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# MEDICINAL PLANTS IN THE ROPOTAMO RESERVE: BIODIVERSITYAND CONSERVATION SIGNIFICANCE

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**Abstract.** The paper presents the recent diversity and conservational importance of the medicinal plants in the Ropotamo Reserve (SE Bulgaria): 211 species from 181 genera and 68 families. They comprised significant part of the total plants biodiversity of the reserve, which consisted of 550 species.

The spread ofthe medicinal plants in different habitats ofEuropean significance was shown together with the threatened status ofthe species and their relative abundance. The distribution of all medicinal species was analyzed according to the frequency or rarity of their occurrence and it was proved that the reserve area hosted some rare forBulgaria species ofmedicinal plants.

**Key words:** Black Sea coast, Bulgaria, rare species, threatened species

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## INTRODUCTION

Ropotamo Reserve was created in 1940 to preserve the dense forests *(longozes)* along the banks of the river Ropotamo. In 1975, it was declared as Ramsar site. The reserve is a part of a wetland complex of great national and international significance and recently has been included in a Natura 2000 network protected site (Michev & Stoyneva 2007; Vassilev et al. 2013).

The reserve with its complicated reliefis characterized by rich floristic diversity caused mainly by the diversity ofhabitats *(e.g.* dense forests along the river banks, swamps, rocky shores, dunes, open spaces and oak forests). Although the spread of some medicinal plants has been studied (Bondev & Velchev 1984; Gussev et al. 2003; Sidrmova 2007), a complex study on the recent distribution and resources of all medicinal plants in Ropotamo Reserve has not been conducted so far (Vitkova Et al., in press). Therefore, the present paper represents detailed data on the species composition ofthe medicinal plants in the area, collected during larger study aimed at the preparation ofthe new Ropotamo Reserve Management Plan (2015-2025), abbreviated hereafter as RRMP.

## MATERIALAND METHODS

Ropotamo Reserve is situated between 150 and 0 metres above the sea level along the lowest stream of the Ropotamo River in South-eastern Bulgaria. It occupies an area of 1000.7 ha and falls in the European Continental and Continental Mediterranean climatic areas characterized by mild winter and warm, dry summer (Subev & Stanev 1963).

For the implementation ofthe task, field trips were organized in the autumn period of 2014 and two methods were applied: Route method and Method for monitoring of higher plants (Gussev et al. 2008) with the following important features ofthe populations taken into account: area, horizontal structure, number, project coverage. Species identification was done in the filed with some additional cameral work, following mainly Jordanov (1963-1979), Velchev (1982, 1989), Kozuharov (1995) and Delipavlov et al. (2003). In addition to our own findings, all data concerning medicinal plants in the available literature were analyzed in terms offloristics and nature conservation significance. The list ofmedicinal plants was prepared after the Application to Art. 1 ofthe Medicinal Plants Act (2000 - MPA). The threatened status of each species was determined according to different international and national documents: Bern Convention (1979), CITES (1973), IUCN (2001), Medicinal Plants Act (2000 - MPA), Biological Diversity Act (2002), Act on Amending and Suplementing the Biological Diversity Act (2007 - BDA), Red List ofBulgarian vascular plants (Petrova & Vladimirov 2009 - RL) and Red Data Book of the Republic of Bulgaria (Peev 2015 - RDB). The

habitats were classified according to EUNIS (2007).



**Table 1.** Medicinal plants in the Ropotamo Reserve. Abbreviations used: SCS - Species of conservation significance; RS - resources (G - group, Gs - groups, N- numerous, Sp - single plants); EHb - habitat (indicated by its relevant number); RL - Red List of vascular plants (Petrova & Vladimirov 2009); RDB - Red Data Book ofthe Republic ofBulgaria (Peev 2015): EN (Endangered); VU (Vulnerable); LC (Least Concern); BDA - Biological Diversity Act (2002); SRPU - Special Regime ofProtectionandUse according to Medicinal Plants Act (2000); BC - Bern Convention (1979); CITES - Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973); * - Literary data. Families and species are enlisted in alphabetical order.

**Family** *Taxon* **SCS RS EHb** 1 Aceraceae *Acerplatanoides* L. Sp G1.76A1

2 Aceraceae *Acertataricum* L. Gs G1.2232; G1.76A1

3 Alliaceae *Allium rotundum* L. G Fl.4344

4 Alliaceae *Nectaroscordum siculum* ssp. *bulgaricum* (Janka) Steam.* G G1.2232

5 Alismataceae *Alismaplantago-aquatica* L. N C3.2

6 Amarillidaceae *Galantlms nivalis* L.* EN. RL.CITES RDB. BDA(Suppl. 3). Gs G1.76A1

7 Amarillidaceae *Leucojum aestivum* L.* VU. RL. BDA N G1.2232

8 Anacardiaceae *Cotimis coggygria* Scop. N G1.76A1; B1.4B11; B1.7

9 Apiaceae *Anethum graveolens* L.* G 10 Apiaceae *Angelica sylvestris* L. * G 11 Apiaceae *Anthriscus cerefolium* (L.) Hoffin. G G1.76A1 12 Apiaceae *Chaerophyllum temulentum* L. N G1.2232 13 Apiaceae *Etyngium campestre* L. N 14 Apiaceae *Etyngium maritimum* L. EN. RL. RDB. BDA (Suppl.3)Sp B1.313

15 Apiaceae *Ferulago sylvatica* (Besser) Rchb.* Gs 16 Apiaceae *Heracleum sibiricum* L. Gs

17. Apiaceae *Opopanax chironium* ssp. *bulgaricum* (Velen.) Andreev* (Suppl. 4)Sp VU. RL. BDA

18 Apiaceae *Pimpinella saxifraga* L. N G1.76A1 19 Apiaceae *Tordylium maximum* L. Gs

20 Apocynaceae *Trachomitum venetum* (L.) EN.N B1.4B11 RL. RDB. BDA(Suppl.3)

21 Araceae *Arum maculatum* L. Gs G1.76A1

22 Araliaceae *Hedera helix* L. N G1.2232;G1.76A1; F5.51A4

23 Aristolochiaceae *Aristolochin clematitis* L. Gs G1.2223 24 Asclepiadaceae *Cionura erecta* (L.) Griseb. N B1.4B1₁

**Family** *Taxon* **SCS RS EHb** 25 Asclepiadaceae *Periploca graeca* L. N Gl .2232 26 Asclepiadaceae *Vincetoxicum hirundinaria* Medic. Gs G1.76A1 27 Aspleniaceae *Asplenium adiantum-nigrum* L.* Gs 28 Aspleniaceae *Asplenium ruta-muraria* L.* Gs 29 Aspleniaceae *Asplenium trichomanesE.* SRPU Gs G1.76A1

3O Asteraceae *Achillea collina* J. Becker ex Reichenb. N El.4344; 1.7

31 Asteraceae *Anthemis cotula* L. Gs 32 Asteraceae *Anthemis tinctoria* L. Gs G1.76A1;B1.4B11 33 Asteraceae *Arctium lappa* L. Gs 34 Asteraceae *Artemisia absinthium* L. N B1.4B11 35 Asteraceae *Artemisia campestris* L. N B1.4B11; Bl.7 36 Asteraceae *Artemisia santonica* L. SRPU N B1.4B11 37 Asteraceae *Artemisia vulgaris* L. N 38 Asteraceae *Bellis perennis* L. N 39 Asteraceae *Carduus acanthoides* L, Gs 40 Asteraceae *Carlina vulgaris* L. Gs El.4344; 1.7

41 Asteraceae *Centaurea cyanus* L. Gs B1.4B11; G1.76A1;B1.7

42 Asteraceae *Cichorium intybus* L. Gs 43 Asteraceae *Cnicus benedictus* L.* SRPU G 44 Asteraceae *Filago vulgaris* Lam. Gs 45 Asteraceae *Inula ensifolia* L. N

46 Asteraceae *Matricaria chamomilla* L. N 47 Asteraceae *Scorzonera hispanica* L. Gs 48 Asteraceae *Senecio vulgaris* L. Gs 49 Asteraceae *Taraxacum officinale* Web. N

50 Asteraceae *Tanacetum vulgare* L. N G1.76A1 51 Asteraceae *Tragopogon pratensis* L. Gs 52 Asteraceae *Xanthium strumarium* L. Gs B1.4B11 53 Asteraceae *Xeranthemum annuum* L, Gs El.4344 54 Betulaceae *Ainus glutinosa* (L.) Gaertner N Gl .2232 55 Betulaceae *Carpinus betulus* L. N Gl .2232 56 Betulaceae *Corylus avellana* L. G1.76A1 57 Boraginaceae *Anchusa officinalis* L. N

58 Boraginaceae *Buglossoides purpurocaerulea* (L.)I. M. lohnst. Gs G1.76A1

59 Boraginaceae *Cynoglossum officinale* L. Gs 60 Boraginaceae *Echium vulgare* L. Gs



**Family** *Taxon* **SCS RS EHb** 61 Boraginaceae *Lithospemium officinale* L. Gs G1.76A1 62 Brassicaceae *Alyssum alyssoides* L. N 63 Brassicaceae *Capsella bursa-pastoris*(L.) Medic N 64 Brassicaceae *Cardamine bulbifera* L. N G1.76A1 65 Brassicaceae *Lepidium ruderale* L. N 66 Brassicaceae *Nasturtium officinale* R. Br. N Gl .2223 67 Brassicaceae *Thlaspi arvense* L. Gs 68 Butomaceae *Butomus umbellatus* L.. Gs G3.2 69 Campanulaceae *Campanula persicifolia* L. G G1.76A1; 1.7 70 Caprifoliaceae *Sambucus ebulus* L. Gs 71 Caprifoliaceae *Sambucus nigra* L. Gs G1.76A1;GL2232 72 Caryophyllaceae *Herniaria lürsuta* L. Gs 73 Caryophyllaceae *Lychnisflos-cuculi* L. Gs E1.4344 74. Caryophyllaceae *Stellaria media* (L.) Vill. N Gl .2232

75 Caryophyllaceae *Viscaria vulgaris* ssp. *atropurpurea* (Griseb.) Stoj. Gs

76 Celastraceae *Euonymus europaeus* L. Gs G1.76A1 77 Celastraceae *Euonymus verrucosus* Scop. Gs G1.76A1 78 Chenopodiaceae *Chenopodium album* L. Gs 79 Convolvulaceae *Calystegia sepium* (L.) R. Br. Gs Gl .2232 80 Convolvulaceae *Convolvulus arvensis* L. N 81 Cornaceae *Cornus mas* L. Gs G1.76A1; Bl.7 82 Crassulaceae *Sedum maximum* (L.) Suter G

83 Cucurbitaceae *Ecballium elaterium* (L.) A. Richard Gs Bl.313

84 Dioscoreaceae *Tamus communis* L,. Gs Gl .2232 85 Dipsacaceae *Knautia arvensis* (L.) Coult. Gs 86 Ephedraceae *Ephedra distachya* L.* VU. RL. BDA

(Suppl. 3) G B1.4B11

87 Equisetaceae *Equisetum sylvaticum* L. Gs Gl .2232 88 Equisetaceae *Equisetum telmateia* Ehrh Gs Gl .2232 89 Euphorbiaceae *Euphorbia amygdaloides* L. Gs G1.76A1 90 Euphorbiaceae *Euphorbia cyparissias* L. Gs El.4344; 1.7

91 Euphorbiaceae *Euphorbia peplis* L. VU. RL. BDA

(Suppl. 3) Sp Bl.313

92 Euphorbiaceae *Mercurialisperennis* L. N 93 Fabaceae *Bituminaria bituminosa* (L.) Stirt. G G1.76A1 94. Fabaceae *Chamaecytisushirsutus*(L.) Link. Gs G1.76A1 95 Fabaceae *Coronilla varia* L. Gs El.4344



**Family** *Taxon* **SCS RS EHb** 96 Fabaceae *Lathyrus niger* (L.) Bernh. Gs G1.76A1;B1.7 97 Fabaceae *Lathyrussylvestris* L. Gs G1.76A1 98 Fabaceae *Latliyrns vermis* (L.) Bernh. Gs G1.76A1 99 Fabaceae *Lotus comiculatus* L. N 100 Fabaceae *Melilotus officinalis* (L.) Palla. N 101 Fabaceae *Ononis spinosa* L. N El.4344 102 Fabaceae *Trifolium pratense* L,. N 103 Fabaceae *Vicia cracca* L. N 104 Fagaceae *Fagus orientalis* Lipsky N G1.76A1 105 Fagaceae *Ouercusfrainetto* Ten. N G1.76A1; 1.7 106 Geraniaceae *Geranium robertiamim* L. N G1.76A1 107 Geraniaceae *Geranium sanguineum* L. Gs G1.76A1;B1.7 108 Hypericaceae *Hypericum androsaemum* L.* EN. RL. RDB.

BDA (Suppl. 3) Sp G1.76A1

109 Hypericaceae *Hypericum perforatum* L. N E1.4344;G1.76A1 110 Hypolepidiaceae *Pteridium aquilinum* (L.) Kuhn N G1.76A1;B1.7 111. Iridaceae *Iris pseudacorus* L. N G1.2232 112. Lamiaceae *Acinos an˙ensis* (Lam.) Dandy N 113. Lamiaceae *Ajuga laxmannii* (L.) Benth. Gs G1.76A1 114 Lamiaceae *Ballota nigra* L. Gs 115 Lamiaceae *Clinopodium vulgare* L. Gs G1.76A1 116 Lamiaceae *Glechoma hederacea* L. N G1.76A1 117. Lamiaceae *Lamiumpurpureum* L. Gs 118 Lamiaceae *Lycopus europaeus* L. Gs C3.2 119 Lamiaceae *Marrubiumperegrinum* L. Gs B1.4B11; B1.7 120 Lamiaceae *Melissa officinalis* L. Gs G1.76A1 121 Lamiaceae *Mentha an˙ensis* L. Gs 122 Lamiaceae *Mentha spicata* L. Gs 123 Lamiaceae *Origanum vulgare* ssp. *vulgare* L. N El.4344 124 Lamiaceae *Prunella vulgaris* L. N 125 Lamiaceae *Salvia verticillata* L. N El.4344 126 Lamiaceae *Sideritis montana* L. N 127 Lamiaceae *Stachys recta* L. G

128 Lamiaceae *Teucrium chamaedtys* L. N B1.4B11; G1.76A1;B1.7

129 Lamiaceae *Teucrium polium* L. N B1.4B11; B1.7

130 Lamiaceae *Thymus longidentatus* (Deg. et Urum.) Ronn. N E1.4344; G1.76A1

131 Lamiaceae *Thymus sibthorpii* Benth. N E1.4344 71

**Family** *Taxon* **SCS RS EHb** 132 Lemnaceae *Lenina minor* L. N C3.2 133 Liliaceae *Colchicum autumnale* L. N

134 Liliaceae *Polygonatum odoratum* (Millr)Druce BDA(Suppl. 4) Gs G1.76A1; Bl.7

135 Liliaceae *Ruscus aculeatus* L. BDA(Suppl. 4) SRPU N G1.76A1; G1.2232; F5.51A4

136 Liliaceae *Scilla bifolia* L. BDA(Suppl. 4) N G1.76A1 137 Lorantaceae *Viscum album* L. G

138 Lytraceae *Lythrum salicaria* L. N Gl .2232 139 Lytraceae *Lythrum virgatum* L. Gs C3.2 140 Malvaceae *Malva sylvestris* L. Gs

141 Nymphaeaceae *Nuphar lutea* (L.) Sibth. et Sm. EN. RL. RDB. BDA (Suppl. 3) RL. RDB. N C3.2

142 Nymphaeaceae *Nymphaea alba* L. EN.

BDA (Suppl. 3)N C3.2

143 Oleaceae *Fraxinus ornus* L. N G1.76A1; F5.51A4;B1.7

144 Oleaceae *Fraxinus oxycarpa* Willd. N Bl.7 145 Oleaceae *Ligustmm vulgare* L. Gs G1.76A1

146. Oleaceae *Phyllirea latifolia* L. N F5.51A4

147. Orchidaceae *Anacamptis pyramidalis* (L.) L. C. M. Reichard* VU. RL. BDA (Suppl. 3). CITESSp El.4344

148. Orchidaceae *Orchispapilionaceae* L.* VU. RL. BDA (Suppl. 3). CITESSp El.4344

149. Papaveraceae *Chelidonium majus* L. Gs 150. Papaveraceae *Glauciumflavum* GrantZ. SRPU G 1.313 151. Papaveraceae *Papaverrhoeas* L. Gs El.4344 152. Plantaginaceae *Plantago lanceolata* L. Gs 153. Plantaginaceae *Plantago media* L. Gs 154. Polygonaceae *Persicaria hydropiper* (L.) Opiz N G3.2 155. Polygonaceae *Polygonum aviculare* L. N 156 Polygonaceae *Rumex acetosella* L. N El.4344 157 Polypodiaceae *Polypodium vulgare* L. Gs G1.76A1 158 Portulacaceae *Portulaca oleracea* L. Gs 159 Primulaceae *Anagallis arvensis* L. Gs

160 Primulaceae *Cyclamen coum* Mill. LC.RL.BC.BDA (Suppl. 3). CITES N G1.76A1

161 Primulaceae *Lysimachia nummularia* L. N Gl .2232 162 Primulaceae *Primula acaulis* ssp. *rubra*

(Sm.) Greuter & Bürdet VU. RL Gs G1.76A1

163 Primulaceae *Primula veris* L. SRPU Gs G1.76A1 72

**Family** *Taxon* **SCS RS EHb** 164 Ranunculaceae *Adonis aestivalis* L. Gs 165 Ranunculaceae *Clematis vitalba* L. N Gl .2232

166 Ranunculaceae *Consolida hispanica* (Costa) Greuter & Bürdet Gs Bl.7

167 Ranunculaceae *Helleborus odorus* Waldst. & Kit. Gs E1.4344 168 Ranunculaceae *Ranunculusficaria* L, N Gl .2232 169 Ranunculaceae *Raminciihis repens* L. N 170 Rhamnaceae *Paliiirnsspina-christi* Mill. N B1.4B11;G1.76A1; F5.51A4;B1.7 171 Rhamnaceae *Rhamnus catharticus* L. Sp G1.76A1;B1.7 172 Rosaceae *Agrimonia eupatoria* L. N El.4344 173 Rosaceae *Crataegus monogyna* Jacq. Gs G1.76A1; Bl.7 174 Rosaceae *CrataeguspentagyndW.* etKexWilld G G1.76A1 175 Rosaceae *Filipendula vulgaris* Moench. N E1.4344 176 Rosaceae *Fragaria vesca* L. N G1.76A1; Bl.7 177 Rosaceae *Geum urbanum* L. N Gl .2232 178 Rosaceae *Malus sylvestris* Mill. Sp G1.76A1 179 Rosaceae *Potentilla reptans* L. N Gl .2232 180 Rosaceae *Prunus spinosa* L. Gs G1.76A1 181 Rosaceae *Rosa gallica* L. Gs G1.76A1 182 Rosaceae *Rubus caesius* L. Gs G1.76A1 183 Rosaceae *Sanguisorba minor* Scop. Gs E1.4344 184 Rosaceae *Sorbus aucuparia* L, Sp G1.76A1 185 Rosaceae *Sorbus domestica* L. Sp 186 Rosaceae *Sorbus torminalis* (L.) Crantz. Sp G1.76A1 187 Rubiaceae *Cruciata laevipes* Opiz. N G1.76A1 188 Rubiaceae *Galium aparine* L. N Gl .2232 189 Rubiaceae *Galium verum* L. N El.4344 190 Salicaceae *Salix alba* L. N 191 Scrophulariaceae *Digitalis lanata* Ehrh. Gs E1.4344 192 Scrophulariaceae *Scrophularia nodosa* L. Gs 193 Scrophulariaceae *Verbascum densiflorum* Bertol. Gs 194. Scrophulariaceae *Verbascum phlomoides* L. Gs G1.76A1 195 Scrophulariaceae *Verbascum phoeniceum* L. Gs G1.76A1 196 Scrophulariaceae *Veronica officinalis* L. Gs G1.76A1 197 Smilacaceae *Smilax excelsa* L. N Gl .2232 198 Solanaceae *Datura stramonium* L. Gs



**Family** *Taxon* **SCS RS EHb** 199 Solanaceae *Solatium dulcamara* L. Gs G1.2232 200 Solanaceae *Solatium nigrum* L. Gs B1.7 201 Tiliaceae *Tilia tomentosa* Moench Gs G1.76A1 202 Typhaceae *Typha angustifolia* L. N C3.2 203 Ulmaceae *Celtis australis* L. Sp B1.7 204 Ulmaceae *Ulmus minor* Mill. Gs G1.2232 205 Urticaceae *Parietaria officinalis* L. Gs G1.2232 206 Urticaceae *Urtica dioica* L. N G1.2232 207 Valerianaceae *Valeriana officinalis* L. SRPU G G1.76A1 208 Verbenaceae *Verbena officinalis* L. Gs 209 Violaceae *Viola odorata* L. N G1.76A1 210 Vitaceae *Vitis sylvestris C.C.Gmelin* Sp G1.2232 211 Zygophyllaceae *Tribulus terrestris* L. N B1.4B11

## RESULTS

All documentedmedicinal plants ofthe Ropotamo Reserve are enlisted in **Table 1.** The list contains 197 species found by us during the present study, together with 14 other species which have been recorded at least once in the area and published in the relevant literature (indicated by asterisk - *). The total list ofmedicinal plants reported from the reserve comprised 211 species belonging to 181 genera and 68 families. This

number represents 38% of all 550 species of vascular plants known form the reserve territory (for details see Vitkova et al., in press) and 28% of all medicinal plants in Bulgaria (MPA).

Twenty-three species ofthe medicinal plants, or 11 %, were threatened according to different documents **(Table 1):** seven were *Endangered* in the Bulgarian Red Data Book (Peev 2015), fifteen were from the Red List of Bulgarian vascular plants (Petrova & Vladimirov 2009), eighteen species were from the Biological Diversity Act (2002), four species were from the species protected under CITES and seven species were protected by the MPA with Special Regime of Protection and Use (2000). ~

Many medicinal plants were found to grow in habitats ofEuropean significance according to EUNIS (2007) - **Table 1.** The mixed oak forests, which represent the habitat EUNIS G1.76A1 *Euxino-Thracian [Ouercus frainettoJ-fOuercus cerris] forests* **(Fig. 1),** coverlarge areas in the reserve reaching the coastal area north ofthe megalith Begliktash, the shores above the Black Sea bay St. Paraskeva **(Fig. 2)** and the slopes ofthe Vulchanovoto Kale area as well. Totally 68 medicinal plants were found there, ten ofthem were ofconservation significance **(Table 1).** Three species were protected: *Cyclamen coum, Galanthus nivalis* and *Hypericum androsaemum.*



*C. coum* and *Ruscus aculeatus* were abundant (Vitkova et al., in press). Both banks ofthe Ropotamo River are covered with dense forests **(Fig. 3).** The periodically flooded mixed deciduous forests along the banks ofthe river represent the habitat **EUNIS G1**.2232 *Helleno-Balkanic ash-oak-alderforest***(Fig. 4).** Thirty one medicinal plants were found there, and two of them were of conservation significance - *Leucojum aestivum* and *Ruscus aculeatus* **(Table 1).** The habitat EUNIS C3.2 *Water-fringing reedbeds and tall heleophytes other than cans* **(Fig. 5)** is represented by the vegetation ofthe Arkutino marsh, where we found nine medicinal plants. Two of them were with conservation status - *Nymphaea alba* and *Nuphar lutea* **(Table 1).**

The secondary grasslands at the sides of destroyed forests represent the

**Figs. 1-4: 1 -** Habitat *G1.76A1 Euxino-Thracian [QuercusfrainettoNkQuercuscerris] forests:* Over the bay of St. Paraskeva; **2** - The bay of St. Paraskeva; **3** - Ropotamo River; **4** - Habitat *G1.2232 Helleno-Balkanicash-oak-alderforest:* Ropotamo Riverbank.



habitat EUNIS El.4344 *Helleno-Balkanic andropogonoid grass steppe.* Twenty two medicinal plants were found there, among which two were of conservation significance - *Anacamptis pyramidalis* and *Orchis papilionaceae* **(Table 1).**

Habitat 1.7. *Coastal dune woods* occupies the eastern steep and the western sloping slopes ofthe dune at the Cape Kaya **(Fig. 6).** This is the largest dune along the Bulgarian Black sea coast covered with woods. The forest communities on the dune have typical xerothermic features, the trees are low and branched. These coenoses are dominated by *Carpimis orientalis* Mill., *Fraxinus ornus, Ouercus cerris* Morariu, *O. firainetto, O. pubescens* Schwarz and *Celtis australis* is also characteristic. Twenty-four medicinal plants were found in this habitat **(Table 1).**

The habitat EUNIS B1.4B11 *Southwestern Pontic fixed dunes* **(Fig. 7)** is widely presented in the reserve by fixed grey dunes. We found 15 medicinal plants

**Figs. 5-8: 5** - Habitat *C3.2 Water-fringing reedbeds and tall heleophytes other than cans:* Arkutino marsh; 6 - Coastal dune woods: Cape Kaya; 7 - Habitat *B1.4B11 Southwestern Ponticfixed dunes;* **8** - Habitat *B1.313 Pontic embryonic dunes.*

there, two ofwhich were of conservation significance - *Trachomitum venetum* and *Ephedra distachia* **(Table 1).**

The habitat EUNIS Bl.313 *Pontic embryonic dunes* represents the first stages of the dune formation **(Fig. 8).** Four medicinal plants, mostly obligate psammophytes, were found there. Two species were of conservation significance: *Eryngium maritimum* and *Euphorbia peplis* **(Table 1).** During the study, we



proved that the localities ofthe threatened medicinal plants *Eryngium maritimum, Euphorbia peplis* and *Glauciumfiavum* often fall into the beach area actively used for recreation.

The next habitat of European significance in the reserve is EUNIS F5.51A4 *Eastern [Phillyrea] thickets* which occupies the exposed dry slopes in the locality Luvska Glava. There, besides the main species *Phillyrea latifolia,* four other medicinal plant species were found: *Fraxinus ornus, Paliurus spina-christi, Hedera helix, Ruscus aculeatus* **(Table** 1).

The largest number of medicinal plants was found in the habitats G1.76A1

*Euxino-Thracian [Quercus frainetto]-[Quercus cerris] forests* (68 species) followed by G1.2232 *Helleno-Balkanic ash-oak-alderforest* (31) 1.7. *Coastal dune woods* (24), El.4344 *Helleno-Balkanic andropogonoid grass steppe* (22) and B1.4B11 *Southwestern Pontic fixed dunes* (15). The largest number (10) of conservationally significant species was found in the habitat G1.76A1.

Some ofthe recorded medicinal plants are ofmedium to high rarity in Bulgaria. Moreover, some of them are distributed only along the Black Sea coast and Strandzha Mountain *(e.g. Artemisia santonicum, Eryngium maritimum. Euphorbia peplis, Glaucimfiavum, Hypericum androsaemum, Trachomitum venetum). Worthy* to note is that 58% ofthe medicinal species were found as single plants, in a group or in groups (14, 14 and 95 species, respectfully), and only 42% (88 species) were more abundant **(Table 1).**

## DISCUSSION

The high number of medicinal plants recorded in the reserve territory (211), which represents 38% of its flora and the finding of 23 threatened species (six of which with the IUCN category *Endangered)* proves the nature conservation significance of the flora of the Ropotamo Reserve. Noteworthy, some of the threatened species occur only as single specimens in the reserve area. In addition, 140 medicinal plants in eight reserve habitats of European significance were reported. Moreover, some ofthe medicinal species were rare for the country and this, combined with the well-known strong recent anthropogenic pressure on the Black Sea coast, increases their vulnerability and threat of extinction.

## CONFLICT OF INTERESTS

The authors declare thatthere is no conflict ofinterestsregarding the publication ofthis article.


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