

Interní grant JU

1. Název projektu: Taxonomy of the *Caloplaca thuringiaca* species complex within the *C. holocarpa* group (Teloschistales, lichenized fungi)

2. Stav řešení problematiky projektu:

Caloplaca Th Fr. is a large cosmopolitan genus represented by presumably more than 800 species worldwide (Kärnefelt et al. 2002). As the formerly used generic names such as *Blastenia*, *Gasparrinia*, *Pyrenodesmia*, etc. were lumped into *Caloplaca* (e.g. Kärnefelt 1989), the genus has recently been treated in a very broad sense and displays a great morphological variability comprising mainly types with crustose, placodioid, but also foliose to fruticulose thalli (Poelt & Peltzer 1984). However, modern molecular phylogenetic studies (Gaya et al. 2003, Søchting & Lutzoni 2003) clearly demonstrated the artificiality of the present classification and found the genus *Caloplaca* paraphyletic.

Our project is focused on a species complex within a relatively small *Caloplaca holocarpa* group. This group is characterized by yellow/orange/red apothecia with biatorine to zeorine margins, rather small, broadly ellipsoid spores with thick septa (except of *C. luteoalba*), and a reduced, inconspicuous white/grey thallus. Due to a small morphological and anatomical variability it has discouraged lichenologists from detailed investigations, and the group has never been monographed as a whole. Regarding the preparation of the third volume of the Nordic lichen flora, this group is currently being revised for the territory of Scandinavia and Denmark by Ulf Arup (Lund University). As there is a low species diversity of *C. holocarpa* group in the Nordic countries, the study is focused on corticolous species, *C. cerinella* (Nyl.) Flarey, *C. cerinelloides* (Erichsen) Poelt, *C. luteoalba* (Turner) Th. Fr., *C. pyracea* (Ach.) Th.Fr., and saxicolous species *C. holocarpa* (Hoffm. ex Ach.) A.E.Wade (= *C. lithophila* H.Magn.) and *C. polycarpa* (A.Massal.) Zahlbr. The group is approached in a complex way (morphological, anatomical, chemical, and ecological analyses) and the genetic relationships of the species are analysed using the ITS ribosomal DNA gene. Our project aims to follow this investigation with non-saxicolous and non-corticolous species, which are absent from the Nordic countries. The following “species” will be included:

***Caloplaca saxifragarum* Poelt** (= *C. pyracea* f. *microcarpa* (Anzi) Dalla Torre & Sarnth) is a circumpolar, arctic-alpine lichen found on lignified stems of calciphilous plants *Carex firma*, *Dryas*, *Potentilla*, and *Saxifraga*, and on plant debris. It is distributed from Greenland (Hansen et al. 1987) and Svalbard (Elvebakk & Hertel 1997) to the highest mountains in central and southern Europe (e.g. Lisická 2005, Nimis 2003, Poelt 1955, Vondrák & Slavíková-Bayerová 2006), extending to the mountains of Macaronesia (c.f. Nimis 1993). It is also known from central Asia: Mongolia, Nepal (Vězda 1965, Poelt & Hinteregger 1993), and North America (Thomson & Weber 1992).

***Caloplaca schoeferi* Poelt** is a muscicolous species occurring on calcareous substrates in alpine belt of European mountains; the Alps (Poelt 1955), Carpathians (Alstrup & Olech 1992), and Pyrenees (c.f. Llimona & Hladun 2001). It is also known from central and north Asia; Mongolia (Biazrov et al. 1989), Tajikistan (Kudratov & Mayrhofer 2002) and Russia (Putorana Plateau) (Zhurbenko 1992).

***Caloplaca thuringiaca* Söchting & Stordeur** occurs in steppe-like grasslands connected with limestone and gypsum rocks, on stems of minute shrubs, plant-debris, and bryophytes. It is only known from several localities in eastern Austria, central Germany, northern Italy and Switzerland (Stordeur 2003). In the Czech Republic, it is common in the Pavlovské vrchy hills in southernmost Moravia and in Český kras karst in central Bohemia (unpublished data).

***Caloplaca suaedae* Gilbert & Coppins** is only known from salt marshes in England growing on lignified stems of *Suaeda vera* (Gilbert 2001). Records on stems of shrubby *Limonium suffruticosum* from similar habitats in the Crimean peninsula, Ukraine, probably refer to this species (unpublished data).

The circumscriptions of all treated species are rather vague within *Caloplaca holocarpa* group; for instance, *C. thuringiaca* differs from other species by its “delicate apothecia that are initially immersed in thallus” only (Söchting & Stordeur 2001). *C. suaedae* is mainly characterized by its narrowly ellipsoid, often bowed or curved ascospores (Gilbert 2001), but no data about the number of measurements and investigated samples are provided. In fact, the treated “species” are strongly specific by their ecology, however, there is a need for further genetical, morphological, and chemical studies.

- Alstrup V. & Olech M. (1992): Checklist of the lichens of the Tatra National Park, Poland. – *Zeszyty Naukowe Uniwersytetu Jagiellońskiego [Prace Botaniczne]* 24: 185–206.
- Biazrov L.G., Ganbold E., Gubanov I.A. & Ulzichutag N. (1989): *Flora des Changai*. – Nauka, Leningrad. 191 pp.
- Elvebakk A. & Hertel H. (1997): A catalogue of Svalbard lichens. – In: Elvebakk A. & Prestrud P. (eds.): *A Catalogue of Svalbard Plants, Fungi, Algae, and Cyanobacteria*. Norsk Polarinstitutt Skrifter., pp. 271–359.
- Gaya E., Lutzoni F., Zoller S. & Navarro-Rosinés P. (2003): Phylogenetic study of Fulgensia and allied Caloplaca and Xanthoria species (Teloschistaceae, lichen-forming Ascomycota). – *American Journal of Botany* 90(7): 1095–1103.
- Gilbert O. (2001): The lichen flora of coastal saline lagoons in England. – *Lichenologist* 33(5): 409–417.
- Hansen E.S., Poelt J. & Söchting U. (1987): Die Flechtengattung Caloplaca in Grönland. – *Meddelelser om Grönland, Bioscience* 25: 1–52.
- Kärnefelt I. (1989): Morphology and phylogeny in the Teloschistales. – *Cryptogamic Botany* 1: 147–203.
- Kärnefelt I., Kondratyuk S., Söchting U., Frödén P. & Arup U. (2002): Two new species of Caloplaca (Teloschistaceae) from the Southern Hemisphere. – *The Bryologist* 105(3): 301–309.
- Kudratov I. & Mayrhofer H. (2002): Catalogue of the lichenized and lichenicolous fungi of Tajikistan. – *Herzogia* 15: 91–128.
- Lisická E. (2005): *The Lichens of the Tatry Mountains*. – VEDA, Slovak Academy of Sciences, Bratislava. 439 pp.
- Llimona X. & Hladun N.L. (2001): Checklist of the lichens and lichenicolous fungi of the Iberian Peninsula and Balearic Islands. – *Bocconea* 14: 1–581.
- Nimis P.L. (1993): *The Lichens of Italy*. – Museo Regionale di Scienze Naturali, Torino. 897 pp.
- Nimis P.L. (2003): Checklist of the Lichens of Italy 3.0., University of Trieste, Dept. of Biology, IN3.0/2 (<http://dbiodbs.univ.trieste.it>).
- Poelt J. (1955): Die Gipfelvegetation und -flora des Wettersteingebirges. – *Feddes Repert.* 58(1-3): 157–179.
- Poelt J. & Hinteregger E. (1993): Beiträge zur Kenntnis der Flechtenflora des Himalaya. VII. Die Gattungen Caloplaca, Fulgensia und Ioplaca (mit englischem Bestimmungsschlüssel). – *Bibliotheca Lichenologica*, 50, J. Cramer, Berlin, Stuttgart. 247 pp.
- Poelt J. & Pelleter U. (1984): Zwergstrauchige Arten der Flechtengattung Caloplaca. – *Plant Systematics and Evolution* 148: 51–88.
- Söchting U. & Lutzoni F. (2003): Molecular phylogenetic study at the generic boundary between the lichen-forming fungi Caloplaca and Xanthoria (Ascomycota, Teloschistaceae). – *Mycological Research* 107(11): 1266–1276.
- Söchting U. & Stordeur R. (2001): *Caloplaca thuringiaca* sp. nov., a species from the Caloplaca holocarpa complex. – *Lichenologist* 33(6): 467–472.
- Stordeur R. (2003): Zur Ökologie und Verbreitung von Caloplaca thuringiaca. – In: Jensen, M (ed.): *Lichenological Contributions in Honour of G.B. Feige*. Bibliotheca Lichenologica, J. Cramer, Berlin, Stuttgart, pp. 453–464.
- Thomson J.W. & Weber W.A. (1992): Lichens collected on the Arctic excursion of the 9th International Botanical Congress (Montreal) in 1959. – *The Bryologist* 95(4): 392–405.
- Vězda A. (1965): Flechten aus der NW-Mongolei. – *Acta Mus. Silesiae, ser. A. [Opava]* 14: 187–190.
- Vondrák J. & Slavíková-Bayerová Š. (2006): Contribution to the lichenized and lichenicolous fungi in Bulgaria. II, the genus Caloplaca. – *Mycol. Balcan.* 3: 61–69.
- Zhurbenko M.P. (1992): The new and rare species of lichens from the north-western part of the Putorana Plateau. – *Botanicheskii Zhurnal [Moscow & Leningrad]* 77(3): 108–114.

3. Stanovení badatelských cílů, metody a způsob řešení:

Questions to be solved

1. Is the present conception of the treated species natural? Do the treated taxa represent phylogenetically distinct species?
2. Are there some additional morphological and chemical characters supporting the results from the phylogenetic analyses?

Materials

For the analyses, materials from our herbarium (CBFS) will be used. At the moment, there are 4 available samples of *C. saxifragarum*, 1 sample of *C. suaedae*, 10 samples of *C. thuringiaca*, collected in 2000-2006 in different parts of Europe. Additional materials will be obtained from the herbaria GZU, KHER, M, and the private herbarium of O. Gilbert. A collection trip to the Alps in summer 2007 is planned.

Methods

Suggested solution of the problem:

1. The genetic relationships will be analysed using ITS1, 5.8S, and ITS2 markers in co-operation with Lund University and University of Copenhagen. For details about DNA-extraction, PCR-amplification, sequencing, and phylogenetic analyses see Arup (2006). This work on taxonomy of *Caloplaca citrina* group in the Nordic countries is the key study for the phylogenetic analysis in our project.
2. Morphological characters investigated: presence/absence of thallus, character of thallus (width, structure, colour, surface character), character of apothecia (size, colour, development, convexity), margin of apothecia (biatorine/zeorine, width of true/thalline margin), asci (clavate/cylindrical, size), ascospores (shape, size, width of septum). Morphological characters will be investigated in all available samples. In each specimen, at least 3 apothecia will be investigated and 15 measurements made. Lichen substances (mainly anthraquinones) will be investigated in co-operation with Mgr Pavel Hrouzek (University of South Bohemia) by the high performance thin layer chromatography (HPTLC) according to Arup et al. (1993).

Arup U. (2006): A new taxonomy of the *Caloplaca citrina* group in the Nordic countries, except Iceland. – *Lichenologist* 38(1): 1–20.

Arup U., Ekman S., Lindblom L. & Mattsson J.-E. (1993): High performance thin layer chromatography (HPTLC), an improved technique for screening lichen substances. – *Lichenologist* 25(1): 61–71.

4. Harmonogram prací:

Spring and summer 2007 – obtaining the additional samples; investigation of morphological characters and chemical compounds

Autumn 2007 – DNA-extraction, PCR-amplification, sequencing, phylogenetic analyses, analysis of morphological + chemical vs. phylogenetic data, paper preparation

5. Předpokládaný typ vědeckých výsledků projektu:

Paper in a specialized journal (e.g. *The lichenologist*)

6. Hlavní řešitel (maximálně 30 řádek)

- odborná charakteristika, výběr z publikační a grantové činnosti za poslední 3 roky

Master thesis: Selected saxicolous species of the genus *Caloplaca* (lichenized fungi) occurring in the Czech Republic.

PhD thesis: Diversity of the genus *Caloplaca* (lichenized fungi) on seashore rocks of the western Black sea coast.

- Liška, J., Palice, Z., Dětinský, R. & Vondrák, J. (2006): Changes in distribution of rare and threatened lichens in the Czech Republic II. – In: Lackovičová A., Guttová A., Lisická E. & Lizoň P. (eds), Central European lichens – diversity and threat. Mycotaxon, Ithaca (in press).
- Sparrus L. & Vondrák J. (2006): A new *Opegrapha* with delimited soralia from shaded limestone in Bohemia. – Lichenologist (in press).
- Vondrák J. (2005): *Caloplaca crenulatella*, *Rinodina pityrea* and *Verrucaria macrostoma* f. *furfuracea* - three taxa of lichenised fungi new to Romania. – Contr. Bot. 39: 37–39.
- Vondrák J. (2006): *Lichenostigma elongata* a *Stigmatidium rouxianum*, dva druhy lichenikolních hub zjištěných na *Acarospora cervina* v ČR. – Bryonora 37: 7–9.
- Vondrák J. (2006): Lišejníky chráněného území Vyšenské kopce u Českého Krumlova. – Bryonora 37: 9–18.
- Vondrák J. (2006): Contribution to the lichenized and lichenicolous fungi in Bulgaria. I. – Mycol. Balcan. 3: 7–11.
- Vondrák J., Halda J., Malíček J., Müller A. & Uhlík P. (2006): Lišejníky zaznamenané během 18. bryologicko-lichenologických dnů v Moravskoslezských Beskydech (22.-25.9.2005). – Bryonora 37: 19–23.
- Vondrák J., Kocourková J., Palice Z. & Liška J. (2006): New and noteworthy lichens in the Czech Republic – genus *Rinodina*. – In: Lackovičová A., Guttová A., Lisická E. & Lizoň P. (eds), Central European lichens – diversity and threat. Mycotaxon, Ithaca (in press).
- Vondrák J. & Hrouzek P. (2006): *Caloplaca soralifera*, a new species from Europe. – Graphis Scripta 18: 6–15.
- Vondrák J. & Palice Z. (2004): Lichenologicky významná lokalita Zábrdská skála v Prachatickém Předšumaví. – Bryonora 33: 22–26.
- Vondrák J. & Prach K. (2006): Occurrence of heliophilous species on isolated rocky outcrops in a forested landscape: relict species or recent arrivals?. – Preslia 78: 115–121.
- Vondrák J. & Slavíková-Bayerová Š. (2006): Contribution to the lichenized and lichenicolous fungi in Bulgaria. II, the genus *Caloplaca*. – Mycol. Balcan. 3: 61–69.
- Vondrák J. & Šoun J. (2006): An appraisal of the syntype material of *Caloplaca aurantiomurorum* (Teloschistaceae, lichenized fungi). – Mycotaxon (in press)

7. Spoluřešitelé (maximálně 15 řádek)

- *příjmení, jméno, titul*: Šoun Jaroslav Mgr.

- *pracoviště*: Biologická fakulta, Katedra botaniky, Branišovská 31, 370 05 České Budějovice; *tel.*: 603756815; *e-mail*: jasoun@centrum.cz

- *odborná charakteristika, výběr z publikační a grantové činnosti za poslední 3 roky*:

Graduated at Biological faculty, University of South Bohemia in 2005, with specialization of botany

Master thesis: Revision of the *Caloplaca aurantia* group in the Czech Republic.

PhD thesis: Taxonomy of the *Caloplaca ferruginea* group in Europe.

Vondrák J. & Šoun J. (2006): An appraisal of the syntype material of *Caloplaca aurantiomurorum* (Teloschistaceae, lichenized fungi). – Mycotaxon (in press)

Hrouzek P. & Šoun J. (2004): Some finds of subaerophytic cyanobacteria on wetted walls of La Palma (Canary Islands). – Czech Phycology, Olomouc, 4: 155-162.

JIHOČESKÁ UNIVERZITA V ČESKÝCH BUDĚJOVICÍCH

FORMULÁŘ C

Interní grant JU

Název projektu: Taxonomy of the *Caloplaca thuringiaca* species complex within the *C. holocarpa* group (Teloschistales, lichenized fungi)

Hlavní řešitel: Jan Vondrák

ROZPOČET

1. Osobní náklady (lze nárokovat pouze pro zaměstnance JU)

- mzdové prostředky (odměna řešiteli)

- zdravotní a sociální pojištění

Celkem: 0 Kč

2. Ostatní neinvestiční prostředky

- všeobecný materiál

Office materials; routine chemicals, e.g. acetone and methanol; equipment for microscopical examinations and for HPTLC analyses: **7.000 Kč**

- knihy, učební pomůcky

Special literature: **10.000 Kč**

- služby

DNA analysis of 40 samples: **48.000 Kč**

telephone, mail, copying: **10.000 Kč**

- stipendium (lze nárokovat pouze pro studenta v DSP, který není zároveň zaměstnancem JU)

24.000 Kč for each researcher = **48.000 Kč**

Celkem: 123.000 Kč

Neinvestiční prostředky celkem: 123.000 Kč

Granty získané z jiných zdrojů hlavním řešitelem k tématu grantového projektu podaného do GA JU (rok zahájení, poskytovatel, Kč v tis., název projektu):

Datum: 3.10.2006

podpis hlavního řešitele

JIHOČESKÁ UNIVERZITA V ČESKÝCH BUDĚJOVICÍCH

FORMULÁŘ D

Interní grant JU

Hlavní řešitel: Jan Vondrák

Pracoviště navrhovatele: Biologická fakulta, Katedra botaniky

Název projektu: Taxonomy of the *Caloplaca thuringiaca* species complex within the *C. holocarpa* group (Teloschistales, lichenized fungi)

Požadované finanční prostředky: **123.000 Kč**

- neinvestiční celkem: **123.000 Kč**

- z toho: - osobní náklady (lze nárokovat pouze pro zaměstnance JU):

- stipendium (lze nárokovat pouze pro studenta v DSP): **48.000 Kč**

STANOVISKO A VYJÁDŘENÍ FAKULTY/ÚSTAVU

1. Vyjádření vedoucího pracoviště (vedoucí katedry, u doktorandů školitel) k vědecké významnosti navrhovaného projektu a zařazení jeho problematiky do současného i perspektivního profilu fakulty/ústavu, účelnost a možnosti zajištění řešení, úměrnost finančních požadavků apod. (maximálně 5 řádek).

Datum: 4.10.2006

jméno a podpis vedoucího pracoviště

2. Vyjádření děkana fakulty resp. ředitele součásti (označte křížkem):

Udělení grantu doporučuji
 nedoporučuji.

Datum:

jméno a podpis