, 60 таксонів (44.77 %) є місцевими і 74 таксони (55.23 %) мають чужорідне походження. Серед адвентивних рослин, 31 таксон походить зі Східної Азії, 16 таксонів походять з Середземномор'я, 13 таксонів походять з Європи, десять таксонів походять з Північної Америки і чотири таксони – з Австралії.

Не зважаючи на вирубки та штучні насадження чужорідних представників, деякі з локальних деревних видів (зокрема, Corylus avellana, Frangula alnus, Vaccinium arctostaphylos, Smilax excelsa, Quercus hartwissiana, Carpinus caucasica, Castanea sativa, Hedera colchica) все ще представлені на досліджений території. При цьому, як місцеві, так і адвентивні види беруть участь у формуванні структури описаного ландшафту. Сукцесійні зміни у долині Колхеті розпочалися ще у давні часи. Це довготривалий процес, який, як показали наші дослідження, все ще триває.

Ключові слова: синантропна рослинність, природна флора, адвентивна флора, інвазія, Аджарія, Грузія