Final Report over work done at Cuba, Germany and Mexico
(August 2004-August 2005)
Project:

RUST AND SMUT FUNGI IN CUBA

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Introduction

More than 7.000 species of rusts and about 1.450 of smuts are known worldwide (Kirk, 2001; Vánky, 2002). In Cuba, 39 species of smut fungi are known (Piepenbring, 2003) and concerning Cuban Uredinales, about 190 species have been mentioned in literature, notably by Arthur & Johnston (1918), Kreisel (1971), Urban (1973 and 1990), Seidel (1976), Schmiedeknecht (1983 and 1984), and Arnold (1986). For both groups of fungi the studies have been sporadic and mainly conceived as inventories, being scarce those referring to details of taxonomy, systematics, morphology, and ecology of the species.

In addition to this, many localities in Cuba have not yet been explored, mainly those in the Eastern region where the highest floristic biodiversity and endemism occur. Therefore, as a result of the present study, an increase in numbers of species of rusts and smut fungi is expected, as well as new hosts and data about the distribution and ecology of the species in Cuba.

OBJECTIVES

- to carry out intensive field work in Cuba with emphasis on poorly explored regions in order to increase the knowledge of the diversity of rusts and smuts including taxonomic and systematic investigation combined with observations on their morphology, ecology and distribution.
- to carry out detailed studies in the genera *Sporisorium* and *Ustilago* using traditional methods and electron microscopy, as well as molecular techniques that allow to clarify the delimitation of these genera.

PRELIMINARY RESULTS
First part: Work in Cuba

Field work

During the period August 2004–January 2005 I carried out field work in Cuba. I have collected ca. 153 specimens of rusts (84) and smuts (69) on intensive field trips in Western, Central and Eastern Cuba. The field work was carried out mainly in poorly explored regions of Cuba. The localities visited are mentioned above:

- Biosphere Reserve Guanahacabibes (Pinar del Río province)
- National Park Viñales (Pinar del Río province)
- Natural Reserve San Marcos (Pinar del Río province)
- Protected Area Mil Cumbres (Pinar del Río province)
- Ecological Reserve Los Indios (Isla de la Juventud)
- Estación Experimental de Pastos y Forrajes (Matanzas province)
- Botanical Garden Soledad (Cienfuegos province)
- Floristic Reserve Monte Ramonal (Villa Clara province)
- Ecological Reserve Alturas de Banao (Sancti Spíritus province)
- Topes de Collantes (Sancti Spíritus province)
- National Park Turquino (Santiago de Cuba/Granma provinces)
- Loma El Gigante (Granma province)
- Botanical Garden of Cupainicú (Granma province)
- Pinares de Mayarí (Holguín province)

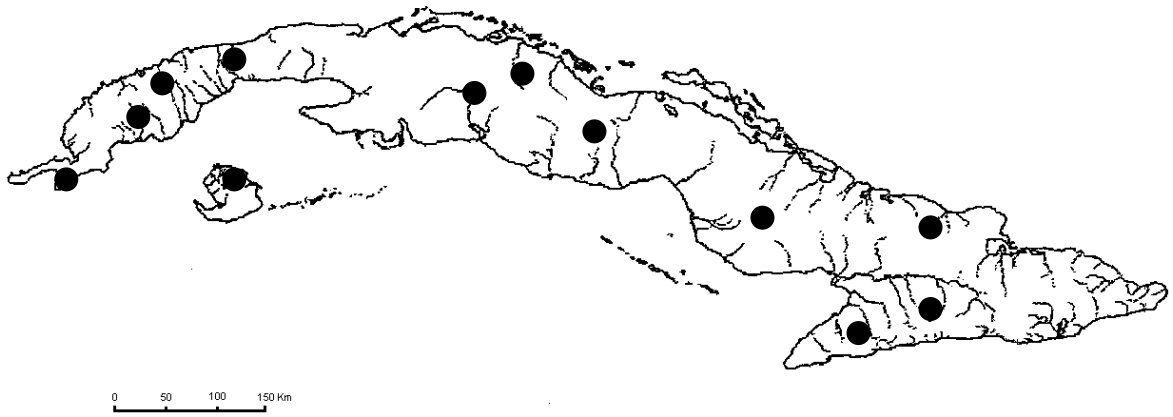

Fig. 1. Localities visited during the field work in Cuba.

The collected material was deposited in the mycological section of the herbarium HAJB (Cuban National Botanic Garden), including several species cited for Cuba, which are not

represented at the moment in Cuban herbaria. Notes on ecological aspects and pictures of the species were taken.

Trips to the field were combined with visits to the following herbaria in the provinces:

- Jardín Botánico de Cienfuegos, Cienfuegos province (AJBC)
- Instituto Superior Pedagógico, Pinar del Río province (HPPR)
- Instituto Superior Pedagógico, Camagüey province (without official Herbarium Acronym).
- Instituto de Ecología y Sistemática, Ciudad Habana province (HAC).
- Jardín Botánico de Cupainicú, Granma province (without official Herbarium Acronym).

The host plants were determined in the herbarium of the Cuban National Botanic Garden (HAJB) according to León (1946), Catasús (1997, 2001) and the help from Cuban botanists.

During the field work it was not possible to find the species *Phakopsora pachyrhizi* on soybeans, although several fields of soybeans have been visited.

It is particularly relevant to say that during the field work, adverse climatic conditions were found, because during May 2004 to February 2005 a severe drought affected the eastern and central regions of the island.

Second part:

Work in Germany

University of Frankfurt

- Bibliographical research

I carried out an exhaustive bibliographical research on rusts and smuts. More than 70 articles were localized and consulted. A checklist of Cuban rusts was compiled, which is very useful because the information about them is much dispersed.

The checklist contains the following information for each rust species: name of the fungus, synonyms, types of spores, host plants, family of the host plants, reference of the reports for the country, citations of original descriptions, distribution in Cuba and herbarium specimens.

- Herbarium and laboratory work

I carried out a revision and identification of specimens of rusts and smuts taken from Cuba, and also checking some material from the private collection of M. Piepenbring.

The identification of the species was based on morphological characteristics of sori and spores using light and scanning electron microscopy (SEM). Drawings and pictures of sori

and teliospores, as well as germination of teliospores of selected species for the observation of basidia were carried out.

23 news records of rust and smut species as well as new host plants for Cuba were found and new localities for known species. A list of Cuban rust and smut fungi and their host plants resulting from this study is attached.

Some Cuban material deposited in the herbaria BPI, JE, M, PRC, and PRM was revised and some species were compared to types of other species by means of herbarium loans.
At present a manuscript on new records and hosts of smut fungi from Cuba is in revision process and other article was recently published:
Pérez-Martínez, J.M. & Martín, Luis. 2005. Micobiota from Viñales National Park, Pinar del Río, Cuba. I. Smut fungi (Ustilaginomycetes). Rev. Mex. Mic. 20: 71-79.
Also a presentation on the diversity of smuts in Cuba was carried out at Botanical Institute of University of Frankfurt.

Work at the University of Tübingen, Germany

In order to elucidate the generic position of problematic species and to confirm the identification of doubtful species it is neccesary to carry out molecular studies. Therefore, DNA sequence data of selected species are being obtained in collaboration with Dr. Matthias Stoll (Lehrstuhl für Spezielle Botanik & Mykologie at the University of Tübingen). This study is now in progress. Also, some publications about rust and smut fungi that are not accessible in Frankfurt were localized in Tübingen.

Work at the Instituto de Ecología, A.C., Xalapa, Mexico

The last two weeks of this project I carried out a revision and identification of specimens of Cuban rusts in collaboration with MSc. Gloria Carrión in the Systematic Mycology Laboratory (Instituto de Ecología, Xalapa, Mexico). The identification of the species was based on morphological characteristics of sori and spores using light microscopy and with the help of specialized literature, more than 20 articles were localized and consulted. In addition a session of field work was carried out during which some species of rusts and other fungi were collected and ecological aspects were observed

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List of species

*New record for Cuba
** New host for Cuba
***New host for the species

SMUT FUNGI
***Cintractia axicola* (Berk.) Cornu**
On *Fimbristylis complanata* (Retz.) Link
HAJB 9591, 10482
***Cintractia limitata* G.P.Clinton**
On *Cyperus* sp.
HAJB 9612, 10529, 10488
***Leucocintractia leucodermoides* M. Piepenbr. & Begerow**
On *Rhynchospora holoschoenoides* (Rich.) Herter
HAJB 9618, 10431, 10489, 10490
***Moesziomyces bullatus* (Schröter) K. Vánky**
On *Echinochloa crusgalli* (L.) P. Beauv. **
M. Yemo 529 (HAC)
On *Leersia hexandra* Swartz
Catasús 787 (HAC 36906), Catasús 809 (HAC 31706)
***Mycosyrinx cissi* (DC.) G. Beck**
On *Cissus sicyoides* L.
HAJB 10434, 10437, 10499
On *Cissus trifoliata* L.**
HAJB 10320
***Sporisorium andropogonis* (Opiz) K. Vánky**
On *Andropogon virginicus* L. **
HAJB 9478
***Sporisorium bicorne* (Henn.) Vánky** *
On *Andropogon bicornis* L.
HAJB 9454, 9610, 9614, 9616, 10426, 10429, 10430, 10453, 10454, 10455, 10456, 10459, 10458, 10465, 10472, 10481, 10504, 10522, 10523
***Sporisorium cruentum* (Kühn) K. Vánky**
On *Sorghum halepense* (L.) Pers.
HAJB 10436
***Sporisorium culmiperdum* (J. Schröter) Vánky**
On *Andropogon* sp.
HAJB 8873, 10524
***Sporisorium ellisii* (G. Winter) M. Piepenbr.** *
On *Andropogon glomeratus* (Walt.) Britton **
HAJB 8718, 8837, 9131, 9476, 9833, 10460
***Sporisorium everhartii* (Ell. & Galloway) M. Piepenbr.**
On *Andropogon glomeratus* (Walt.) Britton **
Roman s/n (HAC)
***Sporisorium mesoseti* (Zundel) Vánky**
On *Mesosetum loliiforme* (Hochst.) Chase **
Acuña 20247 (HAC), Baker 2935 (HAC), Curtiss 396 (HAC), Brother Alain & E.P. Killip 2135 (HAC)
***Sporisorium panici-leucophaei* (Bref.) M. Piepenbr.**
On *Digitaria insularis* (L.) Fedde
HAJB 10432, 10464, 10494
***Sporisorium trachypogonicola* Vánky & C. Vánky**
On *Trachypogon renvoizei* Catasús
HAJB 9615
***Tilletia ayresii* Berkeley**
On *Panicum maximum* Jacq.
HAJB 10452, 10435, 10526
***Trichocintractia utriculicola* (Henn.) M. Piepenbr.**
On *Rhynchospora corymbosa* (L.) Britton
HAJB 10433
***Ustanciosporium samanense* (Cif.) M. Piepenbr. & Begerow**
On *Rhynchospora fascicularis* (Michx.) Vahl
HAJB 9130
***Ustanciosporium taubertianum* (Henn.) M. Piepenbr. & Begerow**

On *Rhynchospora* sp.
HAJB 10528
***Ustilago chrysopogonis* Ahmad** *
On *Schizachyrium hirtiflorum* Nees ***
HAJB 9477, 9479
***Ustilago dieteliana* Henn.**
On *Tripsacum latifolium* Hitchc.
HAJB 9717
***Ustilago maydis* (DC.) Corda**
On *Zea mays* L.
HAJB 10427
***Ustilago trichophora* (Link.) Körn.**
On *Echinochloa colona* (L.) Link
HAJB 10428, 10478, 10483

RUST FUNGI
***Aecidium tournefortiae* Henn. 0, I**
On *Tournefortia bicolor* Sw.
HAJB 8692
***Bubakia erythroxylonis* Cummins**
On *Erythroxylum areolatum* L. **
HAJB 9881, 9902, MP 2094
On *Erythroxylum havanense* Jacq.
HAJB 9608
***Coleosporium elephantopodis* Thümen II**
On *Elephantopus mollis* H.B.K.
HAJB10508
***Dasturella divina* (Syd.) Mundk. & Khesw. II**
On *Arthrostylidium* sp.
HAJB 10502
***Diabole cubensis* (Arthur & J.R. Johnst.) Arthur III**
On *Mimosa pigra* s.l.
HAJB 10520
***Endophyllum circumscriptum* Whetzel & Olive**
On *Cissus microcarpa* Vahl
HAJB 10159
On *Cissus sicyoides* L.
MP 3085
***Hemileia vastatrix* Berk. & Broome II**
On *Coffea arabica* L.
HAJB 10451, 10467, 10473, 10512
***Puccinia arechavaletae* Speg. II, III**
on *Viguiera dentata* S.F. Blake
HAJB 9077
On *Pautina bipinnata* **
HAJB 6274
***Puccinia crassipes* Berk. & M.A. Curtis**
On *Ipomoea* sp.
HAJB 9019
***Puccinia heterospora* Berk. & M.A. Curtis III**
On *Sida glabra* Nut. **
HAJB 9094
On *Herissantia crispa* (L.) Brizicky **
HAJB 6304
***Puccinia hydrocotyles* (Links) Cooke II**
On *Hydrocotyle* sp.
HAJB 10521
***Puccinia lateritia* Berk. & M.A. Curtis III**
On *Borreria laevis* Griseb.
HAJB 8625, 10462
On *Borreria* sp. HAJB 10513

***Puccinia melampodii* Dietel & Holw. III**
On *Emilia sonchifolia* (L.) DC.
HAJB 10449
***Puccinia purpurea* Cooke II**
On *Tripsacum latifolium* Hitchcock
HAJB 9718
***Puccinia psidii* G. Winter II**
On *Syzygium jambos* (L.) Alston
HAJB 10441, 10468, 10486, 10509, MP 3038
***Puccinia smilacis* Schwein. II**
On *Smilax havanensis* Griseb.
HAJB 10532
***Puccinia sorghi* Schwein. II**
On *Zea mays* L.
HAJB 10442
***Puccinia thaliae* Dietel**
On *Canna* sp.
HAJB10445, 10487, 10517
***Puccinia oahuensis* Ellis & Everh. II**
On *Digitaria insularis* (L.) Fedde **
HAJB 10492
***Puccinia urbaniana* Henn. III**
On *Stachytarpheta jamaicensis* Vahl
HAJB 10439
***Puccinia* sp. II**
On *Ruellia tuberosa* L. **
HAJB 8828
***Puccinia* sp. II**
On *Cyperus* sp.
HAJB 10491
On *Cyperus odoratus* L.
MP 3102
***Uredo lycoseridis* Kern & Thurst.** * **II**
On *Gochnatia montana* (Britton) Jervis & Alain ***
HAJB 10496
***Uromyces asclepiadis* Cooke II, III**
On *Asclepias curassavica* L.
HAJB 10507
***Uromyces euphorbiae* Cooke & Peck**
On *Euphorbia heterophylla* L.
HAJB 10438, 10447, 10450, 10469
***Uromyces scleriae* Henn. II, III**
On *Scleria melaleuca* Rchb. **
HAJB 10500, 10514
***Uredinales* II**
On *Lasiacis divaricata* Hitchcock **
HAJB 10461, 10480, 10518
***Uredinales* II**
On *Paspalum fimbriatum* H.B.K. **
HAJB 10498
***Uredinales* II**
On *Merremia umbellate* (L.) Hallier **
HAJB 6565