

Electronic Appendix 1. - Complete list of taxa of root-hemiparasitic plants occurring in the Czech Republic (excluding hybrids). Taxonomy and nomenclature follow Danihelka et al. (2012). In addition, Red List status (Grulich 2012), life history and a brief habitat description as indicated in the Flora of the Czech Republic (Slavík 1997, 2000) are provided. A category of the Red List indicates extinct species and C1–C4 categories are threatened species from the most to the least threatened. See Grulich (2012) for the description of Red List status.

| Taxon                           | Red list status | Life history | Habitat description in the Flora of the Czech Republic  |
|---------------------------------|-----------------|--------------|---|
| <i>Bartsia alpina</i>           | C2 (r)          | Perennial    | Spring areas, wet rocks, subalpine grasslands above the timberline; nutrient- and base-rich soils   |
| <i>Euphrasia corcontica</i>     | A1              | Annual       |   |
| <i>Euphrasia frigida</i>        | C1 (r)          | Annual       | Subalpine rocky slope grasslands  |
| <i>Euphrasia micrantha</i>      | C1 (r)          | Annual       | Subalpine grasslands on rocky sites; periodically wet acidic soils  |
| <i>Euphrasia nemorosa</i>       |                 | Annual       | Dry meadows, pastures and heathlands; oligotrophic to mesotrophic acidic soils  |
| - subsp. <i>coerulea</i>        | C2 (b)          |              |   |
| - subsp. <i>nemorosa</i>        |                 |              |   |
| - var. <i>curta</i>             | C4b             |              |   |
| - var. <i>nemorosa</i>          | C2 (t)          |              |   |
| <i>Euphrasia officinalis</i>    |                 | Annual       | Moderately dry to wet grasslands, low-productive meadows, pastures, heathlands, peaty meadows, subalpine meadows, dry steppic grasslands; sandy to loamy moderately acidic soils, oligotrophic to mesotrophic |
| - subsp. <i>picta</i>           | C1 (t)          |              |   |
| - subsp. <i>rostkoviana</i>     |                 |              |   |
| - var. <i>monticola</i>         | C1 (t)          |              |   |
| - var. <i>rostkoviana</i>       |                 |              |   |
| <i>Euphrasia salisburgensis</i> |                 | Annual       | Occurrence in the Czech Republic doubtful   |
| <i>Euphrasia slovaca</i>        | C1(t)           | Annual       | Mesic to moderately dry semi-natural meadows and pastures; mesotrophic to oligotrophic soils  |
| <i>Euphrasia stricta</i>        |                 | Annual       | Dry meadows, pastures and heathlands; oligotrophic to mesotrophic acidic soils  |
| - subsp. <i>stricta</i>         |                 |              |   |
| - subsp. <i>tatarica</i>        | C2 (t)          |              |   |
| <i>Melampyrum arvense</i>       | C3              | Annual       | Dry steppes, sunny slopes, open scrub vegetation; more common on basic soils; formerly occurred as cereal weed  |
| <i>Melampyrum barbatum</i>      |                 | Annual       | Weed in crop fields, abandoned fields, dry slopes; not native to the Czech Republic, currently extinct  |
| <i>Melampyrum cristatum</i>     |                 | Annual       |   |
| - var. <i>cristatum</i>         | C3              |              | Thermophilous scrub and forests; loamy basic soils  |
| - var. <i>solstitiale</i>       | C2 (b)          |              | Semi-dry to mesic grasslands; deep base-rich soils  |

|  |        |  |  |
|--|--------|--|--|
| <i>Melampyrum herbichii</i>                  |        | Annual   | Species rejected from taxonomic perspective (Těšitel et al. 2009)  |
| <i>Melampyrum nemorosum</i>                  |        | Annual   |  |
| - var. <i>nemorosum</i>                      |        |  | Broad-leaved and mixed forests, shrubs, forest edges; loamy soils  |
| - var. <i>praecox</i>                        | C1 (t) |  | Mesic and semi-dry meadows; deep, base-rich soils  |
| <i>Melampyrum pratense</i>                   |        | Annual   | Broad-leaved, mixed and coniferous forests, clearings, mountain and subalpine meadows, heathlands and bogs; prefers various acidic soils   |
| <i>Melampyrum subalpinum</i>                 | C3     | Annual   | Oak and pine forests; sandy soils  |
| <i>Melampyrum sylvaticum</i>                 |        | Annual   | Mountain mixed and spruce forests, clearings, subalpine meadows and heathlands; humid acidic soils   |
| <i>Odontites luteus</i>                      | C2 (b) | Annual   | Dry, sunny grassy and rocky slopes and pastures, open scrub vegetation, moderately shaded rocky places; basic calcareous soils   |
| <i>Odontites vernus</i>                      |        | Annual   |  |
| - subsp. <i>serotinus</i>                    |        |  | Cereal weed, abandoned fields; moderately acidic to basic clayish and loamy soils  |
| - subsp. <i>vernus</i>                       | C2 (t) |  | Pastures, disturbed grasslands, grassy forest edges, road edges and similar open disturbed habitats, salt marshes; mostly nutrient- and base-rich clayey soils, including saline sites |
| - late tetraploids<br>(Koutecký et al. 2012) |        |  | Disturbed sites in steppic and dry grasslands  |
| <i>Parentucellia viscosa</i>                 |        | Annual   | Sporadic occurrence; not native to the Czech Republic  |
| <i>Pedicularis exaltata</i>                  | C1 (r) | Perennial  | Wet meadows; nutrient-rich soils   |
| <i>Pedicularis palustris</i>                 |        | Biennial (or monocarpic perennial)                 | Edges of transitional mires, banks of oligotrophic ponds, fen meadows; wet, nutrient-rich soils  |
| - subsp. <i>opsiantha</i>                    | C1 (r) |  |  |
| - subsp. <i>palustris</i>                    | C1 (t) |  |  |
| <i>Pedicularis sceptrum-carolinum</i>        | A1     | Perennial  | Fen meadows; nutrient rich, mostly calcareous soils  |
| <i>Pedicularis sudetica</i>                  | C1 (r) | Perennial  | Moss springs, bogs and fens above the timberline; exclusively on acidic soils  |
| <i>Pedicularis sylvatica</i>                 | C2 (t) | Monocarpic perennial, biennial (rarely polycarpic) | Moist to wet, often peaty meadows, low productive pastures, heathlands; acidic, nutrient-poor soils  |
| <i>Rhinanthus alectorolophus</i>             | C3     | Annual   | Abandoned fields, meadows, open scrub; neutral to moderately acidic nutrient-rich soils; formerly occurred as cereal weed  |
| <i>Rhinanthus major</i>                      |        | Annual   | Meadows, pastures, open scrub vegetation; loamy or sandy soils with variable nutrient availability   |
| <i>Rhinanthus minor</i>                      |        | Annual   | Meadows, pastures, forest edges; various nutrient-poor soil types  |
| <i>Rhinanthus riphaeus</i>                   | C2 (t) | Annual   | Mountain meadows and pastures,   |

|                            |        |                     |  |
|----------------------------|--------|---------------------|--|
| <i>Thesium alpinum</i>     | C3     | perennial           | secondary occurrence along mountain road edges<br>Low-productive meadows and pastures, grassy and rocky slopes, open oak forests; various soil types |
| <i>Thesium bavarum</i>     | C2 (b) | perennial           | Open scrub, forest edges, grassy slopes; base-rich soil types  |
| <i>Thesium dollineri</i>   | C1 (t) | annual or perennial | Field edges, abandoned fields, grassy slopes, moderately disturbed grasslands; calcareous substrates   |
| <i>Thesium ebracteatum</i> | C1 (r) | perennial           | Moist fen or peat meadows and pastures   |
| <i>Thesium linophyllum</i> | C3     | perennial           | Dry grassy or rocky slopes, steppes, steppic vegetation in vineyards and orchards; basic soils   |
| <i>Thesium pyrenaicum</i>  | C2 (t) | perennial           | Low-productive dry to moderately moist meadows, pastures, heathlands; soils on acidic substrates   |
| <i>Thesium ramosum</i>     | C1 (t) | mostly perennial    | Meadows, road edges, abandoned fields; prefers sandy or loess substrates   |
| <i>Thesium rostratum</i>   | C1 (b) | perennial           | Open oak forests, moist fen meadows; no distinct soil type preference  |

Electronic Appendix 2. - Numbers of occupied and suitable sites (in parentheses) of each of the root-hemiparasitic species under study across all vegetation units. Numbers of plots of species marked by asterisk are considered insufficient to provide robust information on habitat preferences. Species displayed in grey are considered rare and their number of occurrences is insufficient for construction of a habitat suitability model. Plots of vegetation classes *Salicetea purpureae*, *Cymbalario muralis-Parietarietea judaicae*, *Thlaspietea rotundifolii*, *Crypsietea aculeatae*, *Thero-Salicornietea strictae*, *Festucetea vaginatae*, *Lemnetea*, *Potametea* and *Charetea* did not contain any record of a hemiparasitic species.

|  | Total number of vegetation plots | Number of plots with hemiparasites | Number of root-hemiparasitic species | <i>Barisia alpina</i> * | <i>Euphrasia nemorosa</i> | <i>Euphrasia officinalis</i> | <i>Euphrasia stricta</i> | <i>Euphrasia stricta</i> subsp.<br><i>tatarica</i> | <i>Melampyrum cristatum</i> | <i>Melampyrum nemorosum</i> | <i>Melampyrum pratense</i> | <i>Melampyrum subalpinum</i> | <i>Odontites vernus</i> group | <i>Odontites luteus</i> | <i>Pedicularis palustris</i> | <i>Pedicularis sylvatica</i> | <i>Pedicularis sudetica</i> | <i>Rhinanthus aleotorophus</i> * | <i>Rhinanthus major</i> | <i>Rhinanthus minor</i> | <i>Rhinanthus riphaeus</i> * | <i>Thesium alpinum</i> * | <i>Thesium bavarum</i> | <i>Thesium ebracteatum</i> | <i>Thesium linophyllum</i> | <i>Thesium pyrenaicum</i> | <i>Thesium ramosum</i> |   |   |
|--|----------------------------------|------------------------------------|--------------------------------------|-------------------------|---------------------------|------------------------------|--------------------------|--|-----------------------------|-----------------------------|----------------------------|------------------------------|-------------------------------|-------------------------|------------------------------|------------------------------|-----------------------------|----------------------------------|-------------------------|-------------------------|------------------------------|--------------------------|------------------------|----------------------------|----------------------------|---------------------------|------------------------|---|---|
| Number of occupied sites                                       | 31512                            | 2631                               | 26                                   | 5                       | 169                       | 71                           | 4                        | 86   | 68                          | 377                         | 990                        | 4                            | 80                            | 194                     | 48                           | 92                           | 2                           | 62                               | 23                      | 40                      | 435                          | 16                       | 16                     | 6                          | 1                          | 106                       | 3                      | 3 |   |
| Number of suitable sites                                       | 8379                             |                                    | 35                                   | NA                      | 1365                      | 278                          | NA                       | 682  | 241                         | 1328                        | 2774                       | NA                           | 670                           | 1366                    | 312                          | 606                          | NA                          | 418                              | 142                     | 797                     | 1963                         | 13                       | 19                     | NA                         | NA                         | 400                       | .                      | . |   |
| Occupied/suitable ratio  |                                  |                                    |                                      |                         | 0.74                      | NA                           | 0.12                     | 0.25   | NA                          | 0.12                        | 0.27                       | 0.28                         | 0.35                          | NA                      | 0.12                         | 0.14                         | 0.15                        | 0.15                             | 0.15                    | 0.16                    | 0.05                         | 0.22                     | 1.00                   | 0.76                       | NA                         | NA                        | 0.27                   | . | . |
| <i>Carpino-Fagetea</i><br>Mesic deciduous broad-leaved forests | 5772                             | 538                                | 7                                    | .                       | .                         | .                            | .                        | .  | 1<br>(0)                    | 4<br>(0)                    | 221<br>(965)               | 345<br>(1332)                | .                             | 10<br>(213)             | .                            | 1<br>(0)                     | .                           | .                                | .                       | .                       | .                            | .                        | .                      | .                          | 3                          | .                         | .                      | . |   |
| <i>Molinio-Arrhenatheretea</i><br>Meadows and mesic pastures   | 3686                             | 505                                | 20                                   | .                       | 3<br>(963)                | 8<br>(36)                    | .                        | 6<br>(20)  | 2<br>(0)                    | 8<br>(33)                   | 5<br>(33)                  | .                            | 3<br>(0)                      | 41<br>(582)             | .                            | 20<br>(220)                  | .                           | 22<br>(185)                      | 3<br>(26)               | 15<br>(389)             | 320<br>(1519)                | 3<br>(3)                 | 1<br>(0)               | 1<br>(1)                   | 1<br>(15)                  | 7<br>(15)                 | 2                      | . |   |
| <i>Festuco-Brometea</i><br>Dry grasslands                      | 1434                             | 378                                | 18                                   | .                       | 1<br>(216)                | 15<br>(214)                  | 43<br>(214)              | 4  | 65<br>(484)                 | 23<br>(112)                 | 75<br>(123)                | 14<br>(44)                   | .                             | 11<br>(154)             | 46<br>(312)                  | .                            | .                           | 3<br>(3)                         | 14<br>(296)             | 55<br>(226)             | .                            | 1<br>(0)                 | 1<br>(0)               | 1<br>(322)                 | 91<br>(322)                | 1                         | 3                      |   |   |
| <i>Quercetea robori-petraeae</i><br>Acidophilous oak forests   | 462                              | 225                                | 4                                    | .                       | .                         | .                            | .                        | .  | 2<br>(0)                    | 6<br>(6)                    | 220<br>(317)               | 3                            | .                             | .                       | .                            | .                            | .                           | .                                | .                       | .                       | .                            | .                        | .                      | .                          | .                          | .                         | .                      |   |   |
| <i>Quercetea pubescens</i><br>Thermophilous oak forests        | 618                              | 213                                | 8                                    | .                       | 1<br>(0)                  | 1<br>(0)                     | .                        | 1<br>(0)   | 36<br>(129)                 | 51<br>(180)                 | 147<br>(270)               | .                            | 1<br>(0)                      | .                       | .                            | .                            | .                           | .                                | .                       | .                       | .                            | .                        | .                      | .                          | 6<br>(61)                  | .                         | .                      |   |   |
| <i>Calluno-Ulicetea</i><br>Nardus grasslands and heathlands    | 540                              | 163                                | 13                                   | .                       | 44<br>(89)                | 4<br>(0)                     | .                        | 2<br>(0)   | .                           | 44<br>(213)                 | 1<br>(168)                 | 29                           | .                             | 3<br>(0)                | .                            | 16<br>(68)                   | 2<br>(2)                    | 3<br>(3)                         | 30<br>(103)             | 5<br>(5)                | 4<br>(4)                     | .                        | .                      | .                          | .                          | .                         | .                      |   |   |

|   |      |     |   |            |            |          |            |   |            |          |           |          |              |             |          |          |             |            |             |             |
|---|------|-----|---|------------|------------|----------|------------|---|------------|----------|-----------|----------|--------------|-------------|----------|----------|-------------|------------|-------------|-------------|
| <i>Vaccinio-Piceetea</i>  |      |     |   |            |            |          |            |   |            |          |           |          |              |             |          |          |             |            |             |             |
| Boreal coniferous forests   | 931  | 133 | 2 | .          | .          | .        | .          | . | .          | .        | .         | .        | 125<br>(364) | 9<br>(246)  | .        | .        | .           | .          | .           |             |
| <i>Scheuchzerio palustris-Caricetea nigrae</i>  |      |     |   |            |            |          |            |   |            |          |           |          |              |             |          |          |             |            |             |             |
| Vegetation of fens, transitional mires and bog hollows                                  | 799  | 124 | 9 | 10<br>(18) | 11<br>(97) | .        | .          | . | .          | .        | .         | .        | 8<br>(37)    | 1<br>(0)    | .        | .        | 55<br>(248) | 1<br>(165) | 24<br>(109) | 15<br>(110) |
| <i>Stellarietea mediae</i>  |      |     |   |            |            |          |            |   |            |          |           |          |              |             |          |          |             |            |             |             |
| Annual vegetation of arable land and ruderal habitats                                   | 2340 | 94  | 5 | .          | .          | 1<br>(0) | .          | . | 6<br>(178) | .        | .         | .        | 74<br>(454)  | .           | .        | .        | 14<br>(111) | 3<br>(0)   | .           |             |
| <i>Oxycocco-Sphagnetea</i>  |      |     |   |            |            |          |            |   |            |          |           |          |              |             |          |          |             |            |             |             |
| Bog vegetation  | 210  | 61  | 3 | .          | .          | .        | .          | . | .          | .        | .         | .        | 1<br>(0)     | 57<br>(131) | 3<br>(0) | .        | .           | .          | .           |             |
| <i>Festuco-Puccinellietea</i>   |      |     |   |            |            |          |            |   |            |          |           |          |              |             |          |          |             |            |             |             |
| Saline grasslands   | 104  | 40  | 2 | .          | .          | .        | .          | . | .          | .        | .         | .        | .            | 39<br>(55)  | .        | .        | .           | 4<br>(0)   | .           |             |
| <i>Koelerio-Corynephoretea</i>  |      |     |   |            |            |          |            |   |            |          |           |          |              |             |          |          |             |            |             |             |
| Pioneer vegetation of sandy and shallow soils   | 434  | 23  | 8 | .          | 1          | 1<br>(0) | 12<br>(28) | . | 2<br>(0)   | .        | 2<br>(0)  | 1<br>(0) | .            | .           | 1<br>(0) | .        | .           | 5<br>(5)   | .           |             |
| <i>Phragmito-Magno-Caricetea</i>  |      |     |   |            |            |          |            |   |            |          |           |          |              |             |          |          |             |            |             |             |
| Marsh vegetation  | 5093 | 21  | 5 | .          | .          | 1<br>(0) | .          | . | .          | .        | 2<br>(0)  | .        | 6<br>(71)    | 11<br>(138) | .        | .        | 2<br>(0)    | .          | .           |             |
| <i>Mulgedio-Aconitetea</i>  |      |     |   |            |            |          |            |   |            |          |           |          |              |             |          |          |             |            |             |             |
| Subalpine tall-forb and deciduous-shrub vegetation                                      | 121  | 19  | 5 | 2<br>(2)   | .          | .        | .          | . | .          | .        | .         | .        | 12<br>(37)   | .           | .        | .        | 1<br>(0)    | 5<br>(5)   | 7<br>(12)   |             |
| <i>Artemisietae vulgaris</i>  |      |     |   |            |            |          |            |   |            |          |           |          |              |             |          |          |             |            |             |             |
| Xerophilous ruderal vegetation with biennial and perennial species                      | 1287 | 19  | 4 | .          | .          | 1<br>(0) | 1<br>(0)   | . | 2<br>(0)   | .        | .         | .        | 15<br>(50)   | .           | .        | .        | .           | .          | .           |             |
| <i>Rhamno-Prunetea</i>  |      |     |   |            |            |          |            |   |            |          |           |          |              |             |          |          |             |            |             |             |
| Mesic and xeric scrub   | 339  | 15  | 7 | .          | .          | .        | 1<br>(0)   | . | 1<br>(0)   | 1<br>(0) | 7<br>(21) | 2<br>(0) | 1<br>(0)     | .           | .        | .        | 1<br>(0)    | 2<br>(0)   | .           |             |
| <i>Epilobietea angustifoli</i>  |      |     |   |            |            |          |            |   |            |          |           |          |              |             |          |          |             |            |             |             |
| Herbaceous vegetation of forest clearings and disturbed habitats in forest environments | 310  | 11  | 4 | .          | .          | .        | 1<br>(0)   | . | .          | .        | 8<br>(33) | 1<br>(0) | .            | .           | .        | 1<br>(0) | .           | .          | .           |             |
| <i>Elyno-Seslerietea</i>  |      |     |   |            |            |          |            |   |            |          |           |          |              |             |          |          |             |            |             |             |
| Alpine grasslands on base-rich soil   | 12   | 9   | 3 | 8<br>(9)   | .          | .        | .          | . | .          | .        | .         | .        | .            | .           | .        | 1<br>(0) | 3<br>(3)    | .          | .           |             |

|  |      |   |   |          |   |          |   |   |          |          |          |          |   |          |   |
|--|------|---|---|----------|---|----------|---|---|----------|----------|----------|----------|---|----------|---|
| <i>Roso pendulinae-</i>                                    |      |   |   |          |   |          |   |   |          |          |          |          |   |          |   |
| <i>Pinetea mugo</i>  | 28   | 8 | 2 | .        | . | .        | . | . | 2<br>(0) | 6<br>(6) | .        | .        | . | .        | . |
| Subalpine krummholz vegetation                             |      |   |   |          |   |          |   |   |          |          |          |          |   |          |   |
| <i>Montio-Cardaminetea</i>                                 | 304  | 7 | 3 | 6<br>(6) | . | .        | . | . | .        | .        | 1<br>(0) | .        | . | 1        | . |
| Vegetation of springs                                      |      |   |   |          |   |          |   |   |          |          |          |          |   |          |   |
| <i>Asplenietea trichomanis</i>                             | 204  | 6 | 3 | .        | . | .        | . | . | 3<br>(0) | 1<br>(0) | 2<br>(0) | .        | . | .        | . |
| Vegetation of rocks, walls and stable screes               |      |   |   |          |   |          |   |   |          |          |          |          |   |          |   |
| <i>Anetea glutinosae</i>                                   | 306  | 5 | 2 | .        | . | .        | . | . | 2<br>(0) | 3<br>(0) | .        | .        | . | .        | . |
| Alder and willow carrs                                     |      |   |   |          |   |          |   |   |          |          |          |          |   |          |   |
| <i>Erico-Pinetea</i>                                       |      |   |   |          |   |          |   |   |          |          |          |          |   |          |   |
| Basiphilous submontane pine forests                        | 26   | 4 | 1 | .        | . | .        | . | . | 4<br>(0) | .        | .        | .        | . | .        | . |
| <i>Polygono arenastri-</i>                                 |      |   |   |          |   |          |   |   |          |          |          |          |   |          |   |
| <i>Poëtea annuae</i>                                       | 542  | 4 | 2 | .        | . | 1<br>(0) | . | . | .        | .        | 3<br>(0) | .        | . | .        | . |
| Vegetation of trampled habitats                            |      |   |   |          |   |          |   |   |          |          |          |          |   |          |   |
| <i>Loiseleurio-Vaccinietea</i>                             | 21   | 3 | 3 | .        | . | .        | . | . | 1<br>(0) | 2<br>(0) | .        | .        | . | 1<br>(0) | . |
| Alpine heathlands  |      |   |   |          |   |          |   |   |          |          |          |          |   |          |   |
| <i>Littorelletea uniflorae</i>                             | 210  | 3 | 2 | .        | . | .        | . | . | .        | .        | 2<br>(0) | 1<br>(0) | . | .        | . |
| Vegetation of oligotrophic water bodies                    |      |   |   |          |   |          |   |   |          |          |          |          |   |          |   |
| <i>Galio-Urticetea</i>                                     |      |   |   |          |   |          |   |   |          |          |          |          |   |          |   |
| Nitrophilous perennial vegetation of wet to mesic habitats | 1407 | 3 | 3 | .        | . | .        | . | . | 1<br>(0) | .        | 1<br>(0) | .        | . | 1<br>(0) | . |
|  |      |   |   |          |   |          |   |   |          |          |          |          |   |          |   |
| <i>Juncetea trifidi</i>                                    | 41   | 2 | 2 | .        | . | .        | . | . | 1(0)     | .        | .        | .        | . | 1<br>(0) | . |
| Alpine grasslands on base-poor soil                        |      |   |   |          |   |          |   |   |          |          |          |          |   |          |   |
| <i>Isoëto-Nano-Juncetea</i>                                | 323  | 2 | 2 | .        | . | .        | . | . | .        | 1<br>(0) | 1<br>(0) | .        | . | .        | . |
| Vegetation of annual wetland herbs                         |      |   |   |          |   |          |   |   |          |          |          |          |   |          |   |
| <i>Bidentetea tripartitae</i>                              |      |   |   |          |   |          |   |   |          |          |          |          |   |          |   |
| Vegetation of annual nitrophilous wetland herbs            | 393  | 1 | 1 | .        | . | .        | . | . | .        | .        | 1<br>(0) | .        | . | .        | . |

Electronic Appendix 3. – Box plot displaying ranges of altitude of occupied and suitable sites for each root-hemiparasitic species. Median, quartiles and full range are displayed. Up- and down-pointing triangles display the range of values of occupied sites.

