# Do saxicolous lichen communities represent photobiont-mediated guilds?



LEGEND

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| :  |  |                     |
|--|--|---------------------|
| r samples, strains delimitating clades (often au | thentic)   |                     |
| e rock   |  |                     |
| vein in limestone                                |  |                     |
|  |  |                     |
| rock   |  |                     |
| <i>rock</i>                                      | BUD_06_ex_Rhizocarpon_geographicum<br>SRB_02_ex_Caloplaca_coronata<br>MOT_15_ex_Lecidea_fuscoatra<br>OTV_12_ex_Acarospora_fuscata<br>OTV_08_ex_Lecanora_saxicola<br>-PLU_17_ex_Caloplaca_subpallida<br>OTV_01_ex_Xanthoparmelia_conspersa<br>TRUB_07_ex_Lecanora_argopholis<br>OTV_13_ex_Candelariella_vitellina<br>WOT_06_ex_Lecanora_argopholis<br>MOT_06_ex_Lecanora_argopholis<br>MOT_05_ex_Rhizocarpon_disporum<br>-PB_10_ex_Lecanora_dispersa<br>-MOT_03_ex_Xanthoparmelia_conspersa<br>-MOT_03_ex_Xanthoparmelia_delisei<br>FJ792801_Trebouxia_incrustata_ex_Xanthoparmelia_tinctina<br>OTV_03_ex_Xanthoparmelia_tex_Anthoparmelia_tinctina<br>OTV_03_ex_Xanthoparmelia_tinctina<br>-CIS_K09_ex_Lecanora_saxicola<br>BUD_07_ex_Rhizocarpon_disporum<br>MOT_13_ex_Circinaria_contorta<br>PLU_08_ex_Lecanora_saxicola<br>BUD_16_ex_Lecidea_fuscoatra<br>MOT_08_ex_Lecanora_argopholis<br>CIS_K02_ex_Xanthoparmelia_telisei<br>BUD_07_ex_Rhizocarpon_disporum<br>MOT_08_ex_Lecanora_saxicola<br>BUD_11_ex_Lecanora_saxicola<br>BUD_16_ex_Lecidea_fuscoatra<br>MOT_08_ex_Lecanora_argopholis<br>CIS_K02_ex_Xanthoparmelia_telisei<br>BUD_08_ex_Lecanora_argopholis<br>CIS_K02_ex_Xanthoparmelia_telisei<br>BUD_08_ex_Lecanora_argopholis<br>CIS_K02_ex_Xanthoparmelia_telisei<br>BUD_19_ex_Candelariella_vitellina<br>MOT_09_ex_Lecanora_saxicola<br>SOK_01_ex_Acarospora_irregularis<br>VAL_01_ex_Xanthoparmelia_conspersa | T. incrustata (A06) |
|  | PETR_15_ex_Xanthoparmelia_conspersa<br>OTV_09_ex_Aspicilia_intermutans<br>OTV_06_ex_Rhizocarpon_geographicum   |                     |
|  |  |                     |

# Introduction

More then 15 000 lichen (fungal) species have been described to date, occurring in almost all terrestrial ecosystems, colonizing a wide range of habitats. In a certain geographical space, particular habitats can host more or less unvarying lichen communities. Their composition is usually a good indicator of specific local conditions (e.g. heavy-metal content in siliceous rock). Many of lichen communities were described based on the composition of lichen (fungal) species, however, we know almost nothing about the composition of their photobionts...

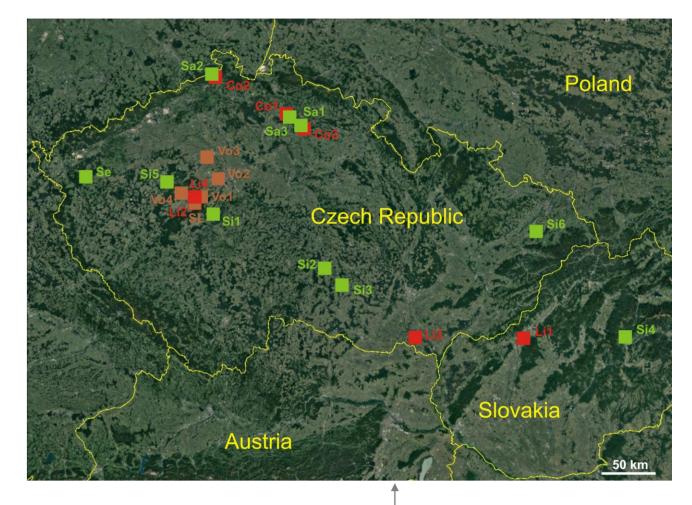
Some recent studies have found lichen-forming algae or cyanobacteria from different environments clustered in distinct lineages. Such environmental preferences of autotrophic partners may limit ecological niches available to lichens. Together with requirements of mycobionts they result in the existence of lichen guilds.

Hypothesis: Lichen communities function as lichen guilds, i.e. each lichen (fungal) community growing in specific environmental conditions associates with a distinct pool of photobionts.

**Object:** saxicolous lichen communities of central Europe...

... growing in similar climatic conditions (low altitudes) on different rock types

... sharing *Trebouxia* photobionts



|     |  | VAL_19_ex_Candelariella_vitellina   | 1               |  |
|-----|--|---|-----------------|--|
|     |  | SRB_01_ex_Caloplaca_oasis   | 1               |  |
|     |  | -A06_AJ293795_Trebouxia_incrustata_UTEX784_ex_Lecanora_dispersa   | 1               |  |
|     | 100  | IVAL_08_ex_Rhizocarpon_distinctum   |                 |  |
|     | 100  | CIS_K07_ex_Lecanora_saxicola  | I               |  |
|     |  | -MOT_12_ex_Aspicilia_intermutans  | 1               |  |
|     |  | CIS_K01_ex_Xanthoparmelia_protomatrae   |                 |  |
|     |  | SRB_17_ex_Lecidella_stigmatea   | 1               |  |
|     |  | AM920667_Trebouxia_incrustata_PAR1_ex_Xanthoparmelia_conspersa  | i               |  |
|     |  | BUD_01_ex_Xanthoparmelia_conspersa  | i               |  |
|     |  | TRUB_04_ex_Xanthoparmelia_loxodes   | i               |  |
|     |  | MOT_01_ex_Xanthoparmelia_protomatrae  | i               |  |
|     |  | VAL_02_ex_Xanthoparmelia_protomatrae  | i               |  |
|     | 98   | RABI_02_ex_Caloplaca_erodens  |                 |  |
| [   |  | RABI_01_ex_Caloplaca_limonia  | i               |  |
|     |  | A15_AJ249577_Trebouxia_gigantea_UTEX2231_ex_Caloplaca_cerina  | T. gigantea     |  |
|     |  | -KT819930_Trebouxia_gigantea_AV040_ex_Candelariella_medians   | (A15)           |  |
|     |  | —A23_AF242470_Trebouxia_showmanii_UTEX2234_ex_Lecanora_hagenii  | (A13)           |  |
|     | -CIS V15   | _ex_Lecania_rabenhorstii  |                 |  |
| I I |  | Q133497_Uncultured_Trebouxia_E6_ex_Lecanora_saxicola  | A18             |  |
|     |  | ecanora_saxicola  |                 |  |
|     |  | arov_usa_ID_saxi_078  |                 |  |
|     |  |   |                 |  |
|     |  | rebouxia_sp_URa6_Tuerk51493_ex_Fulgensia_fulgens  |                 |  |
|     |  | Lecanora_saxicola   | <del>〔</del>    |  |
|     |  | Caloplaca_soralifera  | ò               |  |
| Ч   |  | ecidella_stigmatea  | (A              |  |
|     |  | Lecanora_saxicola   | cretacea (A01)  |  |
|     |  | rebouxia_cretacea_SAG2503_AV066_ex_Aspicilia_desertorum   | ee ee           |  |
|     |  | _Lobothallia_radiosa  | ta              |  |
|     |  | Lobothallia_alphoplaca  | e               |  |
|     |  | ex_Circinaria_contorta  | ō               |  |
|     |  | _Xanthoria_papillifera  | μ' I            |  |
|     |  | Toninia_opuntioides   |                 |  |
|     |  | _Acarospora_cervina   | 1               |  |
|     | JM_7873_ex   | _Caloplaca_teicholyta   |                 |  |
| 14  |  | B_14_ex_Lobothallia_radiosa   |                 |  |
|     |  | 344177_Trebouxia_asymmetrica_B207_ex_Toninia_sedifolia  |                 |  |
|     | 86 BE  | C_14_ex_Placocarpus_schaereri   | 1               |  |
|     | SR   | B_11_ex_Diplotomma_venustum   | <b>T</b>        |  |
|     | SR   | B_10_ex_Caloplaca_crenulatella_sl   | T. asymmentrica |  |
|     |  | AMAZE Technic commenties 00.00000 en Eulerasia filida   |                 |  |
|     | 'AF  | 344175_Trebouxia_asymmetrica_99_023C2_ex_Fulgensia_fulgida  | (A11)           |  |
|     |  | 344175_Trebouxia_asymmetrica_99_023C2_ex_Fuigensia_fuigida<br>RB_04_ex_Caloplaca_flavocitrina   | (A11)           |  |
|     | 100 SF   | RB_04_ex_Caloplaca_flavocitrina   | (A11)           |  |
|     | 100 SF   | RB_04_ex_Caloplaca_flavocitrina<br>9927_Trebouxia_asymmetrica_AV028_ex_Caloplaca_teicholyta   | (A11)           |  |
|     | 100 SF<br>KT81   | RB_04_ex_Caloplaca_flavocitrina<br>9927_Trebouxia_asymmetrica_AV028_ex_Caloplaca_teicholyta<br>-A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens  |                 |  |
|     | 100 SF<br>KT81<br>   | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_AV028_ex_Caloplaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis  | (A11)<br>A12    |  |
|     | 100 SF<br>KT81<br>   | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_AV028_ex_Caloplaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_terr_126   |                 |  |
|     | 100 SF<br>KT81<br>96 KF907<br>A12  | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_AV028_ex_Caloplaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_terr_126   |                 |  |
|     | 100 SF<br>KT81<br>96 KF907<br>A12<br>BUD_  | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_AV028_ex_Caloplaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_terr_126   KJ576667_Uncultured_Trebouxia_S65_ex_Bryoria_smithii    15_ex_Lobothallia_alphoplaca  |                 |  |
|     | 100 KT81<br>96 KF907<br>A12<br>BUD_<br>HRUB  | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_AV028_ex_Caloplaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_terr_126   |                 |  |
|     | 100 KT81<br>96 KF907<br>A12<br>BUD<br>HRUB<br>TRUB   | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_AV028_ex_Caloplaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_terr_126   |                 |  |
|     | 100 SF<br>KT81<br>96 KF907<br>A12<br>HRUB<br>TRUB<br>TRUB  | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_AV028_ex_Caloplaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_terr_126   |                 |  |
|     | 100 SF<br>KT81<br>96 KF907<br>A12<br>HRUB<br>TRUB<br>TRUB<br>KNIN_   | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_AV028_ex_Caloplaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_terr_126   |                 |  |
|     | 100 SF<br>KT81<br>96 KF907<br>A12<br>HRUB<br>TRUB<br>TRUB<br>KNIN_C  | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_AV028_ex_Caloplaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_terr_126   |                 |  |
|     | 100 SF<br>KT81<br>96 KF907<br>A12<br>HRUB<br>TRUB<br>TRUB<br>KNIN_<br>KNIN_<br>BUD_0   | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_AV028_ex_Caloplaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_terr_126   |                 |  |
|     | 100 SF<br>KT81<br>96 KF907<br>A12<br>HRUB<br>TRUB_<br>TRUB_<br>KNIN_<br>BUD_0<br>TRUB_   | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_AV028_ex_Caloplaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_terr_126   |                 |  |
|     | 100 SF<br>KT81<br>96 KF907<br>A12<br>HRUB<br>TRUB_<br>TRUB_<br>KNIN_C<br>BUD_0<br>TRUB_<br>PRAC  | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_AV028_ex_Caloplaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_terr_126   |                 |  |
|     | 100 SF<br>KT81<br>96 KF907<br>A12<br>HRUB<br>TRUB_<br>TRUB_<br>KNIN_(<br>BUD_0<br>TRUB_<br>HRUB_<br>CRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_<br>FRUB_ | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_AV028_ex_Caloplaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_terr_126   |                 |  |
|     | 100 SF<br>KT81<br>96 KF907<br>A12<br>HRUB<br>TRUB_<br>TRUB_<br>KNIN_(<br>BUD_0<br>TRUB_<br>HRUB_<br>BUD_0<br>TRUB_<br>BUD_0  | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_AV028_ex_Caloplaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_terr_126   |                 |  |
|     | 100 SF<br>KT81<br>96 KF907<br>A12<br>HRUB<br>TRUB<br>TRUB<br>TRUB<br>TRUB<br>KNIN_C<br>BUD_0<br>TRUB<br>PETR_<br>BUD_0<br>MOT_0  | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_AV028_ex_Caloplaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_terr_126   |                 |  |
|     | 100 SF<br>KT81<br>96 KF907<br>A12<br>HRUB<br>TRUB<br>TRUB<br>TRUB<br>KNIN_C<br>BUD_0<br>TRUB<br>PETR_<br>BUD_0<br>MOT_0<br>BUD_0   | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_AV028_ex_Caloplaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_terr_126   | A12             |  |
|     | 100 SF<br>KT81<br>96 KF907<br>A12<br>BUD_9<br>HRUB<br>TRUB_<br>TRUB_<br>KNIN_0<br>BUD_0<br>TRUB_<br>PETR_<br>BUD_0<br>MOT_0<br>BUD_0<br>OTV_0  | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_AV028_ex_Caloplaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_terr_126   | A12             |  |
|     | 100 SF<br>KT81<br>96 KF907<br>A12<br>BUD_<br>HRUB<br>TRUB_<br>TRUB_<br>KNIN_<br>KNIN_<br>BUD_0<br>TRUB_<br>PETR_<br>BUD_0<br>MOT_0<br>BUD_0<br>OTV_0<br>SOK_1  | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_AV028_ex_Caloplaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_terr_126   | A12             |  |
|     | 100 SF<br>KT81<br>96 KF907<br>A12<br>BUD_9<br>HRUB<br>TRUB_<br>TRUB_<br>TRUB_<br>KNIN_0<br>BUD_0<br>TRUB_<br>PETR_<br>BUD_0<br>MOT_0<br>BUD_0<br>OTV_0<br>SOK_1<br>PLU_0   | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_AV028_ex_Caloplaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_terr_126   | A12             |  |
|     | 100 SF<br>KT81<br>96 KF907<br>A12<br>BUD_0<br>HRUB<br>TRUB_<br>TRUB_<br>KNIN_0<br>BUD_0<br>TRUB_<br>PETR_0<br>BUD_0<br>OTV_0<br>SOK_1<br>PLU_0<br>97 KT819   | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_AV028_ex_Caloplaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_terr_126   | A12             |  |
|     | 100 SF<br>KT81<br>96 KF907<br>A12<br>BUD_0<br>HRUB<br>TRUB_<br>TRUB_<br>KNIN_0<br>BUD_0<br>TRUB_<br>PETR_0<br>BUD_0<br>OTV_0<br>SOK_1<br>PLU_0<br>97 KT819<br>OTV_0  | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_AV028_ex_Caloplaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_terr_126   | A12             |  |
|     | 100 SF<br>KT81<br>96 KF907<br>A12<br>BUD_0<br>TRUB_<br>TRUB_<br>TRUB_<br>KNIN_0<br>BUD_0<br>TRUB_<br>PETR_<br>BUD_0<br>TRUB_<br>PETR_<br>BUD_0<br>MOT_0<br>BUD_0<br>OTV_0<br>SOK_1<br>PLU_0<br>97 KT819<br>OTV_0<br>VAL_0  | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_AV028_ex_Caloplaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_terr_126   | A12             |  |
|     | 100 SF<br>KT81<br>96 KF907<br>A12<br>BUD_0<br>TRUB_<br>TRUB_<br>TRUB_<br>TRUB_<br>KNIN_0<br>BUD_0<br>TRUB_<br>PETR_<br>BUD_0<br>MOT_0<br>BUD_0<br>OTV_0<br>SOK_1<br>PLU_0<br>97 KT819<br>OTV_0<br>VAL_0<br>ZAL_0   | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_AV028_ex_Caloplaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_terr_126   |                 |  |
|     | 100 SF<br>KT81<br>96 KF907<br>A12<br>HRUB<br>TRUB<br>TRUB<br>TRUB<br>KNIN_C<br>BUD_0<br>TRUB<br>PRAC<br>PETR<br>BUD_0<br>TRUB<br>PRAC<br>PETR<br>BUD_0<br>OTV_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>A10_X   | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_AV028_ex_Caloplaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_terr_126   | A12             |  |
|     | 100 SF<br>KT81<br>96 KF907<br>A12<br>HRUB<br>TRUB<br>TRUB<br>TRUB<br>TRUB<br>KNIN_C<br>BUD_0<br>TRUB<br>PRA<br>PETR_<br>BUD_0<br>TRUB<br>PRA<br>PETR_<br>BUD_0<br>OTV_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0  | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_AV028_ex_Caloplaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_terr_126   KJ576667_Uncultured_Trebouxia_S65_ex_Bryoria_smithii    15_ex_Lobothallia_alphoplaca    1_11_ex_Lecidella_carpathica    09_ex_Lecanora_rupicola    01_ex_Xanthoparmelia_stenophylla    1_ex_Xanthoparmelia_loxodes    3]ex_Rhizocarpon_geographicum    2_ex_Xanthoparmelia_verruculifera    CH1_2_ex_Lecanora_semipallida    16_ex_Xanthoparmelia_verruculifera    5_ex_Lecanora_garovaglioi    9_ex_Lecidea_fuscoatra    8_ex_Rhizocarpon_geographicum    9_ex_Lecanora_garovaglioi    4_ex_Lecidea_fuscoatra    8_ex_Rhizocarpon_geographicum    9_ex_Lecanora_garovaglioi    4_ex_Lecidea_fuscoatra    8_ex_Rhizocarpon_geographicum    945_Trebouxia_vagua_SAG2505_AV091_ex_Diploschistes_diacapsis    2_ex_Xanthoparmelia_terruculifera    4_ex_Lecidea_grisella    A_cuF1_canada_BC_saxi_1007    8_ex_Lecanora_crenulata  | A12             |  |
|     | 100 SF<br>KT81<br>96 KF907<br>A12<br>BUD_0<br>TRUB_<br>TRUB_<br>TRUB_<br>KNIN_0<br>BUD_0<br>TRUB_<br>PETR_<br>BUD_0<br>TRUB_<br>PETR_<br>BUD_0<br>OTV_0<br>SOK_1<br>PLU_0<br>97 KT819<br>OTV_0<br>VAL_0<br>ZAL_0<br>BUD_0<br>BUD_0<br>BUD_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>BUD_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>BUD_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>SRB_0<br>BUD_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>SRB_0<br>BUD_0<br>SOK_1<br>PLU_0<br>SOK_1<br>SRB_0<br>BUD_0<br>SOK_1<br>SRB_0<br>SUD_0<br>SOK_1<br>SRB_0<br>SUD_0<br>SOK_1<br>SRB_0<br>SUD_0<br>SOK_1<br>SRB_0<br>SUD_0<br>SOK_1<br>SRB_0<br>SUD_0<br>SUD_0<br>SOK_1<br>SRB_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SOK_1<br>SRB_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_0<br>SUD_   | RB_04_ex_Calopiaca_flavocitrina    9927_Trebouxia_asymmetrica_AV/028_ex_Calopiaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_terr_126   KJ576667_Uncultured_Trebouxia_S65_ex_Bryoria_smithii    15_ex_Lobothallia_alphoplaca    1_11_ex_Lecidella_carpathica    09_ex_Lecanora_rupicola    01_ex_Xanthoparmelia_stenophylla    1_ex_Xanthoparmelia_loxodes    13_ex_Rhizocarpon_geographicum    2_ex_Xanthoparmelia_verruculifera    CH1_2_ex_Lecanora_semipallida    16_ex_Xanthoparmelia_verruculifera    5_ex_Athtoparmelia_verruculifera    4_ex_Lecidea_fuscoatra    8_ex_Rhizocarpon_geographicum    945_Trebouxia_sAG2505_AV091_ex_Diploschistes_diacapsis    2_ex_Xanthoparmelia_verruculifera    4_ex_Lecidea_fuscoatra    8_ex_Rhizocarpon_geographicum    945_Trebouxia_vagua_SAG2505_AV091_ex_Diploschistes_diacapsis    2_ex_Xanthoparmelia_stenophylla    4_ex_Lecidea_grisella    A_cuF1_canada_BC_saxi_1007    8_ex_Lecanora_crenulata    3_ex_Xanthoparmelia_delisei                            | A12             |  |
|     | 100 SF<br>KT81<br>96 KF907<br>A12<br>BUD_0<br>TRUB_<br>TRUB_<br>TRUB_<br>KNIN_C<br>BUD_0<br>TRUB_<br>PETR_<br>BUD_0<br>TRUB_<br>PETR_<br>BUD_0<br>OTV_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>BUD_0<br>TRUB_<br>BUD_0<br>BUD_0<br>BUD_0<br>SOK_1<br>PLU_0<br>BUD_0<br>BUD_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>BUD_0<br>BUD_0<br>SOK_2<br>SOK_1<br>PLU_0<br>BUD_0<br>SOK_2<br>SOK_1<br>PLU_0<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2<br>SOK_2   | RB_04_ex_Calopiaca_flavocitrina    9927_Trebouxia_asymmetrica_AV/028_ex_Calopiaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_terr_126   KJ576667_Uncultured_Trebouxia_S65_ex_Bryoria_smithii    15_ex_Lobothallia_alphopiaca    11_ex_Lecidella_carpathica    09_ex_Lecanora_rupicola    01_ex_Xanthoparmelia_stenophylla    11_ex_Anthoparmelia_protomatrae    02_ex_Xanthoparmelia_verruculifera    2H_2_ex_Lecanora_garovaglioi    9_ex_Lecanora_garovaglioi    9_ex_Lecanora_garovaglioi    9_ex_Lecanora_garovaglioi    9_ex_Lecanora_garovaglioi    9_ex_Lecanora_garovaglioi    9_ex_Lecanora_garovaglioi    9_ex_Lecanora_garovaglioi    9_ex_Lecanora_garovaglioi    9_ex_Lecanora_garovaglioi    9_ex_Anthoparmelia_verruculifera    4_ex_Anthoparmelia_stenophylla    4_ex_Lecidea_fuscoatra    8_ex_Rhizocarpon_geographicum    945_Trebouxia_vagua_SAG2505_AV091_ex_Diploschistes_diacapsis    2_ex_Xanthoparmelia_tenophylla    4_ex_Xanthoparmelia_delisei    8_ex_Lecidea_grisella               | A12             |  |
|     | 100 SF<br>KT81<br>96 KF907<br>A12<br>BUD_0<br>TRUB_<br>TRUB_<br>TRUB_<br>KNIN_C<br>BUD_0<br>TRUB_<br>PETR_<br>BUD_0<br>TRUB_<br>PETR_<br>BUD_0<br>OTV_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>DTV_0<br>VAL_0<br>ZAL_0<br>BUD_0<br>BUD_0<br>BUD_0<br>TRUB_<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0   | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_AV028_ex_Caloplaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_che3_usa_UT_terr_126   | A12             |  |
|     | 100 SF<br>KT81<br>96 KF907<br>A12<br>BUD_0<br>TRUB_<br>TRUB_<br>TRUB_<br>KNIN_C<br>BUD_0<br>TRUB_<br>PETR_<br>BUD_0<br>TRUB_<br>PETR_<br>BUD_0<br>OTV_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>DTV_0<br>VAL_0<br>ZAL_0<br>BUD_0<br>BUD_0<br>BUD_0<br>TRUB_<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0   | RB_04_ex_Calopiaca_flavocitrina    9927_Trebouxia_asymmetrica_AV/028_ex_Calopiaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_terr_126   KJ576667_Uncultured_Trebouxia_S65_ex_Bryoria_smithii    15_ex_Lobothallia_alphopiaca    11_ex_Lecidella_carpathica    09_ex_Lecanora_rupicola    01_ex_Xanthoparmelia_stenophylla    11_ex_Anthoparmelia_protomatrae    02_ex_Xanthoparmelia_verruculifera    2H_2_ex_Lecanora_garovaglioi    9_ex_Lecanora_garovaglioi    9_ex_Lecanora_garovaglioi    9_ex_Lecanora_garovaglioi    9_ex_Lecanora_garovaglioi    9_ex_Lecanora_garovaglioi    9_ex_Lecanora_garovaglioi    9_ex_Lecanora_garovaglioi    9_ex_Lecanora_garovaglioi    9_ex_Lecanora_garovaglioi    9_ex_Anthoparmelia_verruculifera    4_ex_Anthoparmelia_stenophylla    4_ex_Lecidea_fuscoatra    8_ex_Rhizocarpon_geographicum    945_Trebouxia_vagua_SAG2505_AV091_ex_Diploschistes_diacapsis    2_ex_Xanthoparmelia_tenophylla    4_ex_Xanthoparmelia_delisei    8_ex_Lecidea_grisella               | A12             |  |
|     | 100 SF<br>KT81<br>96 KF907<br>A12<br>HRUB<br>TRUB_<br>TRUB_<br>TRUB_<br>KNIN_<br>BUD_0<br>TRUB_<br>-PRA0<br>PETR_<br>BUD_0<br>TRUB_<br>-PRA0<br>PETR_<br>BUD_0<br>OTV_0<br>SOK_1<br>PLU_0<br>97 KT819<br>OTV_0<br>VAL_0<br>ZAL_0<br>A10_X<br>SRB_0<br>BUD_0<br>BUD_0<br>CIS_K0   | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_AV028_ex_Caloplaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_terr_126   | A12             |  |
|     | 100 SF<br>KT81<br>96 KF907<br>A12<br>HRUB<br>TRUB_<br>TRUB_<br>TRUB_<br>KNIN_<br>BUD_0<br>TRUB_<br>-PRA0<br>PETR_<br>BUD_0<br>TRUB_<br>-PRA0<br>PETR_<br>BUD_0<br>OTV_0<br>SOK_1<br>PLU_0<br>97 KT819<br>OTV_0<br>VAL_0<br>ZAL_0<br>A10_X<br>SRB_0<br>BUD_0<br>BUD_0<br>CIS_K0   | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_AV028_ex_Caloplaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_che3_usa_UT_terr_126   | A12             |  |
|     | 100 SF<br>KT81<br>96 KF907<br>A12<br>FRUB<br>TRUB<br>TRUB<br>TRUB<br>TRUB<br>TRUB<br>TRUB<br>OTV_0<br>SOK_1<br>PLU_0<br>97 KT819<br>OTV_0<br>VAL_0<br>ZAL_0<br>A10_X<br>SRB_0<br>BUD_0<br>BUD_0<br>OTV_0<br>CIS_K0<br>PLU_1  | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_AV028_ex_Caloplaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_terr_126   | A12             |  |
|     | 100 SF<br>KT81<br>96 KF907<br>A12<br>HRUB<br>TRUB_<br>TRUB_<br>TRUB_<br>KNIN_<br>BUD_0<br>TRUB_<br>-PRA0<br>PETR_<br>BUD_0<br>TRUB_<br>-PRA0<br>PETR_<br>BUD_0<br>TRUB_<br>-PRA0<br>PETR_<br>BUD_0<br>TRUB_<br>-PRA0<br>PETR_<br>BUD_0<br>TRUB_<br>-PRA0<br>PETR_<br>BUD_0<br>TRUB_<br>-PRA0<br>PETR_<br>BUD_0<br>TRUB_<br>-PRA0<br>PETR_<br>BUD_0<br>TRUB_<br>-PRA0<br>PETR_<br>BUD_0<br>TRUB_<br>-PRA0<br>PETR_<br>BUD_0<br>TRUB_<br>-PRA0<br>PETR_<br>BUD_0<br>TRUB_<br>-PRA0<br>BUD_0<br>TRUB_<br>-PRA0<br>BUD_0<br>TRUB_<br>-PRA0<br>BUD_0<br>TRUB_<br>-PRA0<br>BUD_0<br>TRUB_<br>-PRA0<br>BUD_0<br>TRUB_<br>-PRA0<br>BUD_0<br>TRUB_<br>-PRA0<br>BUD_0<br>TRUB_<br>-PRA0<br>BUD_0<br>TRUB_<br>-PRA0<br>BUD_0<br>TRUB_<br>-PRA0<br>BUD_0<br>TRUB_<br>-PRA0<br>BUD_0<br>TRUB_<br>-PRA0<br>BUD_0<br>TRUB_<br>-PRA0<br>BUD_0<br>TRUB_<br>-PRA0<br>BUD_0<br>TRUB_<br>-PRA0<br>BUD_0<br>TRUB_<br>-PRA0<br>BUD_0<br>TRUB_<br>-PRA0<br>BUD_0<br>TRUB_<br>-PRA0<br>BUD_0<br>TRUB_<br>-PRA0<br>BUD_0<br>TRUB_<br>-PRA0<br>BUD_0<br>TRUB_<br>-PRA0<br>BUD_0<br>TRUB_<br>-PRA0<br>BUD_0<br>TRUB_<br>-PRA0<br>BUD_0<br>TRUB_<br>-PRA0<br>BUD_0<br>TRUB_<br>-PRA0<br>BUD_0<br>TRUB_<br>-PRA0<br>BUD_0<br>TRUB_<br>-PRA0<br>BUD_0<br>TRUB_<br>-PRA0<br>BUD_0<br>TRUB_<br>-PRA0<br>BUD_0<br>OTV_0<br>SOK_11<br>PLU_0<br>BUD_0<br>CIS_KC<br>-<br>BUD_0<br>CIS_KC<br>-<br>PLU_1<br>-<br>BUD_0<br>-<br>CIS_KC<br>-<br>PLU_1<br>-<br>BUD_0<br>-<br>BUD_0<br>-<br>CIS_KC   | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_AV/028_ex_Caloplaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_terr_126  | A12             |  |
|     | 100 SF<br>KT81<br>96 KF907<br>A12<br>HRUB<br>TRUB_<br>TRUB_<br>TRUB_<br>KNIN_G<br>BUD_0<br>TRUB_<br>PRA0<br>BUD_0<br>TRUB_<br>PRA0<br>PETR_<br>BUD_0<br>TRUB_<br>PRA0<br>PETR_<br>BUD_0<br>OTV_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>CIS_K(<br>PLU_1<br>TRUB_<br>SOK_0  | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_AV028_ex_Caloplaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_ter_126  | A12             |  |
|     | 100 SF<br>KT81<br>96 KF907<br>A12<br>BUD_0<br>HRUB<br>TRUB_<br>TRUB_<br>KNIN_C<br>BUD_0<br>TRUB_<br>PETR_<br>BUD_0<br>TRUB_<br>PRAC<br>PETR_<br>BUD_0<br>OTV_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>SOK_0<br>OTV_0<br>SOK_0<br>OTV_0<br>SOK_0<br>OTV_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0   | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_AV/028_ex_Caloplaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_ter_126   | A12             |  |
|     | 100 SF<br>KT81<br>96 KF907<br>A12<br>BUD_0<br>HRUB<br>TRUB_<br>TRUB_<br>TRUB_<br>KNIN_C<br>BUD_0<br>TRUB_<br>PETR_<br>BUD_0<br>TRUB_<br>PETR_<br>BUD_0<br>OTV_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>SOK_0<br>OTV_0<br>SOK_0<br>OTV_0<br>SOK_0<br>OTV_0<br>SOK_0<br>OTV_0<br>SOK_0<br>SOK_0<br>OTV_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>S   | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_AV028_ex_Caloplaca_teicholyta    -A11_AF345888_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_terr_126   KJ576667_Uncultured_Trebouxia_S65_ex_Bryoria_smithii    15_ex_Lobothallia_alphoplaca    1_11_ex_Lecidella_carpathica    09_ex_Lecanora_rupicola    01_ex_Xanthoparmelia_stenophylla    14_ex_Xanthoparmelia_istenophylla    14_ex_Xanthoparmelia_verruculifera    211_2_ex_Lecanora_semipallida    16_ex_Xanthoparmelia_verruculifera    211_2_ex_Lecanora_garovaglioi    9_ex_Lecanora_garovaglioi    9_ex_Lecanora_garovaglioi    9_ex_Lecanora_garovaglioi    4_ex_Xanthoparmelia_verruculifera    5_ex_Xanthoparmelia_verruculifera    4_ex_Lacidea_fuscoatra    8_ex_Rhizocarpon_geographicum    945_Trebouxia_vagua_SAG2505_AV091_ex_Diploschistes_diacapsis    2_ex_Xanthoparmelia_tenophylla    4_ex_Lecidea_grisella    A_cuF1_canada_BC_saxi_1007    8_ex_Lecanora_geographicum    0_ex_Liploschistes_scruposus    2_ex_Xanthoparmelia_delisei    0_ex_Liccanap | A12             |  |
|     | 100 SF<br>KT81<br>96 KF907<br>A12<br>BUD_0<br>HRUB<br>TRUB_<br>TRUB_<br>KNIN_G<br>BUD_0<br>TRUB_<br>PETR_<br>BUD_0<br>TRUB_<br>PRAC<br>PETR_<br>BUD_0<br>OTV_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>SOK_0<br>BUD_0<br>CIS_K0<br>SOK_0<br>PLU_1<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_1<br>SOK_0<br>SOK_1<br>SOK_0<br>SOK_1<br>SOK_0<br>SOK_1<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0  | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_VV028_ex_Caloplaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_terr_126   | A12             |  |
|     | 100 SF<br>KT81<br>96 KF907<br>A12<br>BUD_0<br>HRUB<br>TRUB_<br>TRUB_<br>KNIN_G<br>BUD_0<br>TRUB_<br>PETR_<br>BUD_0<br>TRUB_<br>PETR_<br>BUD_0<br>OTV_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_0<br>SOK_1<br>PLU_1<br>TRUB_<br>SOK_0<br>OTV_0<br>TRUB_1<br>SOK_0<br>SOK_0<br>SOK_1<br>PLU_1<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0<br>SOK_0   | RB_04_ex_Caloplaca_flavocitrina    9927_Trebouxia_asymmetrica_VV028_ex_Caloplaca_teicholyta    -A11_AF345889_Trebouxia_asymmetrica_UTEX2507_ex_Diploschistes_albescens    509_Trebouxia_sp_URa4_Tuerk51477_ex_Fulgensia_bracteata_ssp_deformis    XA_chE3_usa_UT_terr_126   | A12             |  |

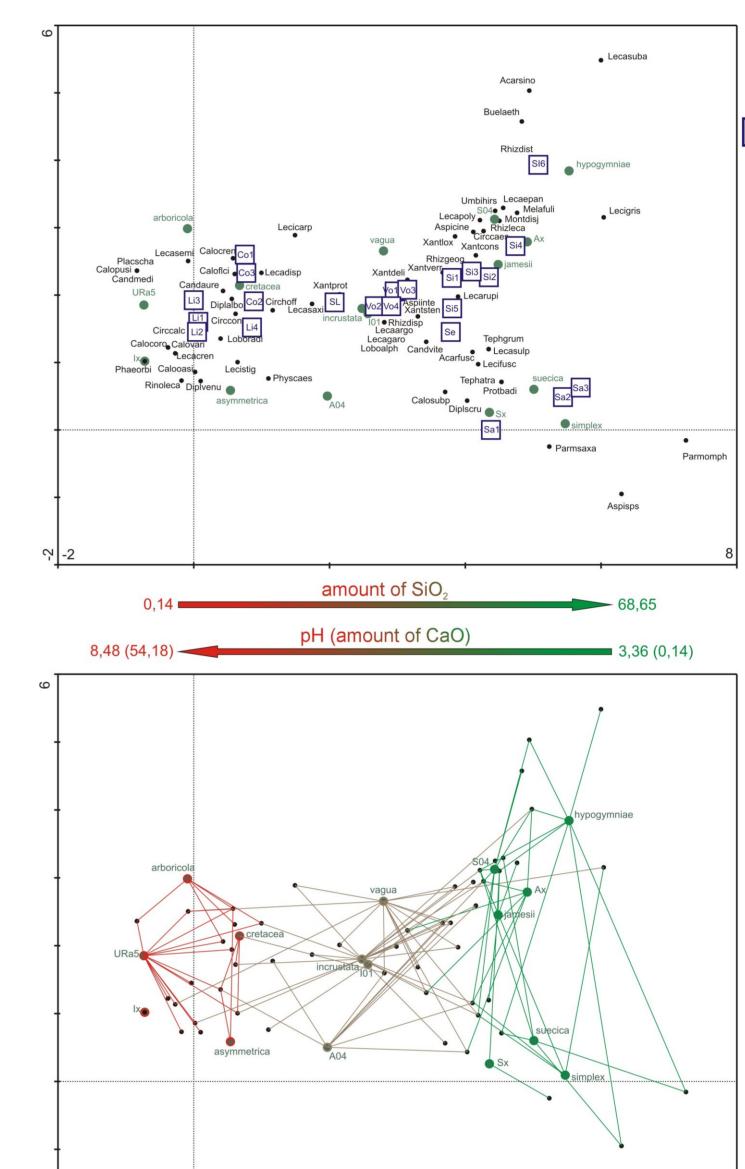
# **Results**

# Photobiont diversity

- In 89 lichen taxa of saxicolous communities, 24 Trebouxia lineages were found, including eight authentic *Trebouxia* species (additional sequences used in the analysis represent further 25 clades).
- Photobionts of saxicolous lichens of central Europe belong to three of four *Trebouxia* major clades – A, I, and S (see phylogenetic tree on the left).

# Lichen guilds

- All individual *Trebouxia* lineages were shared by several fungal species (3–34); the selectivity of fungi varied from low to high.
- The photobionts exhibited rather clear habitat/community preferences – each lichen community shared a specific pool of distinct algal lineages.
- $\rightarrow$  The lichen fungi and their photobionts formed obvious ecological assemblages – limestone (calcareous), volcanic and siliceous rock guilds.
- Each guild had its "core" comprising species with narrow ecology, but the boundaries among guilds were not strictly defined – ecologically closer communities partly shared their photobionts.
- Volcanic guild formed a natural link between limestone and siliceous guild.
- Euryecious lichen taxa often represent the intermediates between "neighbouring" guilds (e.g. Lecanora saxicola between limestone and volcanic guild, Candelariella vitellina between volcanic and siliceous guild – see figs on the right).



Biplot showing the position of study sites, Trebouxia species and lichen taxa in ordination space.

### Study sites

Li1-4 - limestone Co1-3 - concrete SL - siliceous vein in limestone Vo1-4 - diabases, basalts Si1-5 - siliceous rocks Sa1-3 - sandstone

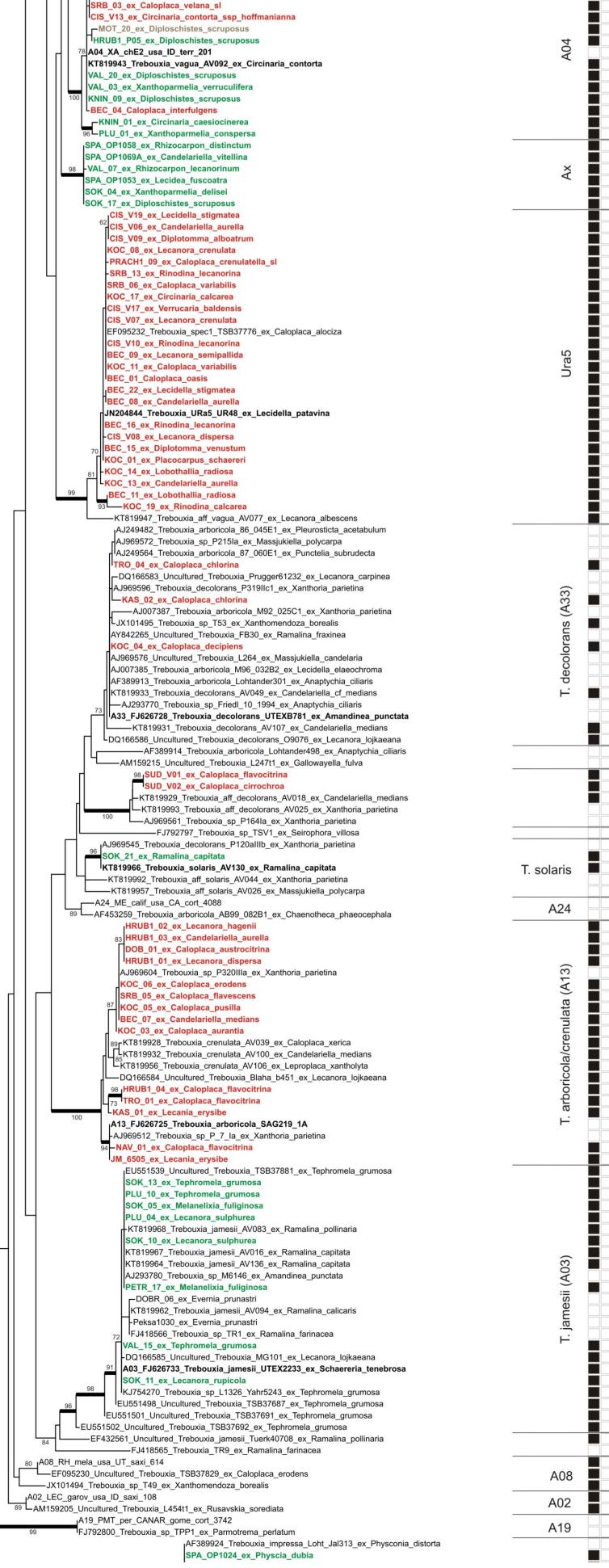
#### Trebouxia species

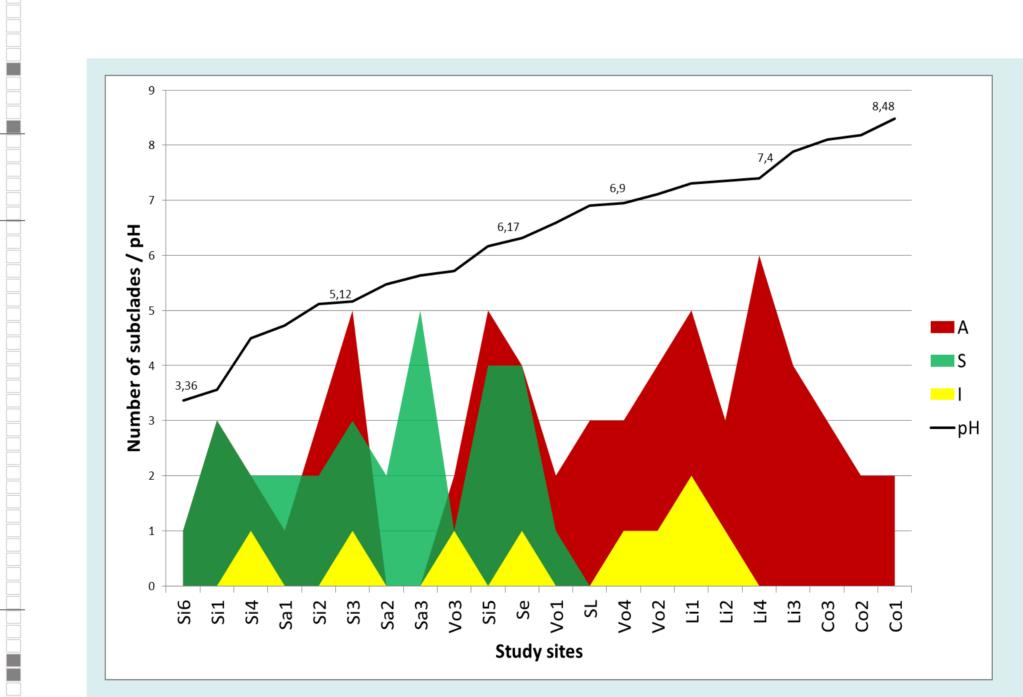
lichen taxa (abbreviaton is composed from first four letters of generic and species name)

#### The same biplot (withou localities) with links among associated mycobionts and photobionts.

Colours highlight the separation of three photobiont-mediated guilds: limestone guild volcanic guild siliceous guild

The interconnections betwee ecologically close guilds through several (ecologica plastic) lichen taxa are apparent





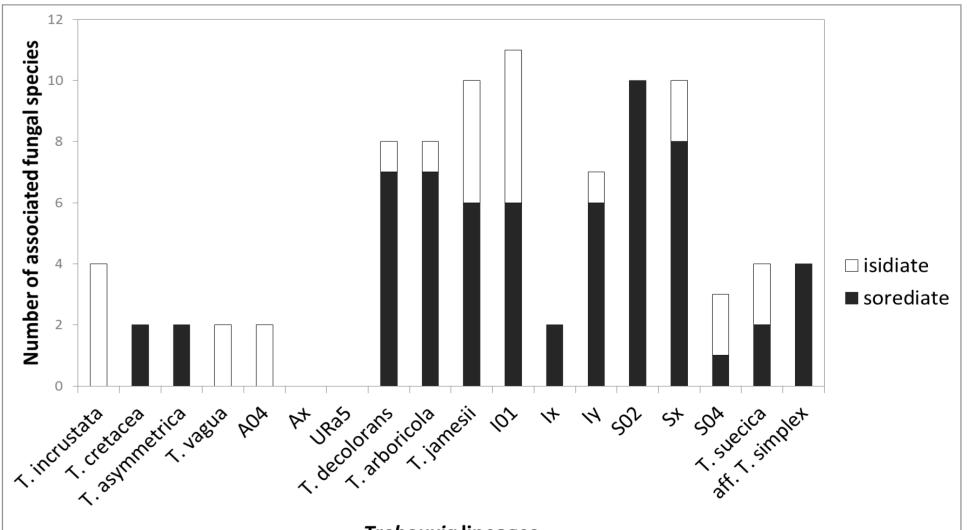
## **Core species wanted!**

- In a system of lichen guilds, vegetatively reproducing lichens (core species sensu Rikkinen et al.) may serve as propagators of photobionts within their soredia or isidia.
- We detect an interesting disproportion in numbers of vegetatively and sexually reproducing lichens associated with individual photobionts – some algae were never found in a core species (especially rock specialists from clade A), other seemed to predominantly associate with asexual, often epiphytic lichens.
- We can speculate about the role of symbiotic propagules as a

Detrended correspondence analysis of saxicolous lichen communities (Canoco 4.5. - ter Braak and Smilauer 1995): distribution of 22 samples 62 fungal (lichen) and 16 Trebouxia species in the space of first and second ordination axes (cumulative percentage variance of species data 25.5 %).

# **Ecology of photobionts**

- The adaptation to different chemical composition and pH of substrate seems to have an origin in the evolution of *Trebouxia* – the preferences were obvious already on the level of major clades:
  - o clade A is rather basiphilous (but including acidophilous subclades as well, e.g. *T. jamesii*, clade *Ax*)
  - clade S is strictly acidophilous
  - o clade I does not prefer distinct pH, but their members were mainly found in lichens typical for eutrophicated environments.
- It may have a consequence in algal preferences to main substrate types: rock, soil and tree bark – *T. incrustata* and its close relatives from clade A were exclusively associated with saxicolous and terricolous lichens, on the other hand, the members of clades I and S represented mainly substrate generalists or prefered epiphytic lichens (see tree on the left).



common source of photobionts. The "photobiont rain" probably includes relatively high portion of free-living forms of symbiotic algae (at least of some algal lineages).

Trebouxia lineages

The plot based on complete dataset of *Trebouxia* sequences of vegetatively reproducing lichens from Europe. Numbers of strictly sexual lichens are not shown (dataset incomplete, yet). Lineages with at least five sequences were included.

# Conclusions

- We found photobiont-mediated guilds in saxicolous lichen communities in central Europe.
- More then 24 photobiont species occured in studied lichens. Four to five distinct *Trebouxia* lineages formed a core of each lichen guild.
- Some photobionts exhibit clear environmental preferences and participate only in one specific guild, several algae represent euryecious taxa participating in various guilds (mainly *Trebouxia* species of volcanic guild).
- The most of *Trebouxia* species "read" chemical characters and pH of substrate rather than its "type" they are able to associate with saxicolous, terricolous as well as epiphytic lichens within similar range of pH.

• Trebouxia-mediated guilds have commonly a low proportion of vegetatively reproducing lichens. Moreover, some algal lineages are associated with very low number of sorediate or isidiate species. Therefore, we suppose they spend considerable part of their existence, including dispersal, as free-living algae.

Phylogenetic tree: nrITS phylogeny, maximum likelihood analysis using GARLI v. 2.0 (Zwickl 2006), GTR+G+I model, ML bootstraps ≥60% are shown, branches with boostrap ≥90% are in bold. Sequences included: own (256) – Trebouxia seq. of saxicolous lichen communities + some seq. of additional sorediate saxicolous lichens from other localities; GenBank (177) – seq. of authentic strains and Trebouxia OTUs sensu Leavitt et al. (2015), all unicate Trebouxia seq. of terricolous, epiphytic and sorediate saxicolous lichens photobionts from Europe The provisional names of Trebouxia clades and OTUs follow Beck (2002), Hauck (2007), Ruprecht et al. (2014), Leavitt et al. (2015). Ax, Ix, Iy, Sx: own provisional codes. Sampling: At each sampling site (see map and legend to DCA plot above), all lichen taxa belonging to a local community were collected and analyzed. DNA was extracted from one thallus of each lichen taxa.

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