Universität für Bodenkultur Wien
Dept. Wald- und Bodenwissenschaften

Borkenkäferforschung an der BOKU -
ein Rück- und Ausblick

Axel Schopf
Institut für Forstentomologie,
Forstpathologie & Forstschutz

Ausgangssituation:
IFF 1981/82

Herausforderung:
Waldsterben

DER SPIEGEL

C 7007 C
Nr. 47
35. Jahrgang · DM 3,50
16. November 1981

Forschungsinitiative gegen das Waldsterben:

(FIW 1: 1983-1991; FIW 2: 1991-1996)

Erhobene Baumparameter:

- Kronenzustand
- Wachstum
- Wasserhaushalt
- Nadel- und Rindeninhaltsstoffe
- Rindenanatomie

Ziel der Untersuchungen:

- Attraktivität
- Abwehrmechanismen
- Nahrungsqualität

Folgt dem Waldsterben eine Borkenkäfer-Epidemie?

168

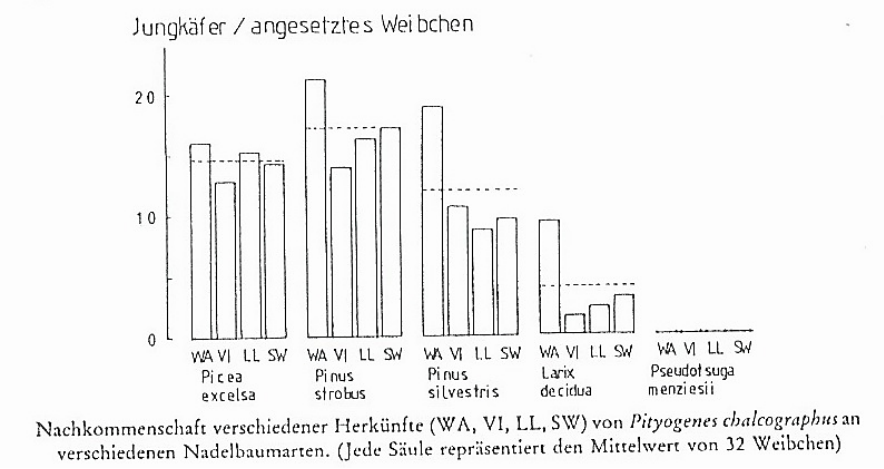
1. **Trypophloeus** asperatus. 2. **Pityophthorus** Lichtensteini, 3. pubescens, 4. micrographus, 5. exsculptus. 6. **Pityogenes** chalcographus. 7. **Ips** typographus, 8. erosus, 9. amitinus. 10. **Pityoctenes** curvidens. 11. **Taphrorychus** bicolor. 12. **Xyloclepies** bispinus ♂. 13. **Dryocoetes** autographus, 14. alni. 15. **Lymantor** coryli. 16. **Xyleborus** eurygraphus, 17. monographus. 18. **Anisandrus** dispar ♂, ♀. 19. **Xyloterus** domesticus. 20. **Platypus** cylindrus.

JOURNAL OF APPLIED ENTOMOLOGY

Brutexperimente mit *Pityogenes chalcographus* L. an verschiedenen Nadelbaumarten1

o. Univ.-Prof. Dr. Erwin Führer, Bertold Mühlenbrock Dipl.-Forstw.

First published: January/December 1983



Nachkommenschaft verschiedener Herkünfte (WA, VI, LL, SW) von *Pityogenes chalcographus* an verschiedenen Nadelbaumarten. (Jede Säule repräsentiert den Mittelwert von 32 Weibchen)

JOURNAL OF APPLIED ENTOMOLOGY

Rindeninhaltsstoffe der Fichte (*Picea abies*): Analysen an Borkenkäfer-Fangbäumen

Dr. Berta Moritz, Prof. Dr. E. Führer

First published: January/December 1988

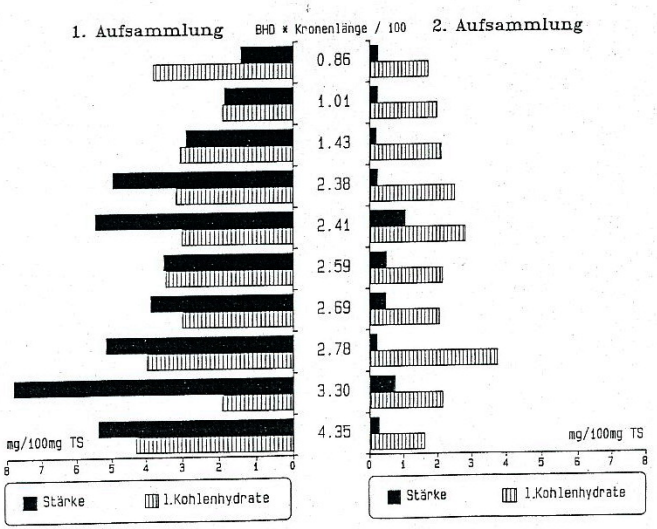


Abb. 2. Stärkegehalt und Gehalt an löslichen Kohlenhydraten im Bast bei der 1. Aufsammlung (8 Tage nach der Fällung) und bei der 2. Aufsammlung (nach 43 Tagen). Der Stärkegehalt nimmt während der Lagerung stark ab

<u>Diplomarbeiten:</u>

Einfluß der Immissionsbelastung auf den Bruterfolg des Kupferstechers (*P.c.*) an Fichte; Diplomarbeit: T. Nedwed 1984

Untersuchung über die Brutleistung des Kupferstechers (*Pityogenes chalcographus* L.) an der Lärche; Diplomarbeit: H. Schneemann 1986

Der Einfluß der Körpergröße auf die Brutleistung beim Borkenkäfer Pityogenes chalcographus. Diplomarbeit: K. Schuster 1986

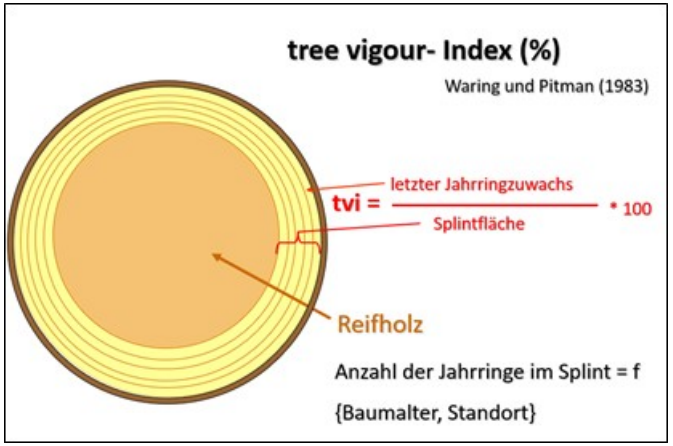
Flug-, Brut- und Entwicklungszyklen des Kupferstechers, Pityogenes chalcographus L. (Col., Scolytidae), in Abhängigkeit vom Überwinterungsstadium; Diplomarbeit: R. Meister 1998

Entomol Gener | 21(1/2): 027-035 | Stuttgart 1996-08 | ISSN: 0178-8177

EGT-Nr 890 III

Auswirkungen von Vitalität und Brutbaum-Qualität der Europäischen Fichte, Picea abies, auf die Entwicklung der Borkenkäfer-Art Ips typographus (Coleoptera: Scolytidae)

PETER BAIER



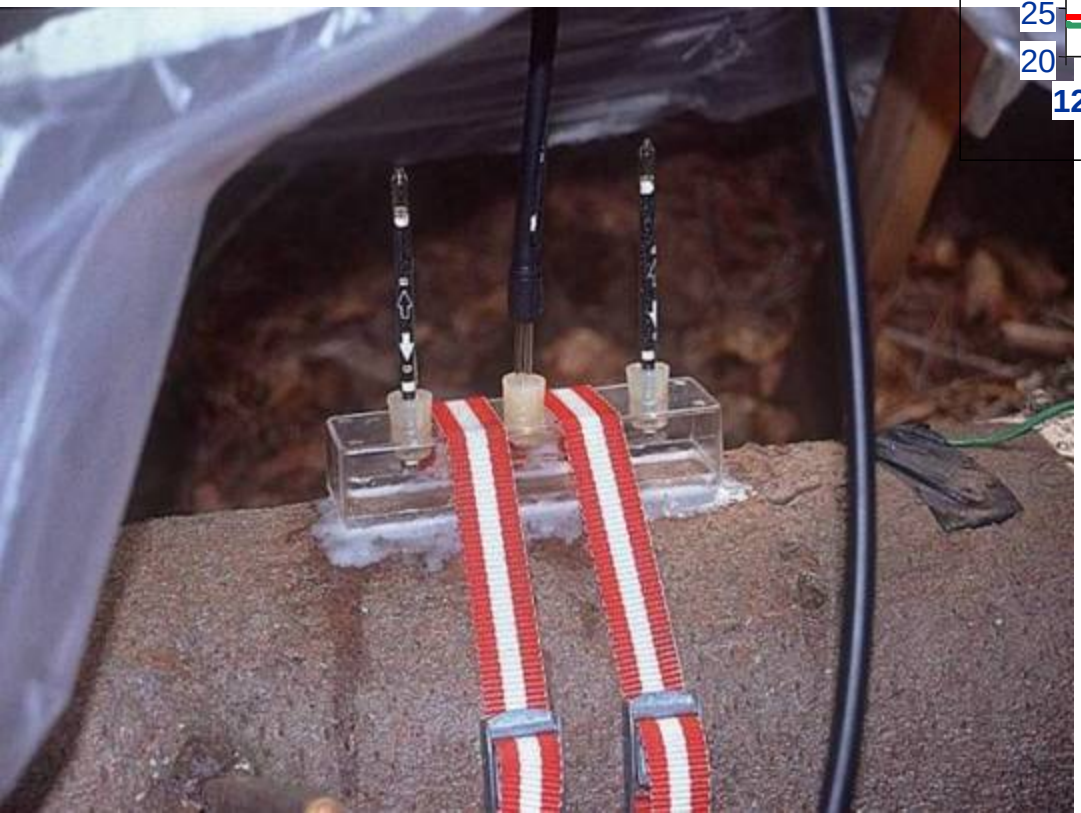
- **geringerer Bruterfolg an geschädigten Fichten**

- **Stärke- und Gesamtstickstoff-Gehalt des Phloems wirkten modifizierend auf den Bruterfolg**, wobei auch saisonale Schwankungen der Bruttauglichkeit auftraten

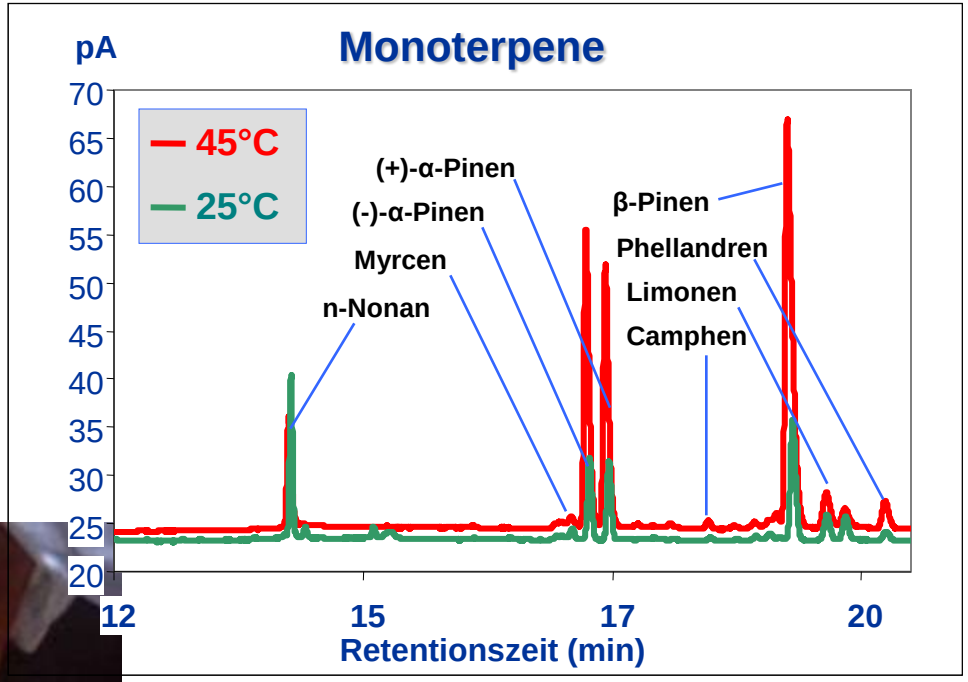
- **relative Splintflächen-Zuwachs [tree-vigour-Index]**: wesentlicher Parameter für die Differenzierung der Bruttauglichkeit

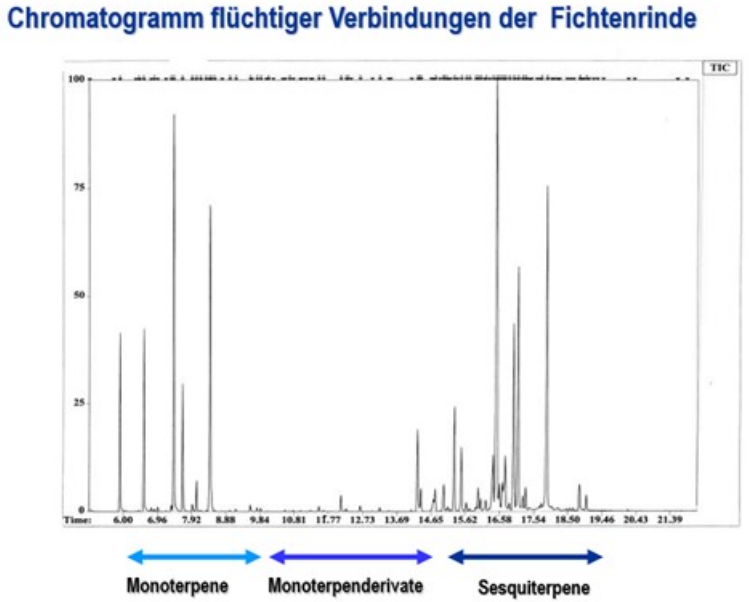
Primärattraktion

(Headspace-GC-Analyse)



flüchtige Verbindungen der Fichtenrinde





Phyton (Austria) Special issue: "D. Grill"	Vol. 45	Fasc. 3	(341)-(354)	1.9.2005

Tree Temperatures, Volatile Organic Emissions, and Primary Attraction of Bark Beetles

By

P. HIETZ[1], P. BAIER[2], I. OFFENTHALER[1)3)], E. FÜHRER[2], S. ROSNER[1] & H. RICHTER[1]

Physiology and Genetics of Tree-Phytophage Interactions
Gujan (France), August 31 - September 5, 1997
Ed. INRA, Paris, 1999 (Les Colloques, n°90)

Monoterpene content and monoterpene emission of Norway spruce (*Picea abies* (L.) Karst.) bark in relation to primary attraction of bark beetles (Col., Scolytidae)

P.BAIER, R. BADER, S. ROSNER

Institute of Forest Entomology, Forest Pathology and Forest Protection, Universität für Bodenkultur Wien, Hasenauerstrasse 38, A-1190 Vienna, Austria

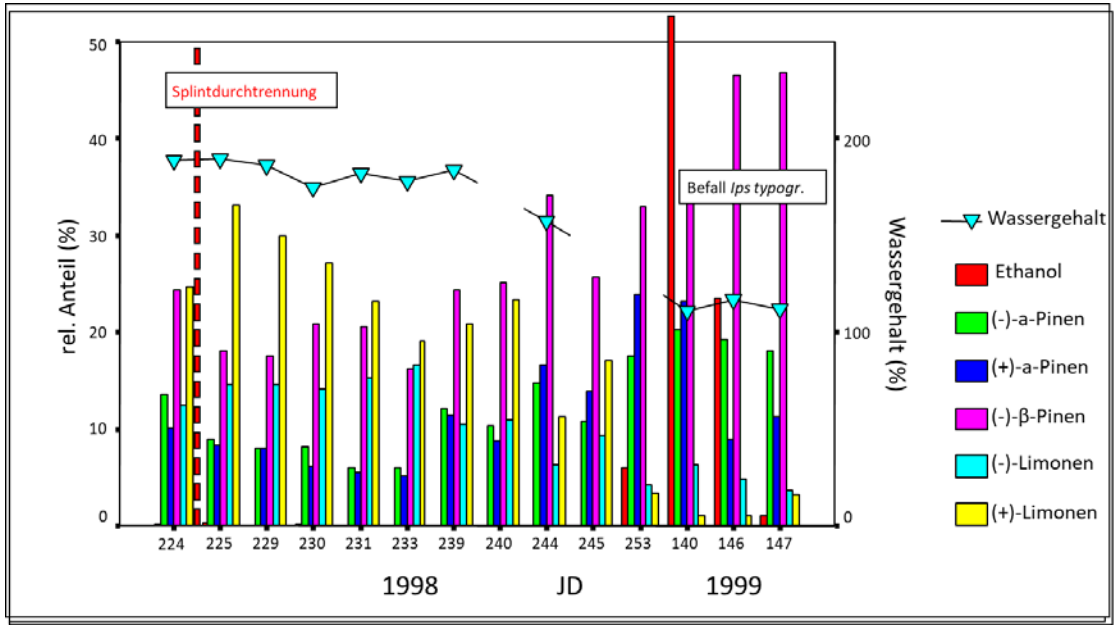


Fig. 5. Mean (± SD) of relative fractions of the main components emitted before and after sapwood transection on August 17 1998 and during the following weeks with the last samples obtained in May of the following year. For absolute total emissions see Fig. 7.

- Xylemsaftstrom hat signifikanten Kühleffekt auf die Kambialtemperatur, jedoch wohl zu gering (max 2,5°C), um Käfer durch erhöhte Emission gestresster Bäume anzulocken
- enger Zusammenhang zwischen Rindentemperatur und Emissionsrate sowie dem täglichen Maximum der Emission und der Wasserstromtemperatur
- Unterbrechung des Saftstroms verändert allmählich das Emissionsspektrum, wobei Pinen relativ zu Limonen ansteigt und Ethanol erst nach einigen Monaten deutlich auftritt
- Emissionsspektrum ist nicht ident mit dem Terpengehalt der Rinde (Teil der Emission stammt aus dem Splintholz)

JOURNAL OF
APPLIED ENTOMOLOGY

Defence reactions of Norway spruce (*Picea abies* Karst.) to controlled attacks of *Ips typographus* (L.) (Col., Scolytidae) in relation to tree parameters

Dr. P. Baier

First published: January/December 1996

- strukturelle und anatomische Eigenschaften der Borke sind die Grundvoraussetzung für das Eindringen der Borkenkäfer
- mit zunehmender Dichte und Stärke radialer Harzgänge im Phloem nimmt die Anzahl der Einbohrversuche ab
- Anzahl der durch primären Harzfluss abgewehrten Einbohrversuche nimmt zu
- temporäre Veränderungen des Kohlenstoff- und Wasserhaushaltes beeinflussen die Abwehrreaktion

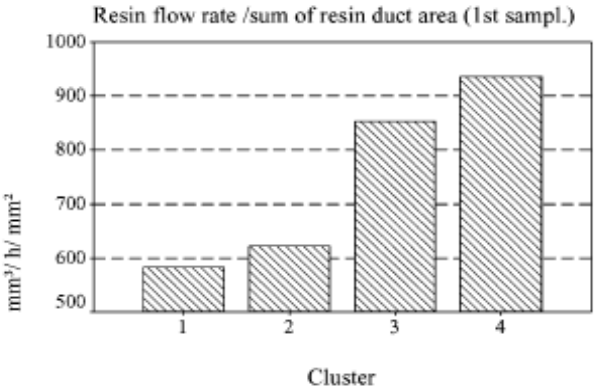
Forest Ecology and Management 159 (2002) 73–86

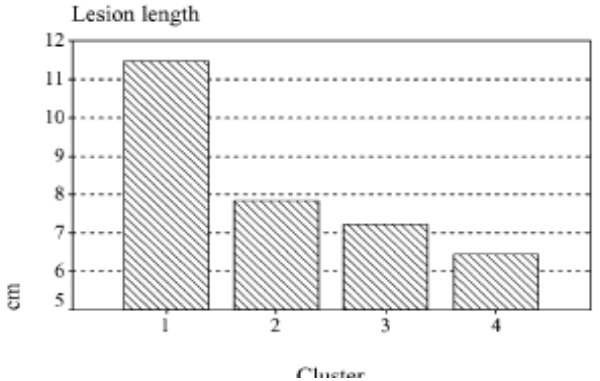
Defence reactions of Norway spruce against bark beetles and the associated fungus *Ceratocystis polonica* in secondary pure and mixed species stands

Peter Baier*, Erwin Führer, Thomas Kirisits, Sabine Rosner[1]

Institute of Forest Entomology, Forest Pathology and Forest Protection, University of Agricultural Sciences (BOKU), Hasenauerstraße 38, A-1190 Vienna, Austria

- cluster 1: fast growing trees with constant high growth level;
- cluster 2: moderately high growth level;
- cluster 3: low growth level;
- cluster 4: high growth level in recent years but slow growth in the past





Lesn. Cas. For. J. 62 (2016) 169–177 DOI: 10.1515/forj-2016-0014

Lesnícky časopis - Forestry Journal
http://www.nlcsk.sk/fj/

ORIGINAL PAPER

Defence reactions of mature Norway spruce (*Picea abies*) before and after inoculation of the blue-stain fungus *Endoconidiophora polonica* in a drought stress experiment

Sigrid Netherer*, Magdalena Ehn, Emma Blackwell, Thomas Kirisits

Institute of Forest Entomology, Forest Pathology and Forest Protection, University of Natural Re Hasenauerstraße 38, A–1190 Vienna, Austria

- primärer und induzierte Harzfluss: positiv mit der Fläche der verletzten Harzkanäle korreliert
- primärer und induzierte Harzfluss: negativ mit Wachstum des Baumes korreliert
- Fläche der Wundnekrose nach Inokulation von Bläuepilzen korreliert direkt mit der radialen Zuwachsrate und dem Wasserstress des Baumes

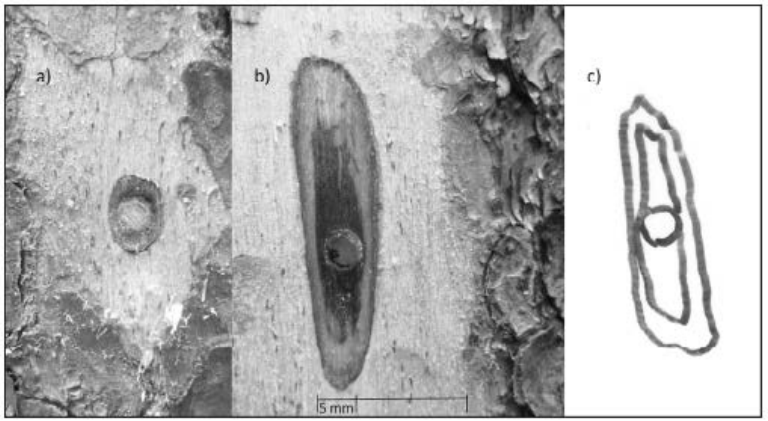
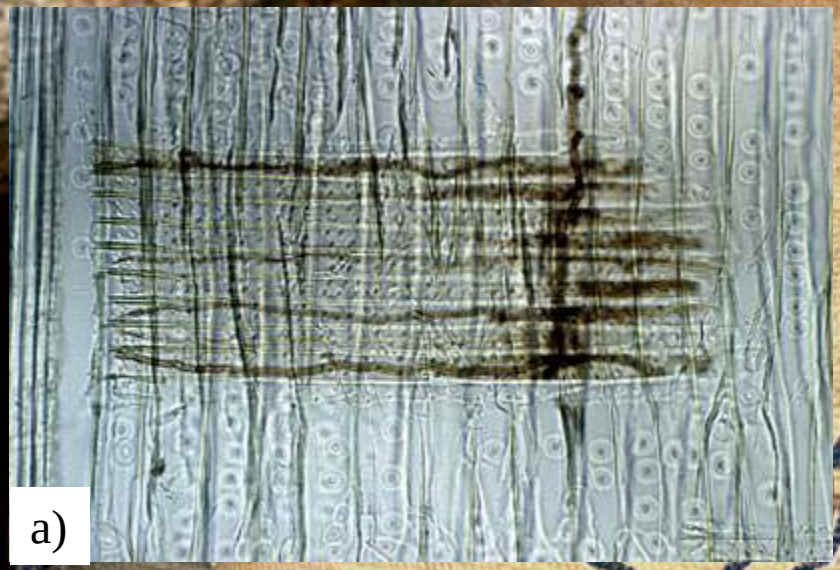


Fig. 2. Hypersensitive wound reaction in the bark of *Picea abies* following inoculation of (a) sterile AMEA, (b) the blue-stain fungus *Endoconidiophora polonica*; (c) sketch of reaction zone on transparent foil dividing necrotic from resin impregnated area.

Der Buchdrucker als Überträger von Bläuepilzen



a)

b)

c)

d)

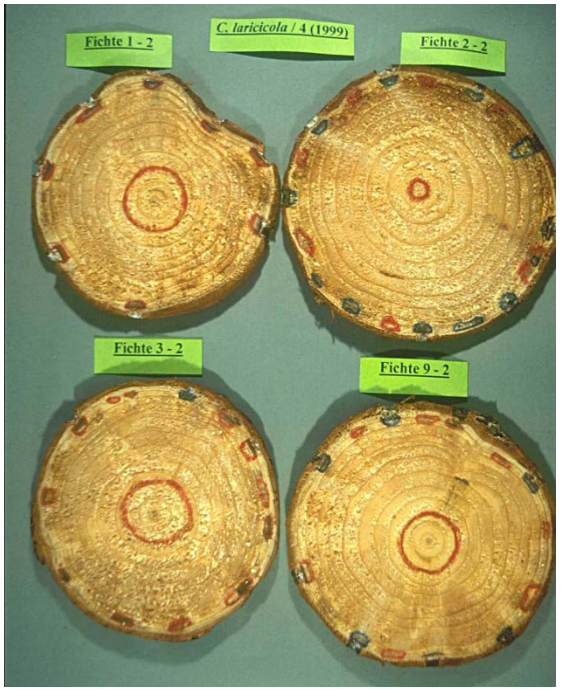
Photo: T. Kirisits

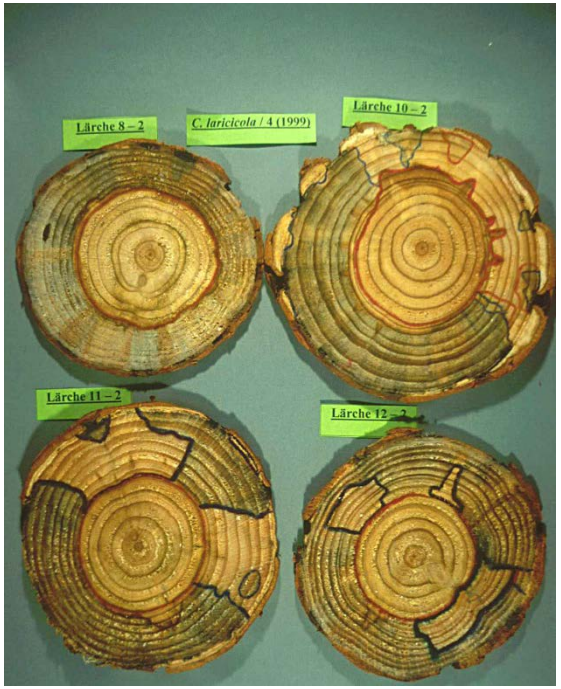
Photo: T. Kirisits

Ceratocystis polonica on *Picea abies*

Ceratocystis polonica on *Larix decidua*

Ceratocystis laricicola on *Picea abies*

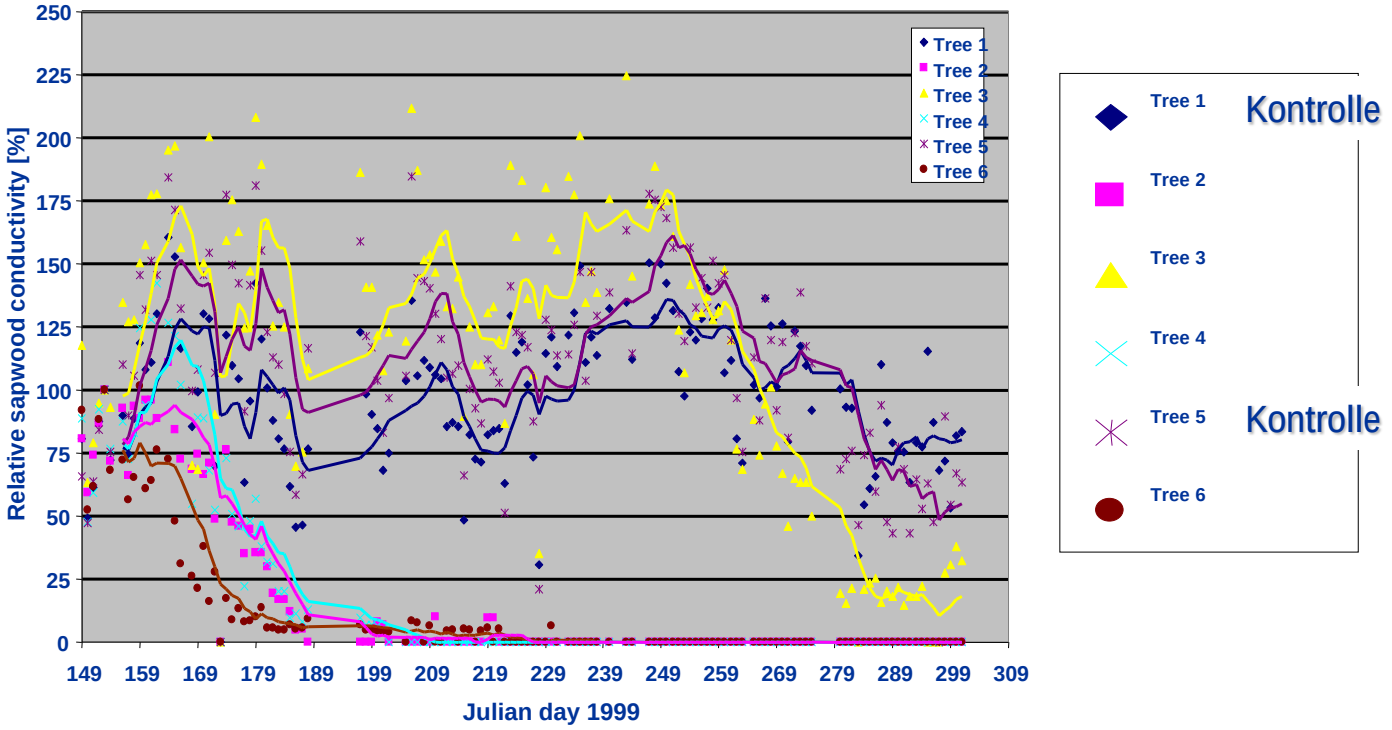




Ceratocystis laricicola on *Larix decidua*

Photo: T. Kirisits

Einfluß von *Ceratocystis polonica*-Infektion auf die Wasserleitfähigkeit der Fichte



- *Ceratocystis polonica* unterbricht den Saftfluss von inokulierten Fichten innerhalb von 4 bis 6 Wochen

- pathogene Bläuepilze erleichtern die Überwindung der Abwehr-mechanismen stehendbefallener Fichten durch den Buchdrucker

Antagonistische Effekte von *Ceratocystis polonica* auf die Entwicklung von *Ips typographus*?

Die Holländische Ulmenwelke in Österreich[1]

Thomas KIRISITS und Heino KONRAD

Abbildung 1:
Symptome der Holländischen Ulmenwelke: (a) Blattwelke (Foto: Erhard Halmschlager, IFFF-BOKU); (b) Dunkle Holzverfärbungen in den äußersten Jahrringen eines Ulmen-Zweiges.

Figure 1:
Symptoms of Dutch elm disease: (a) Wilting of leaves (Photo: Erhard Halmschlager, IFFF-BOKU); (b) Dark discoloration of the xylem in the youngest growth rings of an elm twig.

Abbildung 2:
Der Große Ulmensplintkäfer *(Scolytus scolytus)*, ein wichtiger Überträger der Ulmenwelke-Erreger: (a) Imago, (b) Brutbilder.

Figure 2:
The elm bark beetle *Scolytus scolytus*, an important vector of the Dutch elm disease pathogens: (a) Imago, (b) breeding galleries.

Habilitationsschrift

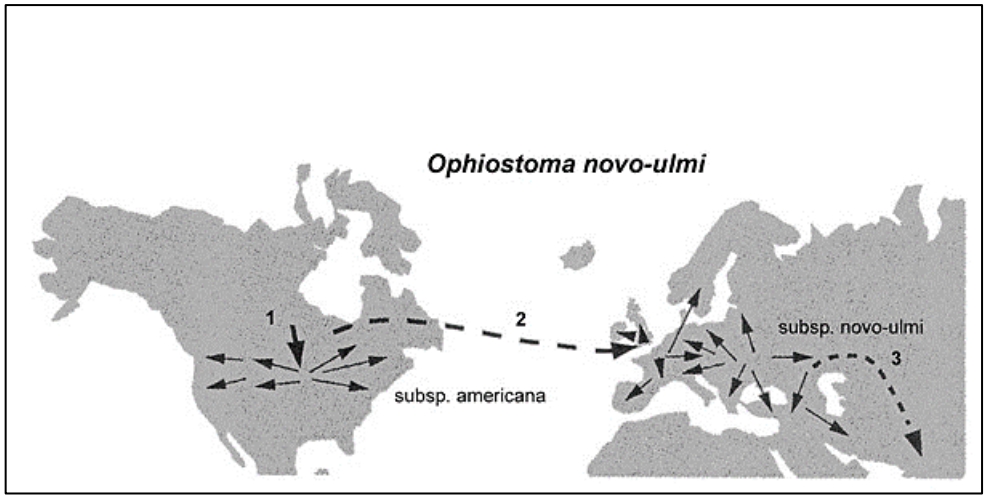
Kirisits, T.
(2009): Studies on ophiostomatoid fungi causing Dutch elm disease and blue-stain.
; Universität für Bodenkultur Wien; Habilitation im Fach Phytopathologie

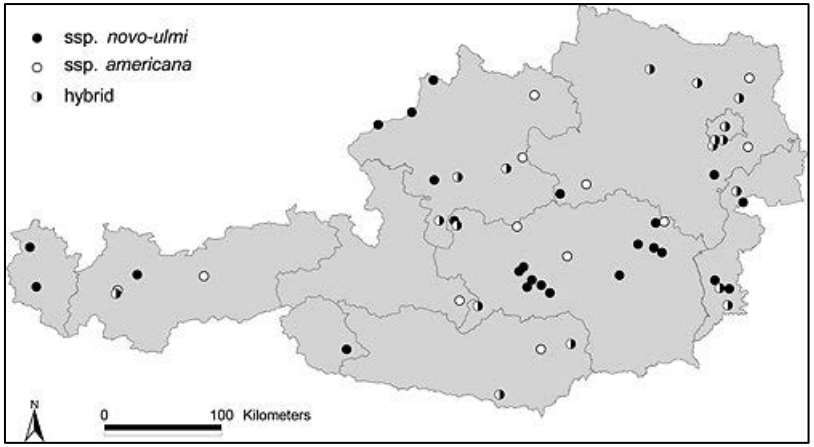
Plant Pathology (2002) **51**, 78–84

Genetic evidence for natural hybridization between the Dutch elm disease pathogens *Ophiostoma novo-ulmi* ssp. *novo-ulmi* and *O. novo-ulmi* ssp. *americana*

H. Konrad*†, T. Kirisits, M. Riegler, E. Halmschlager and C. Stauffer

Institute of Forest Entomology, Forest Pathology and Forest Protection, Universität für Bodenkultur Wien, A-1190 Vienna, Austria





- beide Unterarten der neuen Ulmensterben-Erregers in Österreich nachgewiesen
- bilden Hybride, die in ihrer Aggressivität der stärker pathogenen amerikanischen Unterart gleichen
- besonders bedroht: Feldulme und Bergulme; Flatterulme offenbar erholungsfähig

Insect Molecular Biology (1997) 6(3), 233-240

The phylogenetic relationships of seven European *Ips* (Scolytidae, Ipinae) species

C. Stauffer,[1,2] F. Lakatos[1,3] and G. M. Hewitt[2]
[1] Institute of Forest Entomology, Forest Pathology and Forest Protection, Universität für Bodenkultur, Vienna, Austria
[2]School of Biological Sciences, UEA Norwich, UK, and
[3]Department of Forest Entomology, Sopron, Hungary

- kein gemeinsamer Vorfahre für die 7 europ. *Ips* Arten
- achtzähn. *Ips* –Arten (außer *I. mannsfeldi*) bilden mit *I. acuminatus* eine monophylletische Gruppe
- enge Verwandtschaft zwischen *Ips mannsfeldi* und *Orthotomicus erosus* (*O. erosus* → *Ips* ?)

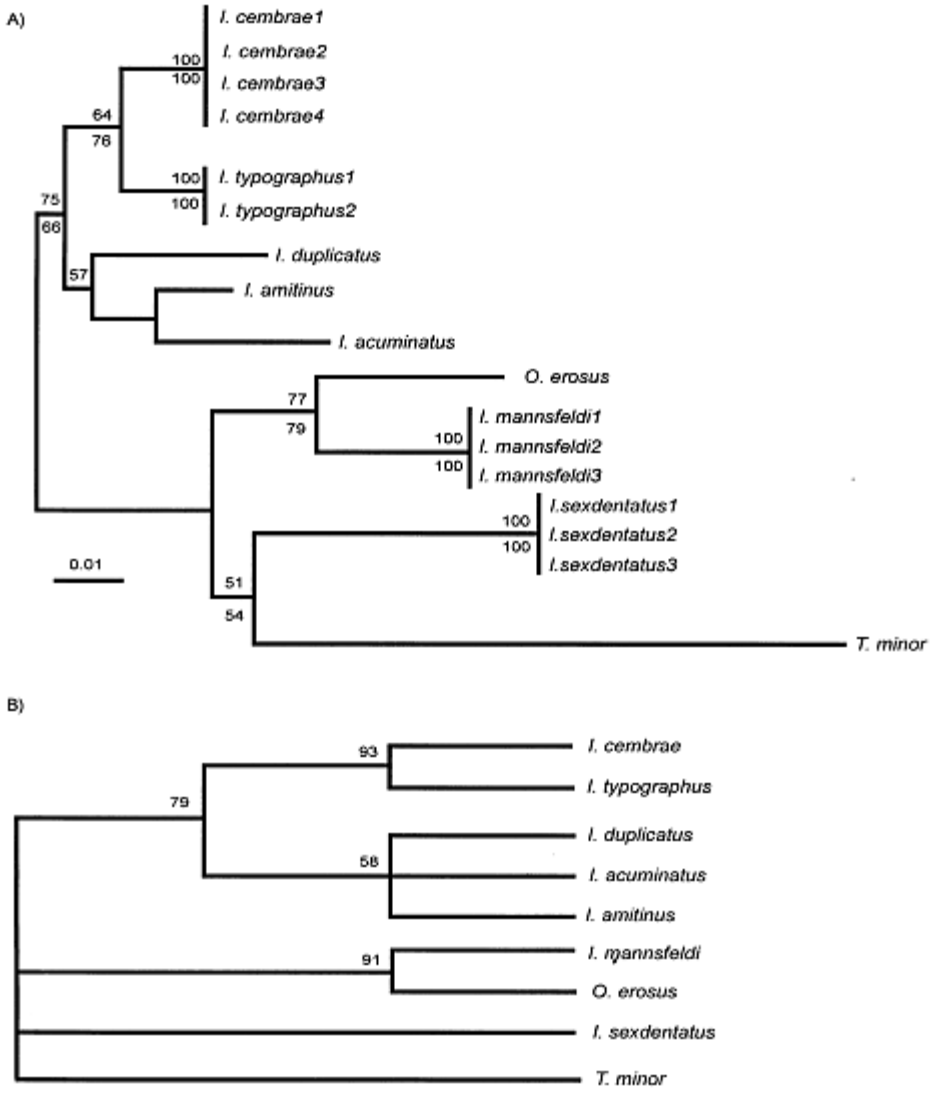


Figure 3. (A) Single most parsimonious tree for the mtDNA haplotype relationships of the seven species of *Ips* and the two outgroup species *O. erosus* and *T. minor*. Only first and second codon positions were taken and Tv were weighted two times as heavily as Ts. The MP topology is identical to that of a neighbour-joining tree using the gamma distance for the Tamura & Nei (1993) model ($\alpha = 0.5$) taking only first and second codon positions. The length of the horizontal branches are proportional to the single base changes and can be read as percentage differences with the scale bar. Bootstrap percentages (> 50%) are indicated above the nodes for NJ and below the nodes for MP. (B) Single most parsimonious tree for the AA translated from the mt COI nucleotide sequence of the seven *Ips* species, *Orthotomicus erosus* and *Tomicus minor*. Bootstrap percentages (> 50%) are indicated above the nodes.

Molecular Ecology (1999) 8, 763–773

Phylogeography and postglacial colonization routes of *Ips typographus* L. (Coleoptera, Scolytidae)

C. STAUFFER,* F. LAKATOS† and G. M. HEWITT‡
*Institute of Forest Entomology, Forest Pathology & Forest Protection, University of Agricultural Sciences Vienna, 1190 Austria, †Department of Forest Entomology, University of Sopron, 9400 Hungary, ‡School of Biological Sciences, University of East Anglia, Norwich NR4 7TJ, UK

∑8 Haplotypen:

- eigener Typ: Russland, Litauen
- 2 Gruppen in Mitteleuropa,
- 1 Haplotyp in Nordeuropa

- *I. typographus* migrierte vom Apennin / Dinari. Alpen nach Norden
- Bottleneck-Effekt im Norden und Osten, in MEu hoher Genaustausch
- offensichtlich keine Ausbrei-- tung vom Gebiet nördl. von Moskau nach Skandinavien (i. Geg. zu Fichte?)

Fig. 6 Mitochondrial DNA haplotypes encountered in the 18 European *Ips typographus* populations. Below the abbreviations of the collection sites (defined in Table 1), haplotypes are given in Roman numbers (e.g. I, II, ...) and individuals sequenced are given in Arabic numbers (e.g. 1, 2,....). Arrows indicate proposed migration routes. Interrupted lines indicate migration barriers. The inset shows the postglacial migration routes of the host tree, *Picea abies* (Schmidt-Vogt 1977; Lagercrantz & Ryman 1990).

Sympatric occurrence of diverged mtDNA lineages of *Pityogenes chalcographus* (Coleoptera, Scolytinae) in Europe

DIMITRIOS N. AVTZIS, WOLFGANG ARTHOFER and CHRISTIAN STAUFFER*
Institute of Forest Entomology, Forest Pathology and Forest Protection, Department of Forest and Soil Sciences, Boku, University of Natural Resources and Applied Life Sciences, Vienna, Austria
October 2007

Analyse von 39 Populationen

→ 58 Haplotypen

→ 3 Haplogruppen

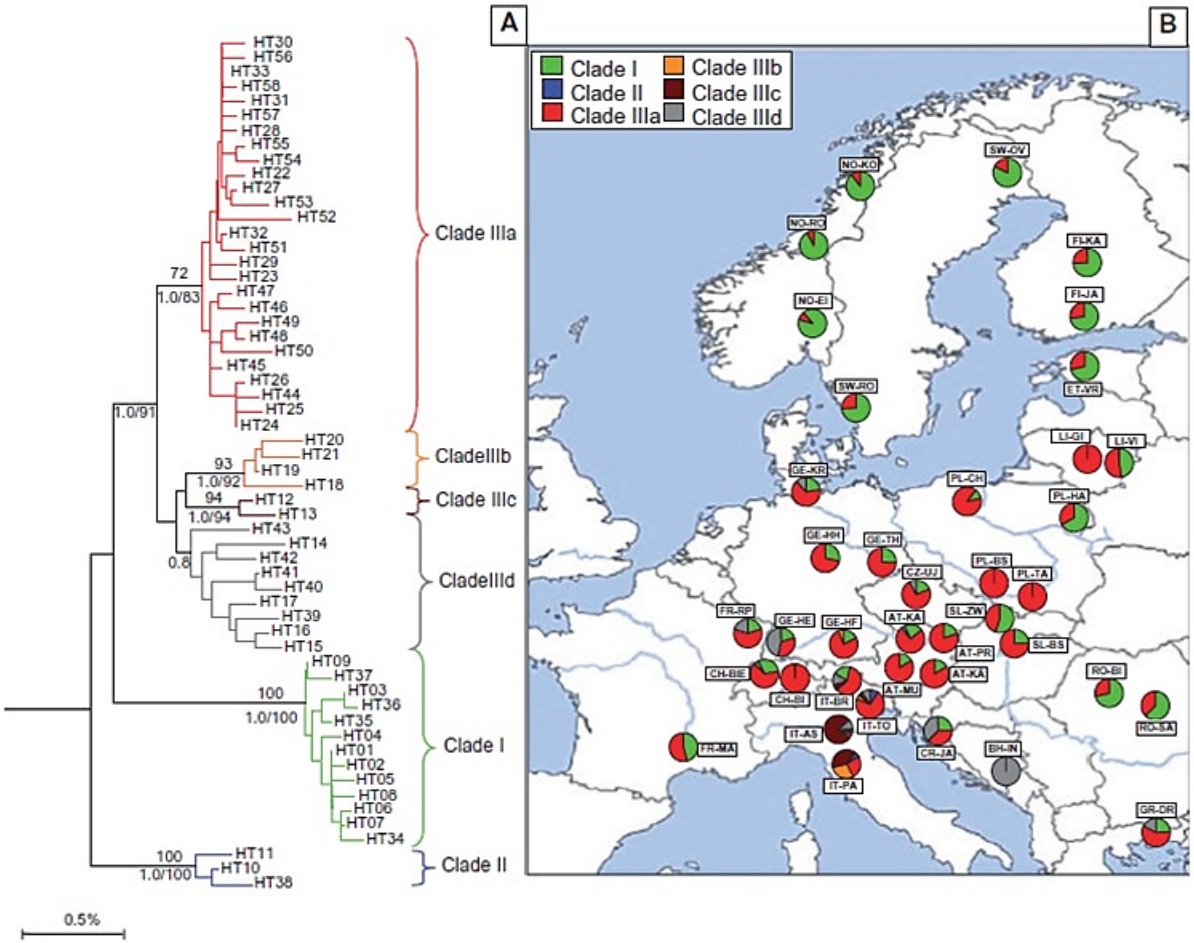


Figure 2. A, neighbour-joining tree of the haplotypes of *Pityogenes chalcographus* based on the Tamura & Nei (1993) model. *Pityogenes trepanatus* was taken as the outgroup. The bar represents a distance of 0.5%. Numbers on nodes represent support values and only those of peripheral nodes over 70% are shown. Neighbour-joining bootstrap values are given above nodes, whereas posterior probabilities and bootstrap values of Bayesian and maximum parsimony (MP) analysis are presented below nodes. B, geographic distribution of the haplotypes of the six clades detected by direct sequencing and single-strand conformation polymorphism (SSCP). Pie charts represent the distribution of the six clades per location (as listed in Table 1).

MOLECULAR ECOLOGY
Molecular Ecology (2013) 22, 3318–3332 doi: 10.1111/mec.12296

Divergent evolutionary histories of two sympatric spruce bark beetle species

CORALIE BERTHEAU,* HANNES SCHULER,* WOLFGANG ARTHOFER,† DIMITRIOS N. AVTZIS,‡ FRANÇOIS MAYER,§ SUSANNE KRUMBÖCK,* YOSHAN MOODLEY¶[1] and CHRISTIAN STAUFFER*[1]
*Department of Forest and Soil Sciences, Institute of Forest Entomology, Forest Pathology and Forest Protection, Boku, University of Natural Resources and Life Sciences, Vienna, Austria, †Molecular Ecology Group, University of Innsbruck, Innsbruck, Austria, ‡Forest Research Institute, NAGREF, Vasilika, Thessaloniki, Greece, §Lutte Biologique et Ecologie Spatiale, Université Libre de Bruxelles, Brussels, Belgium, ¶Department of Integrative Biology and Evolution, Konrad Lorenz Institute of Ethology, University of Veterinary Medicine, Vienna, Austria

Analyse der genetischen Diversität, Struktur und demographischer Entwicklung von 10 Populationen mittels mitochondrialer COI und nuklearer internal transcribed spacer-Verfahren (ITS)

- *I. typographus:*
  - geringe genet. Diversität
  - geringe Populationsstruktur
  - einzelne holozäne Populations-ausbreitung → exisitierende Haplogruppen

- *P. chalcographus:*
  - hohe genet. Diversität
  - hohe Populationsstruktur
  - längere und komplexere Evolutionsgeschichte

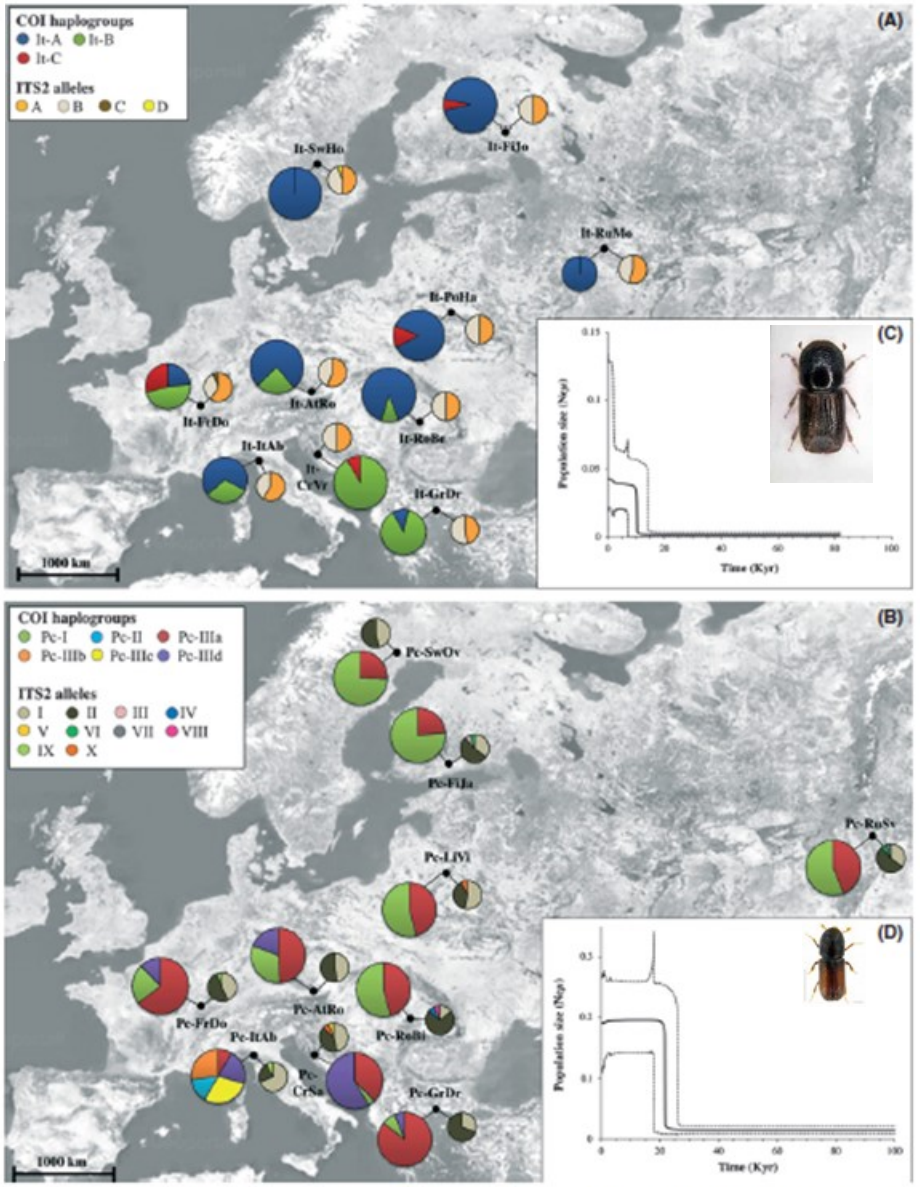


Fig. 1 Geographical distribution of mitochondrial haplogroups (COI) and nuclear alleles (ITS2) of two European spruce bark beetles. (A) Geographical mapping of the three COI haplogroups and the four ITS2 alleles detected in *Ips typographus* populations and (B) of the six haplogroups and ten ITS2 alleles detected in *Pityogenes chalcographus* populations. Population frequencies are approximated by the area of the circle. Haplotype and allele distributions are accompanied by Bayesian skyline plots showing changes in effective population size over evolutionary time. MtDNA COI sequences of the *I. typographus* (C) and *P. chalcographus* (D) were subjected to Bayesian skyline analysis using the software BEAST v. 1.6.1. The dashed lines correspond to the 95% confidence limits while the full lines correspond to the median value. Populations are abbreviated according to Table 1.

www.nature.com/scientificreports

SCIENTIFIC REPORTS

OPEN

Pleistocene climate cycling and host plant association shaped the demographic history of the bark beetle *Pityogenes chalcographus*

Received: 21 June 2018
Accepted: 12 September 2018
Published online: 21 September 2018

Martin Schebeck[1], Eddy J. Dowle[2,3], Hannes Schuler[4,5], Dimitrios N. Avtzis[6], Coralie Bertheau[7], Jeffrey L. Feder[4], Gregory J. Ragland[2] & Christian Stauffer[1]

Genomanalyse (Restriction site associated DNA (RAD) und Einzelnukleotid-Polymorphismus (SNP) von 16 Herkünften

- Identifizierung von 3 glazialer Refugien (italienisch-dinar., karpatische u. russische Region zusammen mit Wirtspflanze

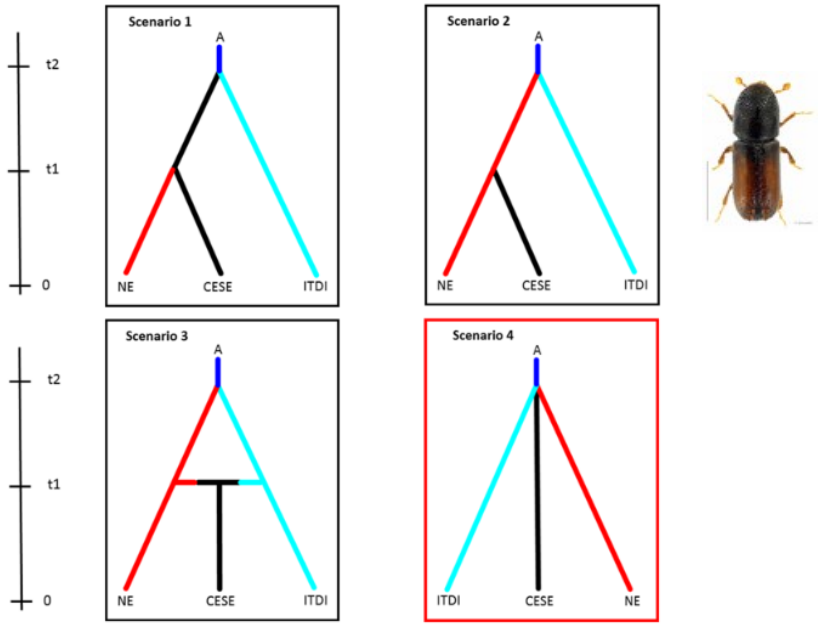


Figure 6. Evolutionary scenarios to describe the demographic history of *Pityogenes chalcographus* using approximate Bayesian computation (ABC) analysis on a reduced data set (712 loci). A (ancestral population), CESE (central/south-eastern sites), NE (north-eastern sites), ITDI (Italian-Dinaric sites). Scenario 4 was best supported (red frame). Posterior probability (PP) scenario 1 = 0.0076, 95% CI 0.0060–0.0092; PP scenario 2 = 0.0066, 95% CI 0.0052–0.0079; PP scenario 3 = 0.0012, 95% CI 0.0009–0.0014, PP scenario 4 = 0.9847, 95% CI 0.9821–0.9873.

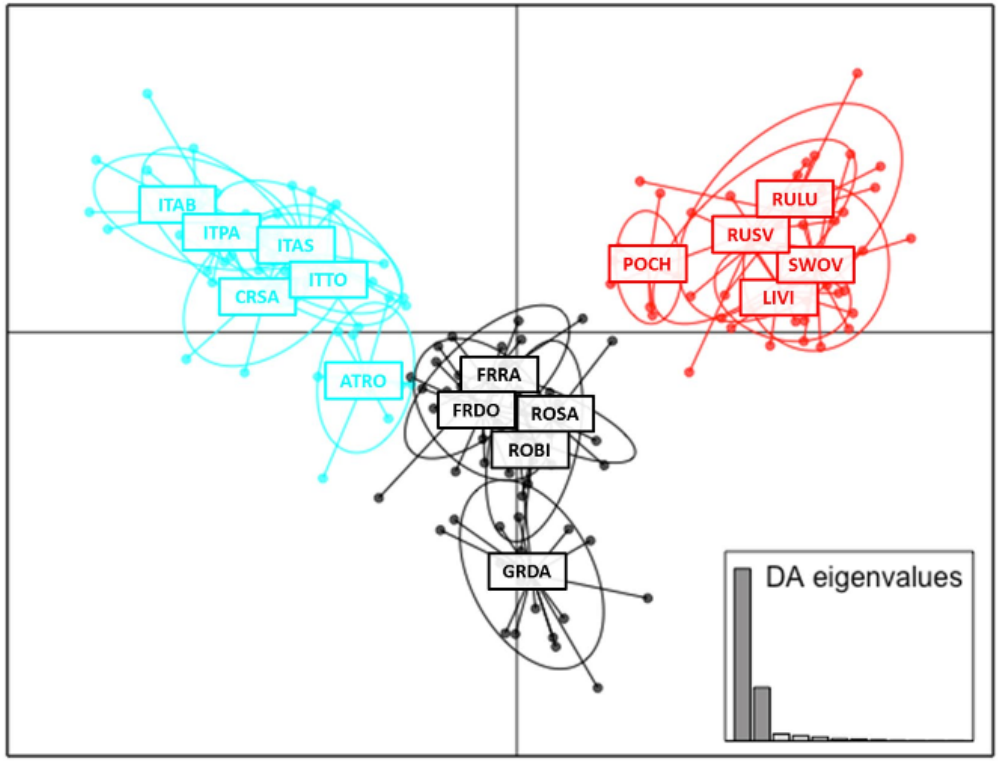


Figure 5. Grouping of *Pityogenes chalcographus* individuals across geography, using a Discriminant Analysis of Principal Components (DAPC) and called genotypes (5,470 loci analysed; abbreviations of geographic sites see Fig. 1). Blue: Italian-Dinaric group. Red: north-eastern group. Black: central/south-eastern group.

Journal of Insect Science, (2018) 18(3): 4; 1–6
doi: 10.1093/jisesa/iey044
Short Communication

OXFORD

Reproductive Manipulators in the Bark Beetle *Pityogenes chalcographus* (Coleoptera: Curculionidae)—The Role of *Cardinium*, *Rickettsia*, *Spiroplasma*, and *Wolbachia*

Martin Schebeck,[1,4] Lukas Feldkirchner,[1] Belen Marín,[1,2] Susanne Krumböck,[1] Hannes Schuler,[1,3,*] and Christian Stauffer[1,*]

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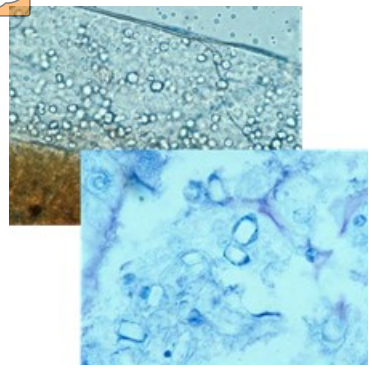
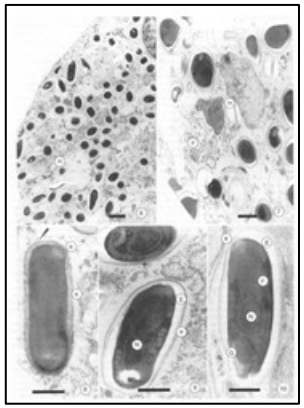
- *Wolbachia* ist selten vorkommend und als Inkompatibilitätsursache von *P. chalcographus* unwahrscheinlich
- die endoparasitischen Bakterien *Cardinium*, *Rickettsia*, and *Spiroplasma* sind ebenfalls sehr selten oder überhaupt nicht in *P. chalcographus* Populationen nachweisbar
- falls ein endoparasitischer Faktor für die Inkompatibilitätseffekte bei *P. chalcographus* vorhanden wäre, sollten unterschiedliche Infektionsraten in den europäischen Populationen vorkommen (s. Führer 1976, 1977)

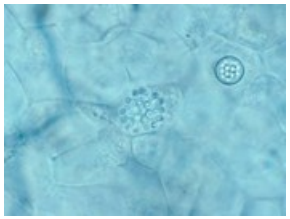
Führer, E. 1976. Fortpflanzungsphysiologische Unverträglichkeit beim Kupferstecher (*Pityogenes chalcographus* L.) – Ein neuer Ansatz zur Borkenkäferbekämpfung? Forstarchiv. 6: 114–117.
Führer, E. 1977. Studien über intraspezifische Inkompatibilität bei *Pityogenes chalcographus* L. (Col., Scolytidae). J. Appl. Entomol. 83: 286–297.



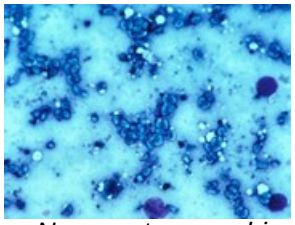
Entomopoxvirus



Canningia spinidentis

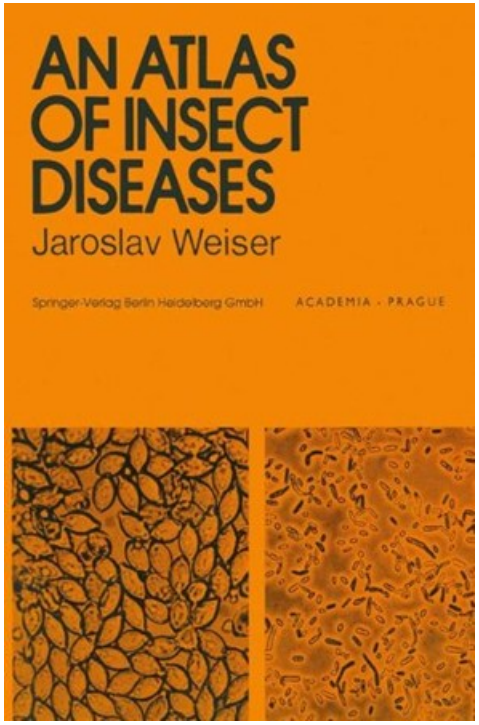


Chytridiopsis typographi



Nosema typographi

Prof. Dr. Jaroslav Weiser
(1920 – 2012)
Institut of Entomology,
Czech Academy Science,
Praha – Ceske Budejovice



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Acta Parasitologica

Flyer drucken

Band 61, Heft 3 ‹ Vorheriger Artikel Nächster Artikel ›

Occurrence of *Microsporidium* sp. and other pathogens in *Ips amitinus* (Coleoptera: Curculionidae)

Jaroslav Holuša / Karolina Lukášová / Zdenek Žižka / Uwe Händel / Bernhard Haidler / Rudolf Wegensteiner

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UDC 57:61
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ISSN 0031-5362

original research article

Infection, course of disease and effects of *Canningia tomici* in *Tomicus piniperda* and *Tomicus minor* (Coleoptera: Curculionidae)

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MILAN PERNEK[2]
UWE HAENDEL[1]
BERNHARD KOHLMAYR[3]
RUDOLF WEGENSTEINER[1]

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[2] Croatian Forest Research Institute, Cvjetno naselje 41, 41250 Jastrebarsko, Croatia.

[3] Leopoldine-Schlinger-Gasse 4/10, A-1020 Vienna, Austria.

Abstract

Background and purpose. *The pine shoot beetles* Tomicus piniperda *and* Tomicus minor *are secondary tree pests attacking weakened* Pinus sylvestris *and* Pinus nigra. *Outbreaks occasionally occur, causing considerable economic damage. The microsporidian pathogen* Canningia tomici *infects* T. piniperda *as its principal host. Bioassays were used to study the infectivity, vertical transmission, and effects on survival and fecundity of* C. tomici *on the two beetle species.*

Materials and methods. *Field collected beetles from several locations in Austria (Lower Austria, Burgenland and Styria), Finland (Hyytiälä), Poland (Sękocin), the Czech Republic (Stará Boleslav), and Croatia (Korenica) (3410* T. piniperda, *413* T. minor*) were dissected and evaluated for the presence of* C. tomici. *Uninfected beetles to be used for infection experiments were only*

Bulletin of Insectology **70** *(2): 291-297, 2017*
ISSN 1721-8861

Pathogens and nematodes associated to three bark beetle species of the genus *Orthotomicus* (Coleoptera Curculionidae) in central-south Europe

Jaroslav Holuša[1], Karolina Lukášová[1], Jolana Hubáčková[1], Miloš Knížek[2], Rudolf Wegensteiner[3]
[1]Czech University of Life Sciences Prague, Faculty of Forestry and Wood Sciences, Department of Forest Protection and Entomology, Prague, Czech Republic
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Journal of Invertebrate Pathology
Volume 143, February 2017, Pages 69-78

Metschnikowia cf. *typographi* and other pathogens from the bark beetle *Ips sexdentatus* – Prevalence, histological and ultrastructural evidence, and molecular characterization

Regina G. Kleespies [a], Young Woon Lim [b], Cezary Tkaczuk [c], Marta Wrzosek [d], Bernhardt M. Steinwender [e, f], Rudolf Wegensteiner [f]

Lesn. Cas. For. J. 62 (2016) 202–206
DOI: 10.1515/forj-2016-0025

Lesnícky časopis - Forestry Journal
http://www.nlcsk.sk/fj/

ORIGINAL PAPER

Extremely low infection levels of pathogens and nematodes in *Trypodendron* spp. (Coleoptera: Curculionidae)

Rudolf Wegensteiner[1], Karolina Lukášová[2]*, Hana Vanická[2], Soňa Zimová[2], Magdalena Kacprzyk[3], Jaroslav Holuša[2]

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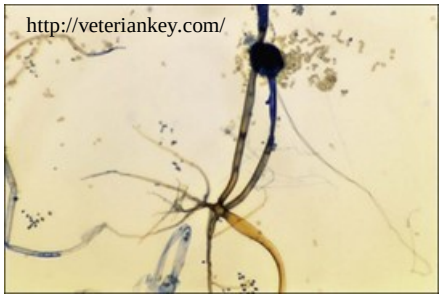
[3] University of Agriculture in Krakow, Faculty of Forestry, Al. 29 Listopada 46, 31 425 Cracow, Poland

Entomopathogene Pilze



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LVA-IFFF
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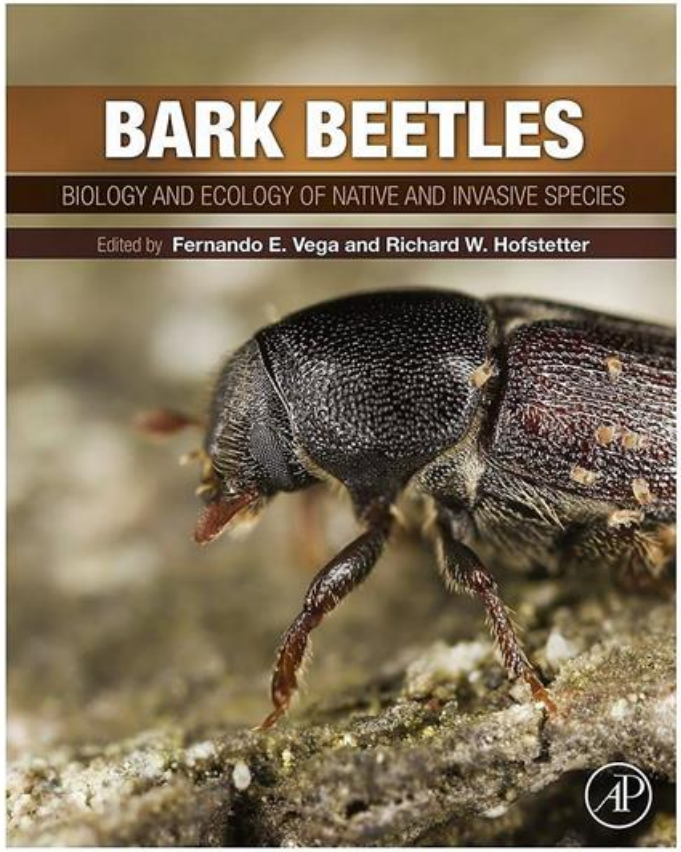
Siegfried Keller, Federal Research Station for Agroecology and Agriculture, CH-8046 Zürich, Switzerland

Cezary Tkaczuk, Univ. Podlasie, Dept Plant Protection, Siedlce (Poland); Rudolf Wegensteiner; Bernard Papierok, Pasteur Institute Paris



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In: F.E. Vega & R.W. Hofstetter, Bark Beetles: biology and ecology of native and invasive species, 247-304; Elsevier.

DE GRUYTER

Biologia 72/7: 807—813, 2017
Section Zoology
DOI: 10.1515/biolog-2017-0085

Occurrence of *Tomicobia seitneri* (Hymenoptera: Pteromalidae) and *Ropalophorus clavicornis* (Hymenoptera: Braconidae) in *Ips typographus* adults (Coleoptera: Curculionidae: Scolytinae) from Austria, Poland and France

Rudolf WEGENSTEINER[1], Cezary TKACZUK[2], Marc KENIS[3]* & Bernard PAPIEROK[4]

[1] *University of Natural Resources and Life Sciences, Gregor Mendel Str. 33, A-1180 Vienna, Austria; e-mail: rudolf.wegensteiner@boku.ac.at*
[2] *Siedlce University, Department of Plant Protection and Breeding, Prusa 14, 08-110 Siedlce, Poland; e-mail: tkaczuk@uph.edu.pl*
[3] *CABI, Rue des Grillons 1, CH-2800 Delémont, Switzerland; e-mail: m.kenis@cabi.org*
[4] *Institut Pasteur, 25 & 28, rue du Docteur Roux, 75015 Paris, France; e-mail: bernard.papierok@laposte.net*

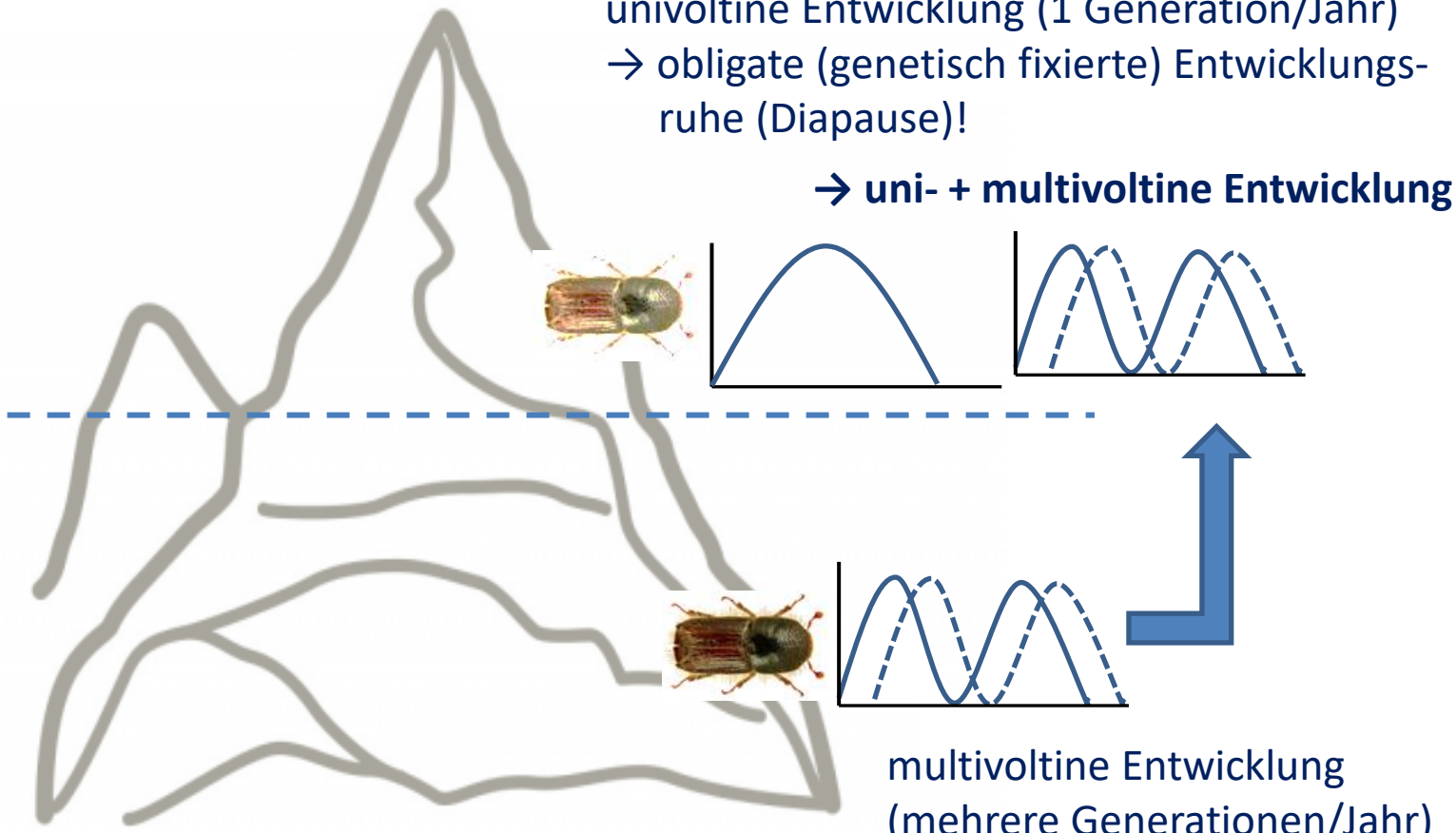
Diapause und Voltinismus des Buchdruckers: Ein genomischer Ansatz

Martin Schebeck, Nina Dobart, Gregory Ragland, Axel Schopf, Christian Stauffer

Forstschutz Aktuell 62 BFW.

univoltine Entwicklung (1 Generation/Jahr)
→ obligate (genetisch fixierte) Entwicklungs-ruhe (Diapause)!

→ uni- + multivoltine Entwicklung



multivoltine Entwicklung
(mehrere Generationen/Jahr)
→ fakultative Diapause!

Wie lassen sich multivoltine von univoltinen Individuen innerhalb einer Käferpopulation unterscheiden?

Welcher Anteil multivoltiner Individuen besteht in den Hochlagenpopulationen?

Multivoltine Individuen des Buchdruckers

kritische Tageslänge:

14.7 h Licht/Tag

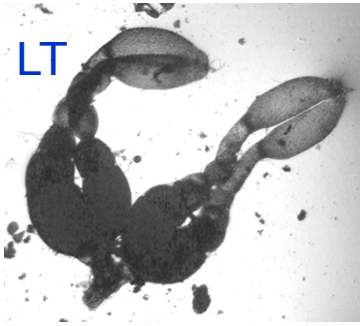
(Schopf (1985,1989); Dolezal et al., 2007)

Langtag (LT) Bedingungen:

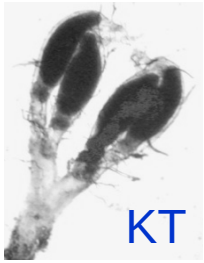
- Auschlüpfen der reifen Käfer
- Induktion der Gonadenentw.
- Reproduktionsaktivität

Kurztag (KT) Bedingungen:

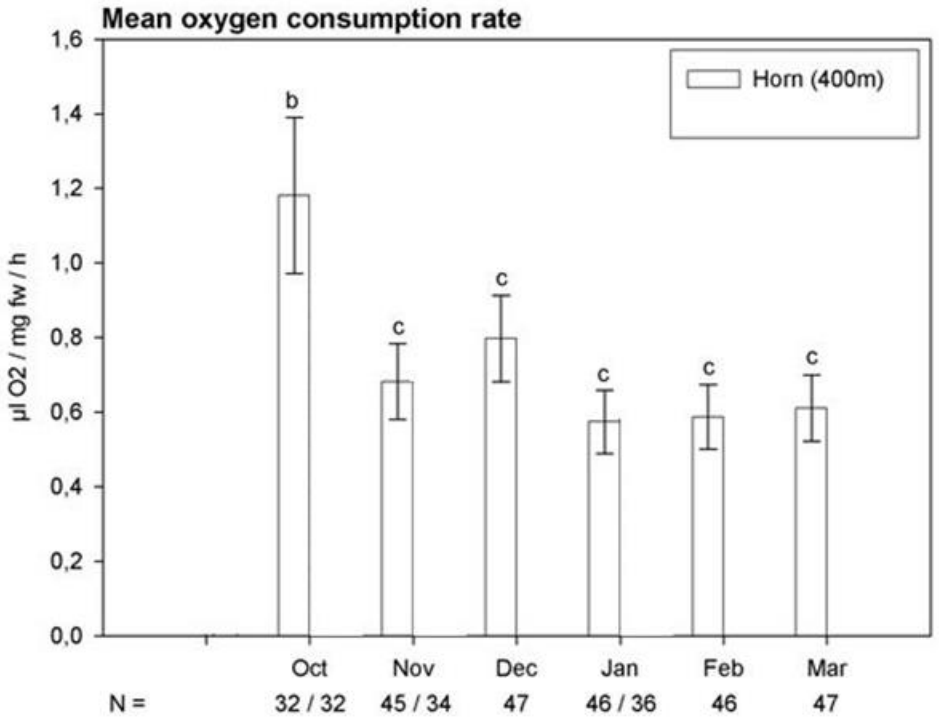
- Arretierung der Käfer im Stamm
- Induktion der Gonadendiapause
- keine Reproduktionsaktivität

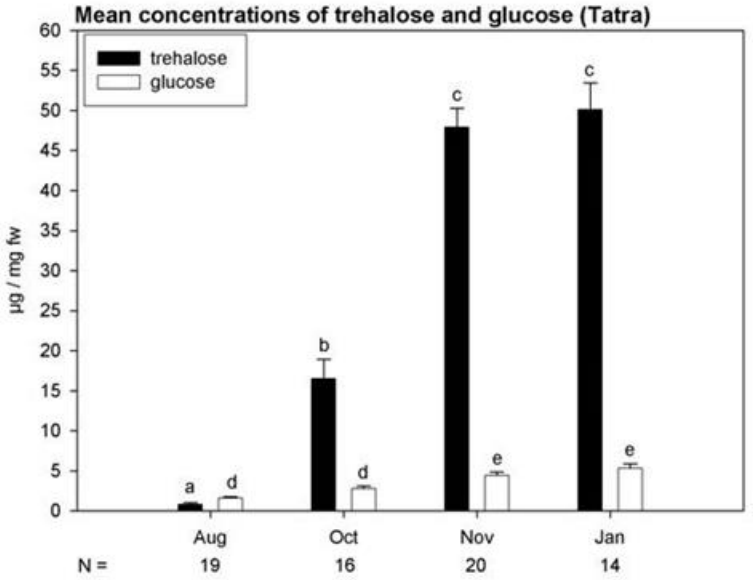


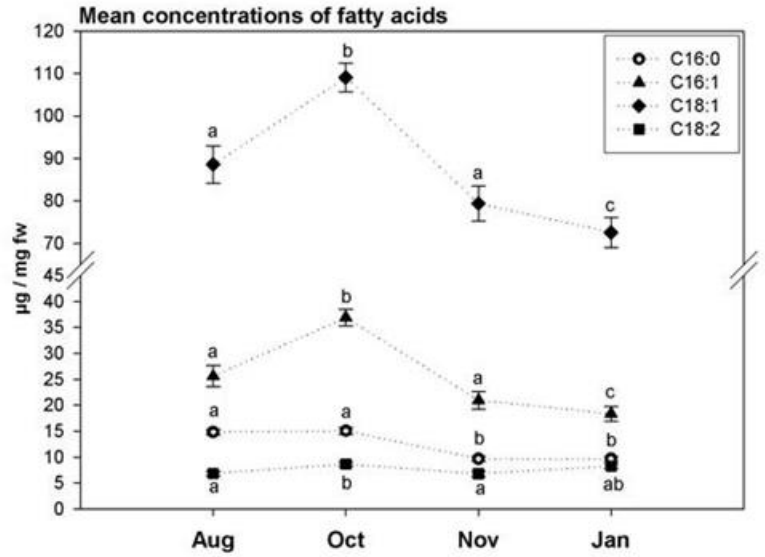
Weibliche Geschlechtsorgane des Buchdruckers;
links: ausgereift unter LT-Bedingung;
rechts: unreif bei KT-Bedingung



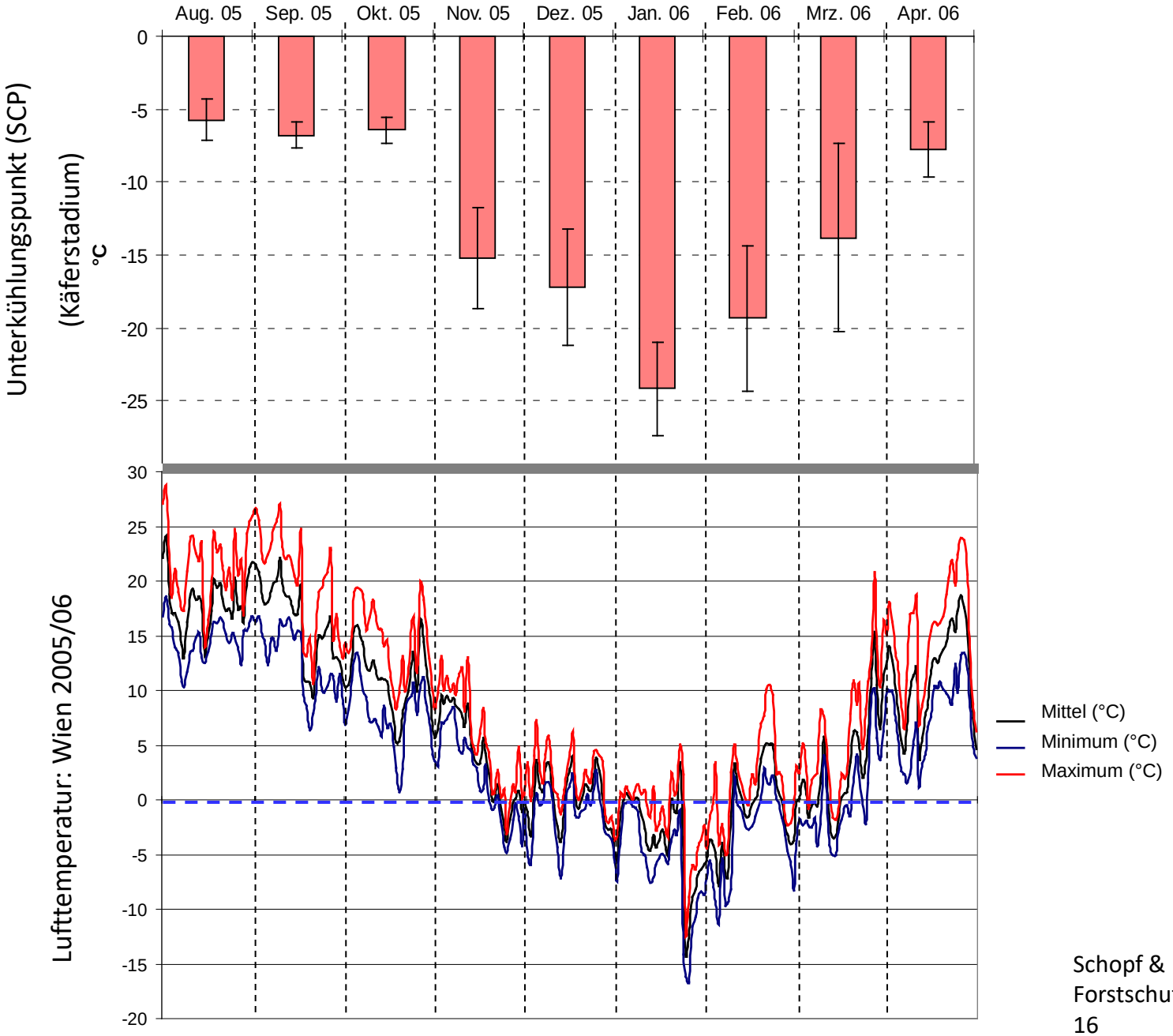
Physiologische Veränderungen bei überwinternden Käfern von *Ips typographus*





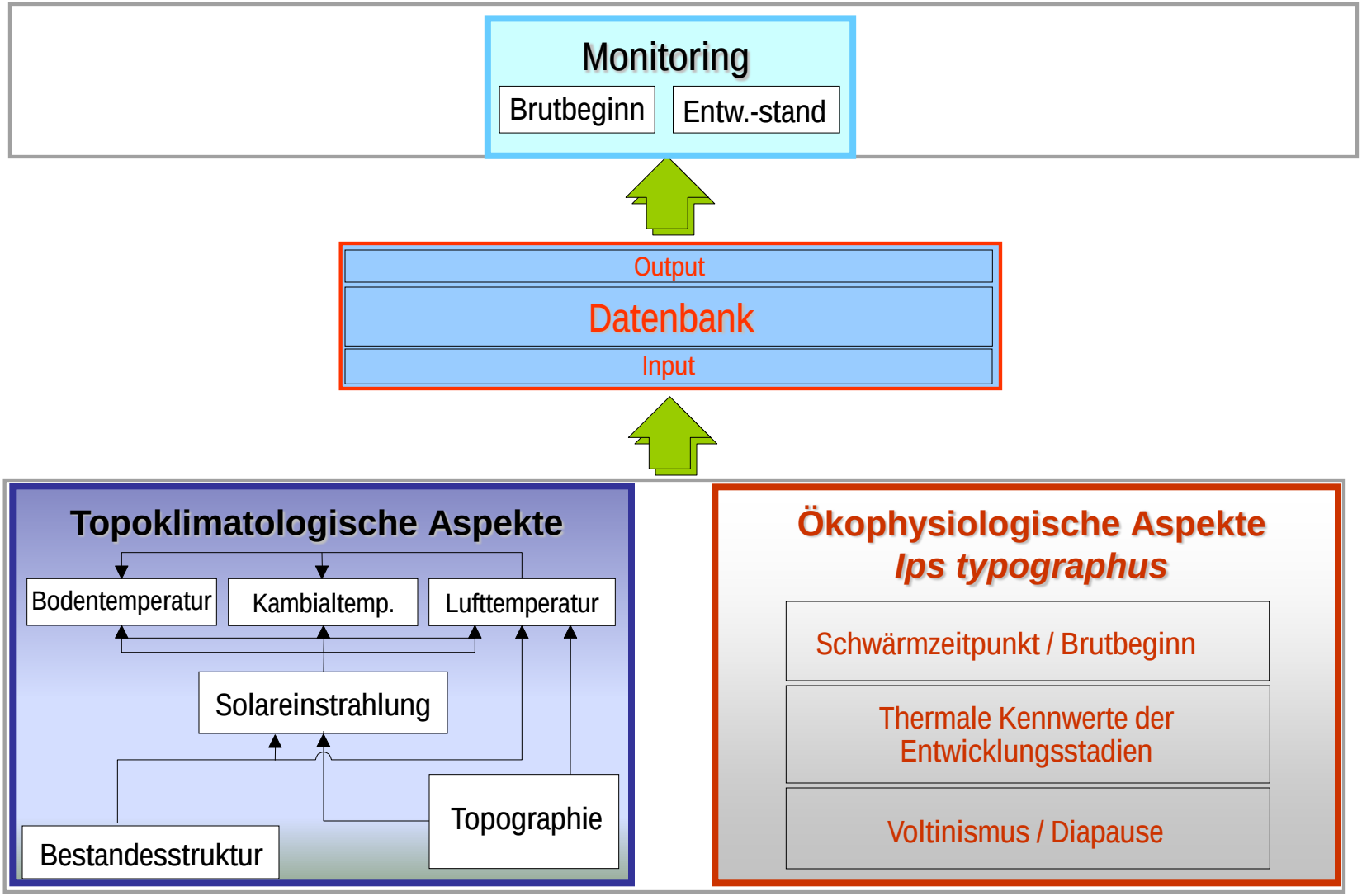


Physiologische Veränderungen bei überwinternden Käfern von *Ips typographus*

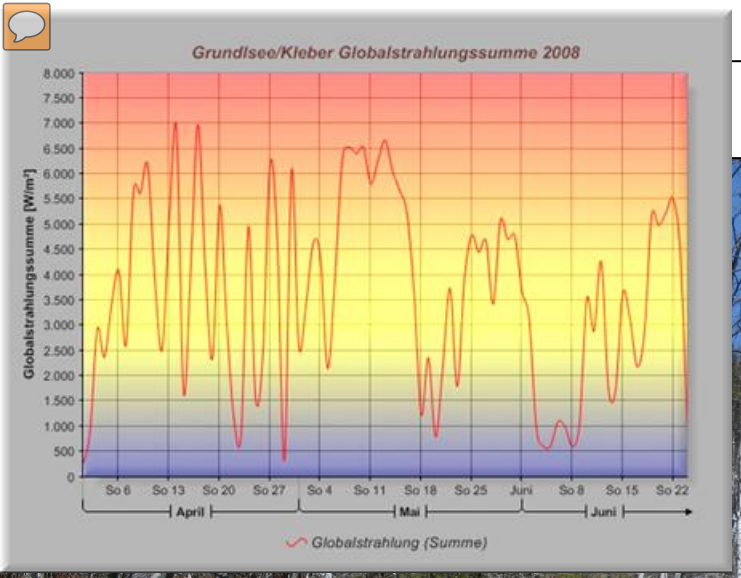


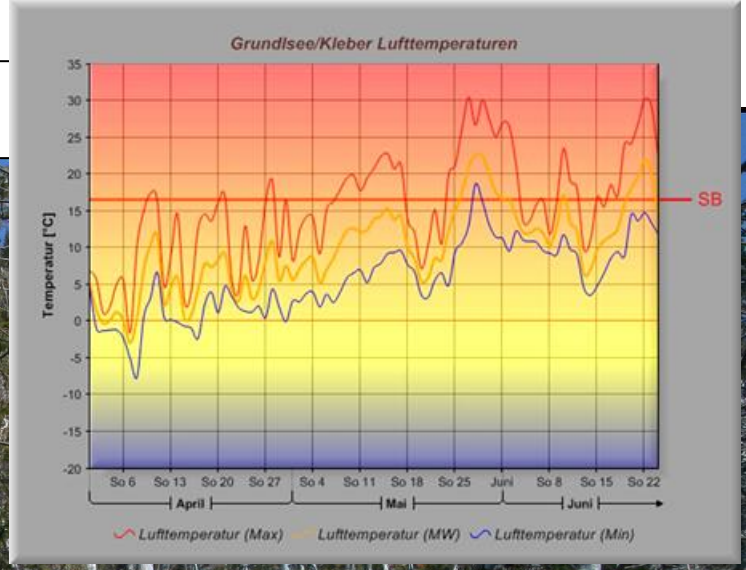
Schopf & Kritsch (2010): Forstschutz Aktuell, 50, 11-16

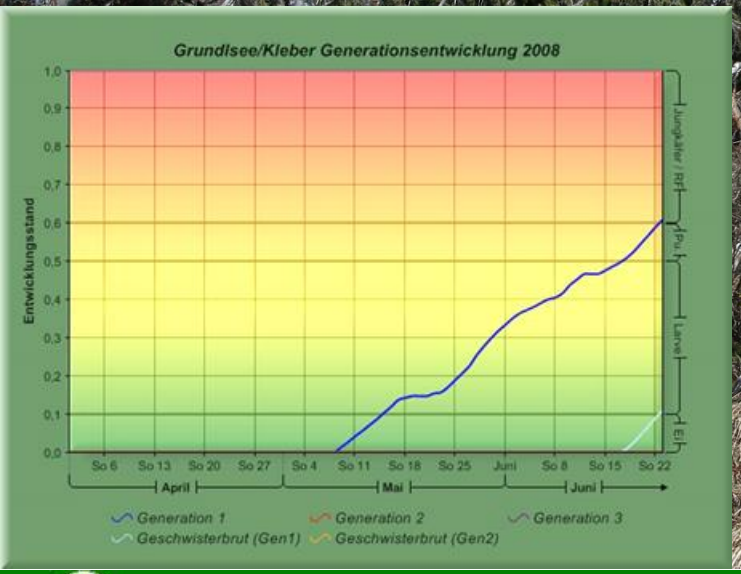
Monitoring der Entwicklung von *Ips typographus*

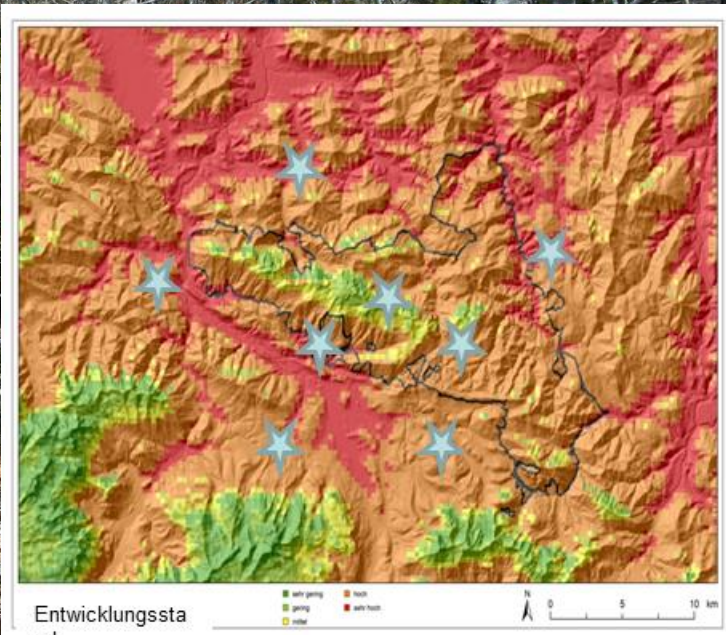


Monitoring


Grundlsee/Kleber Globalstrahlungssumme 2008
Globalstrahlungssumme [W/m²]
So 6 So 13 So 20 So 27 So 4 So 11 So 18 So 25 Juni So 8 So 15 So 22
April Mai Juni
Globalstrahlung (Summe)


Grundlsee/Kleber Lufttemperaturen
Temperatur [°C]
SB
So 6 So 13 So 20 So 27 So 4 So 11 So 18 So 25 Juni So 8 So 15 So 22
April Mai Juni
Lufttemperatur (Max) Lufttemperatur (MW) Lufttemperatur (Min)

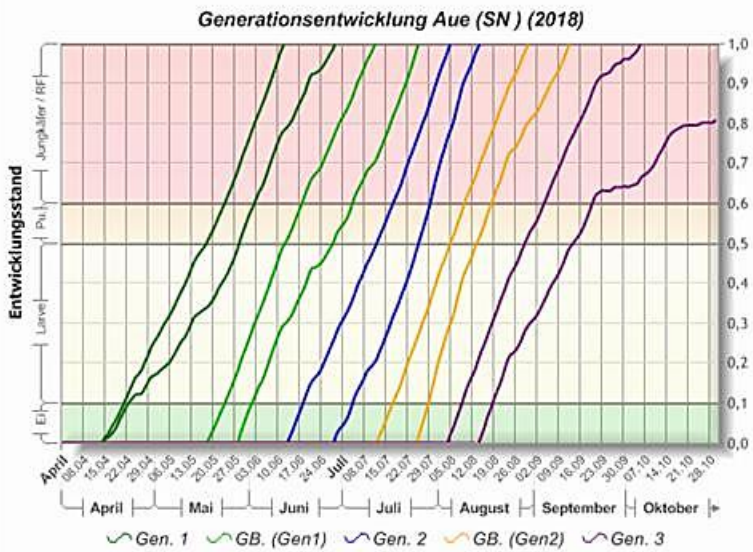

Grundlsee/Kleber Generationsentwicklung 2008
Entwicklungsstand
Jungkäfer / RF
Pu.
Larve
Ei
So 6 So 13 So 20 So 27 So 4 So 11 So 18 So 25 Juni So 8 So 15 So 22
April Mai Juni
Generation 1 Generation 2 Generation 3
Geschwisterbrut (Gen1) Geschwisterbrut (Gen2)


Entwicklungssta
nd

GENERATIONSENTWICKLUNG PHENIPS-SACHSEN (DWD)

Liniendiagramm

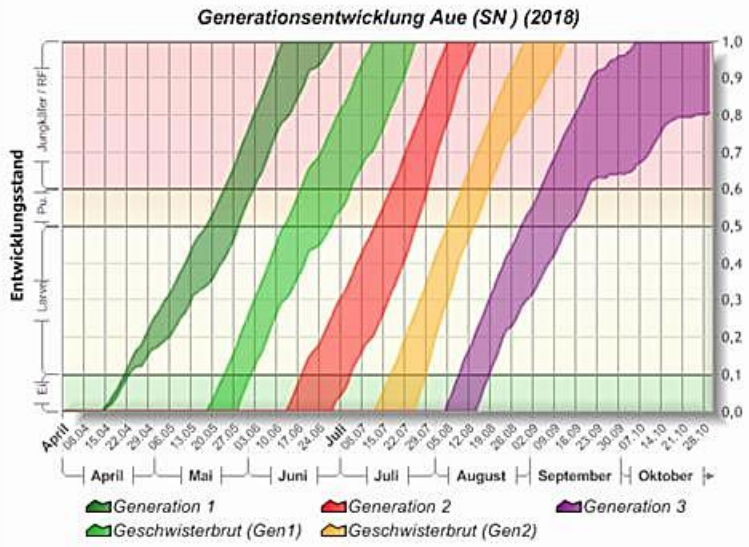
Klimastation: Aue (SN) Jahr: 2018 Set



gleichfarbige Linien repräsentieren den minimalen und maximalen Entwicklungsverlauf der jeweiligen Generation

Flächendiagramm

Klimastation: Aue (SN) Jahr: 2018 Set



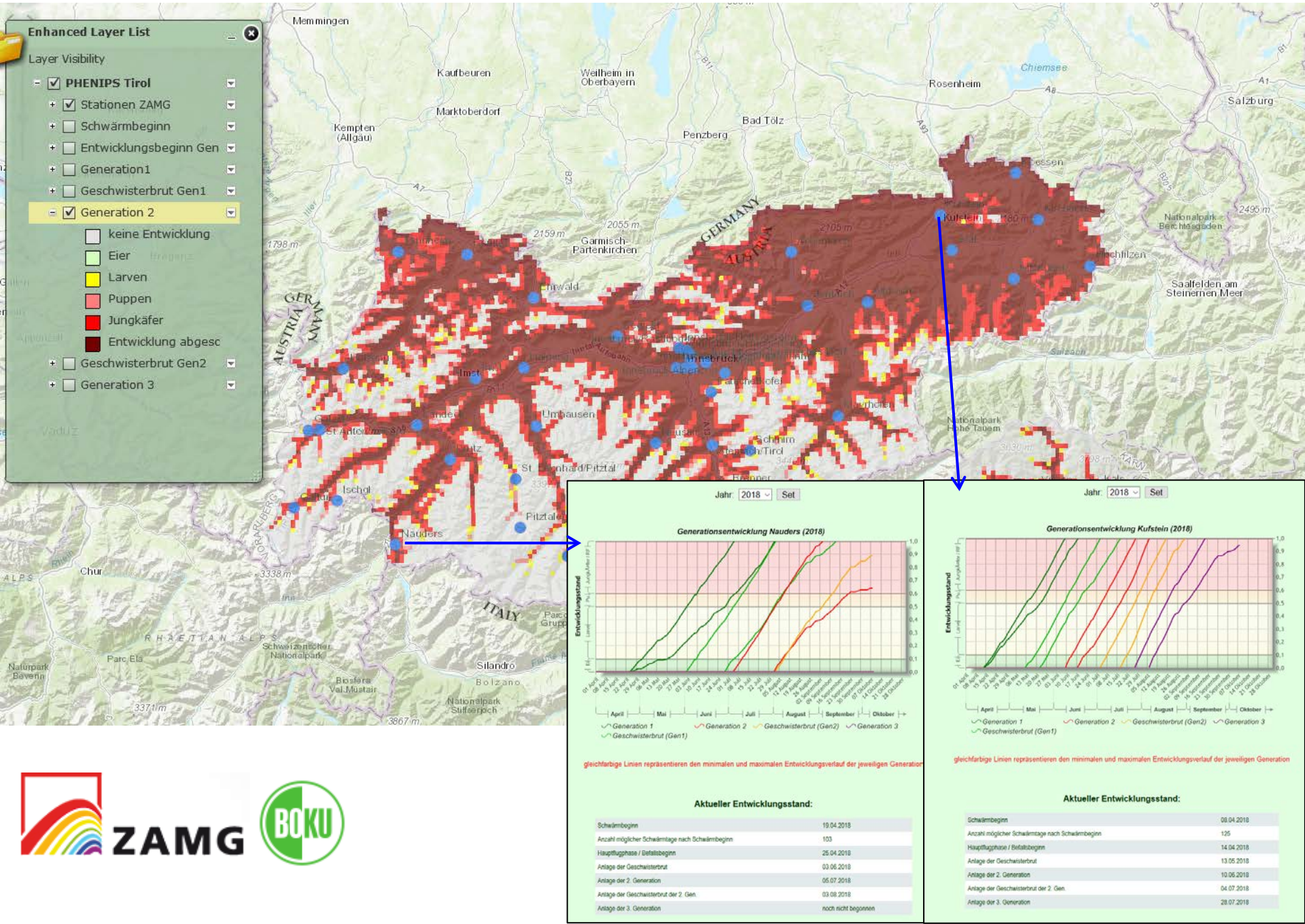
gleichfarbige Linien repräsentieren den minimalen und maximalen Entwicklungsverlauf der jeweiligen Generation

Aktueller Entwicklungsstand:

Schwärmbeginn	09.04.2018
Anzahl möglicher Schwärmtage nach Schwärmbeginn	122
Hauptflugphase / Befallsbeginn	15.04.2018
Anlage der Geschwisterbrut	19.05.2018
Anlage der 2. Generation	14.06.2018
Anlage der Geschwisterbrut der 2. Gen.	13.07.2018
Anlage der 3. Generation	05.08.2018

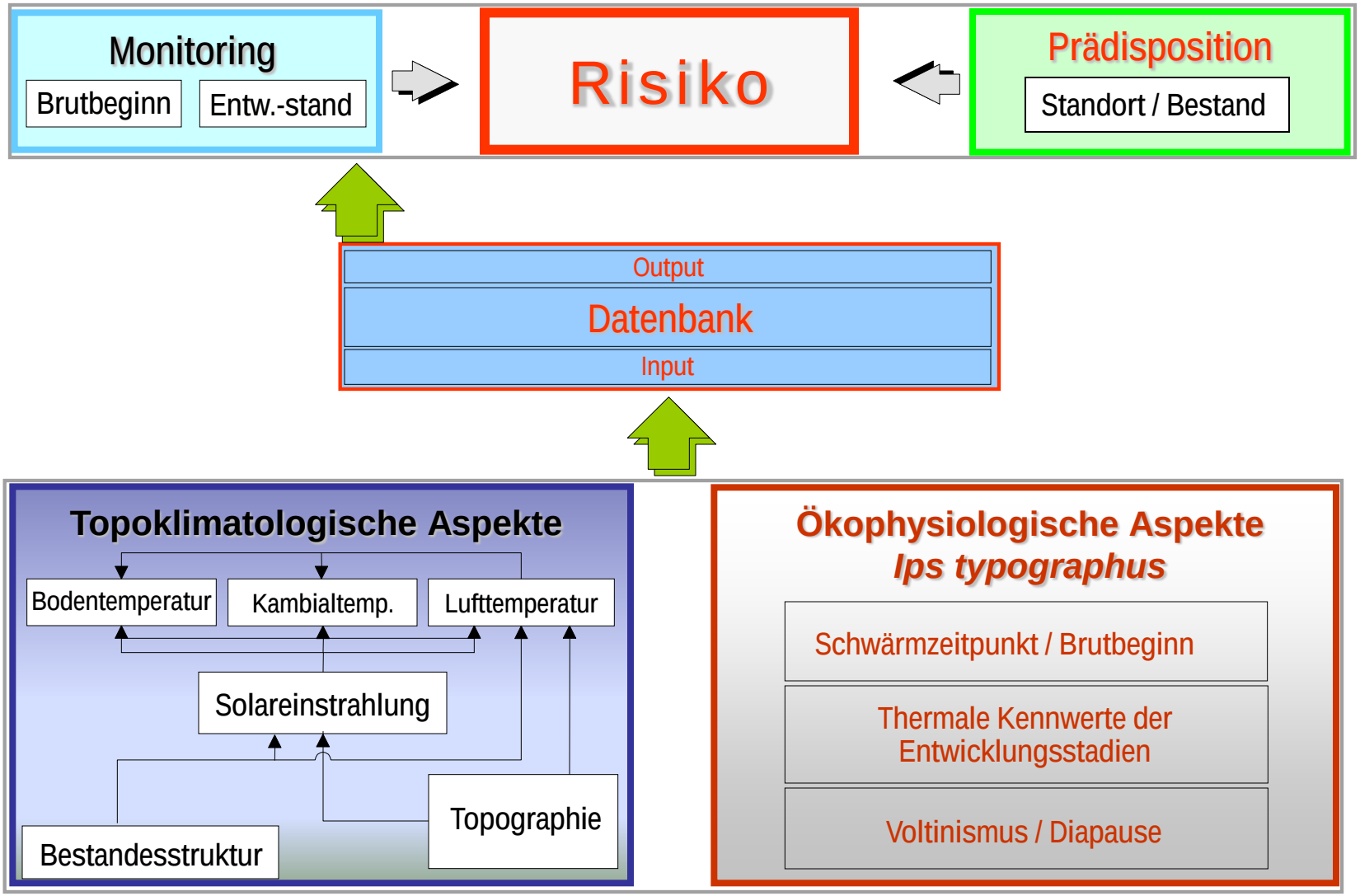
- PHENIPS – Sachsen
  - Agrarmeteorologische Stationen (DWD)
    - Generationsentwicklung
    - Klimadaten
      - Temperaturen
      - Globalstrahlung
      - Niederschlag
  - Waldklimastationen
    - Generationsentwicklung
    - Klimadaten
      - Temperaturen
      - Globalstrahlung
      - Niederschlag
- Regionalisierte Borkenkäferentwicklung

Prototyp INCA-Phenips-Modell



ZAMG BOKU

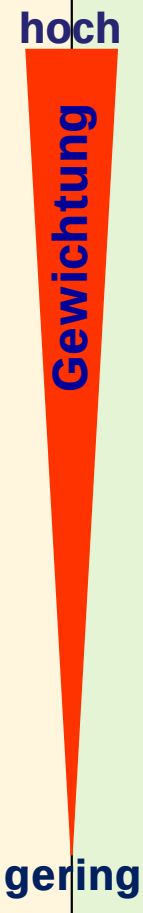
Risikoabschätzung von Borkenkäfer-Gradationen



Indikatoren der Prädisposition für Buchdruckerbefall

Standort

- potentielle Anzahl an Generationen
- Prädisposition ggü Sturm
- Wasserhaushalt
- Niederschlag
- Hanglage (Topologie)
- (Pseudo) Vergleyung
- Skelettgehalt / Gründigkeit
- Bonität
- Prädisposition ggü Schneebruch

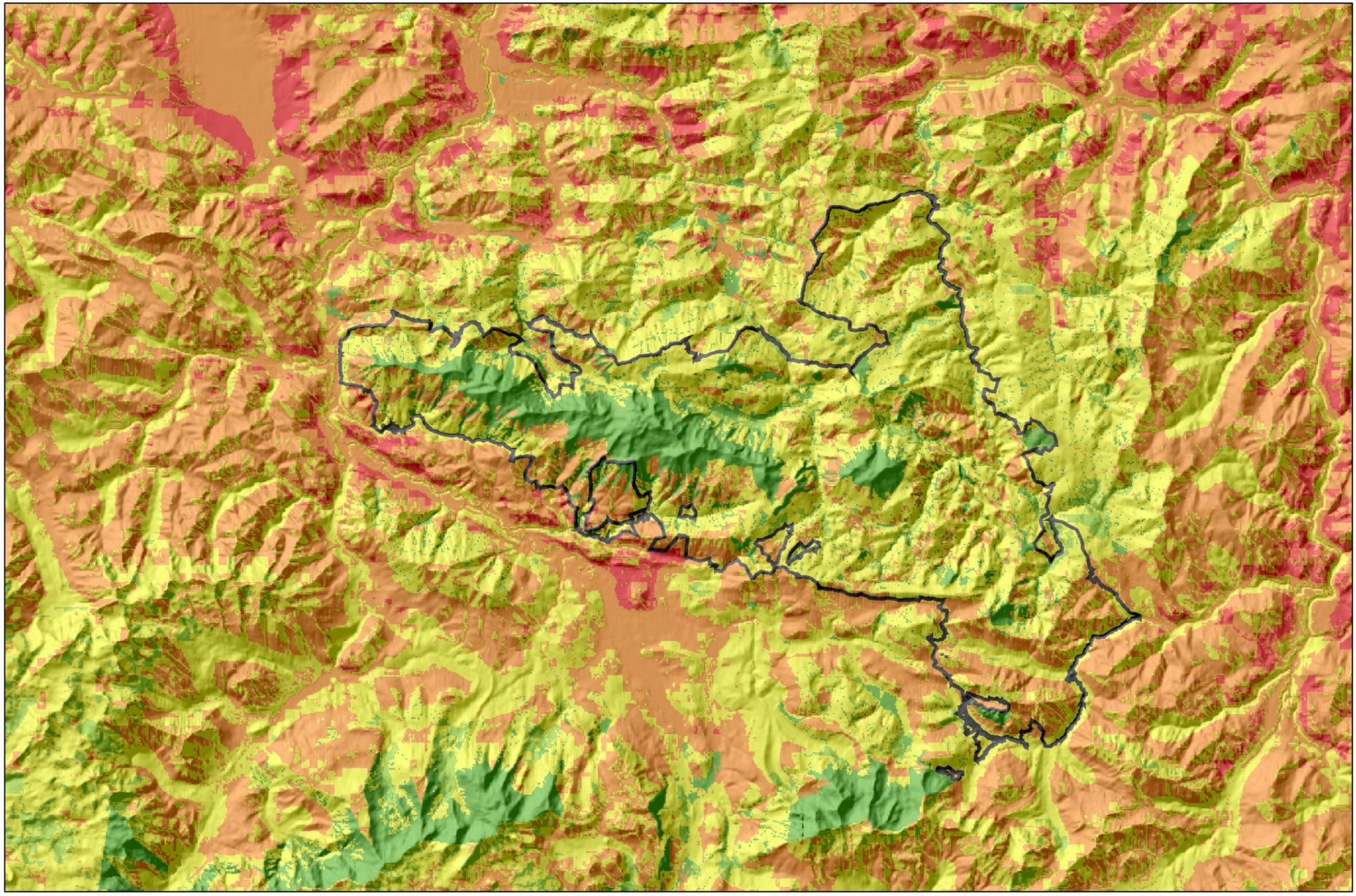


Bestand

- Fichtenanteil
- Bestandesalter
- Prädisposition ggü Sturm
- Anteil (vor)herrschender Baum-individuen
- Bestandesdichte
- Prädisposition ggü Schneebruch

Führer E., Nopp U. 2001: Ursachen, Vorbeugung und Sanierung von Waldschäden. Facultas-Univ. Verlag, Wien, 514 S.

NP Kalkalpen



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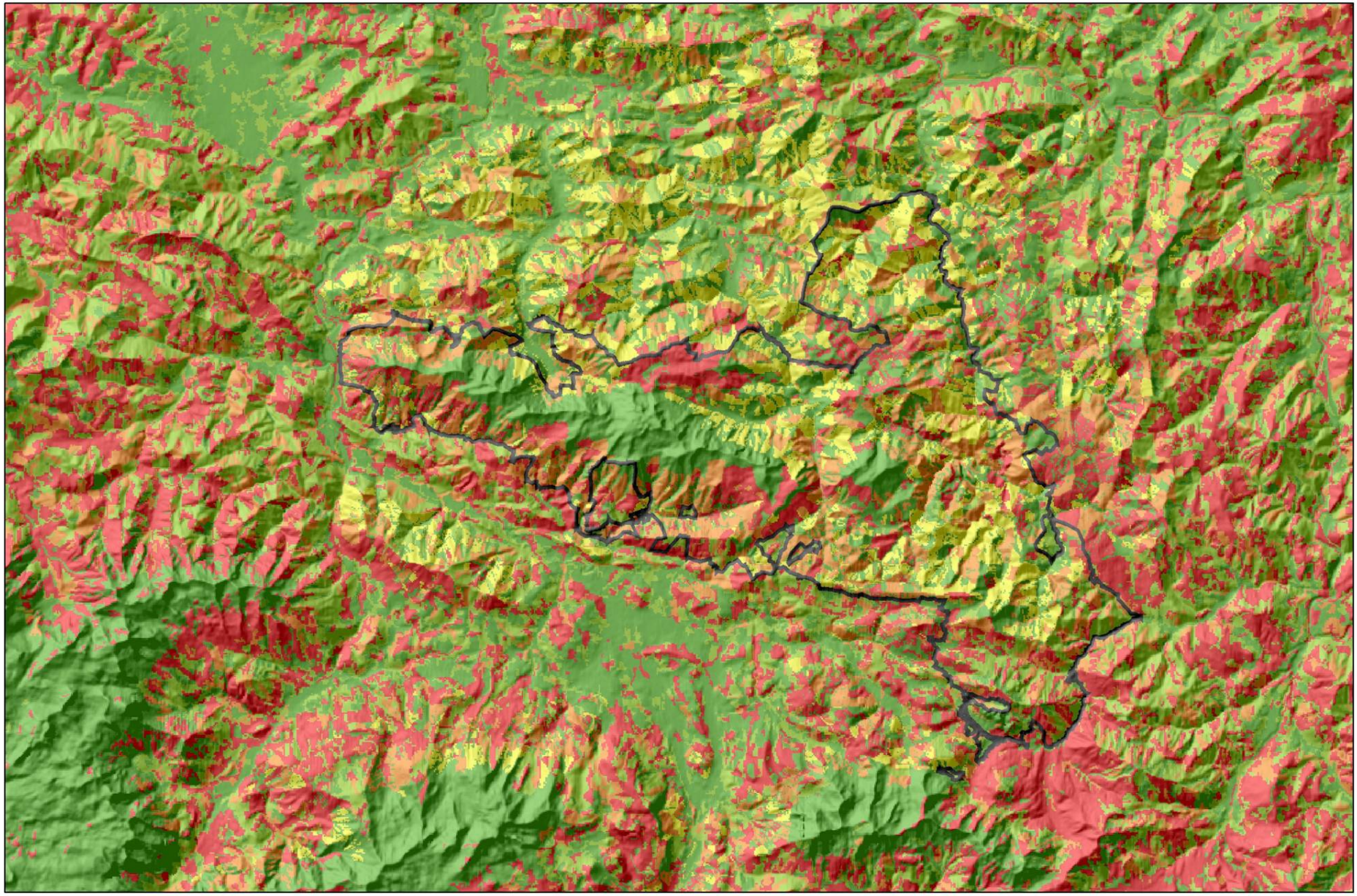
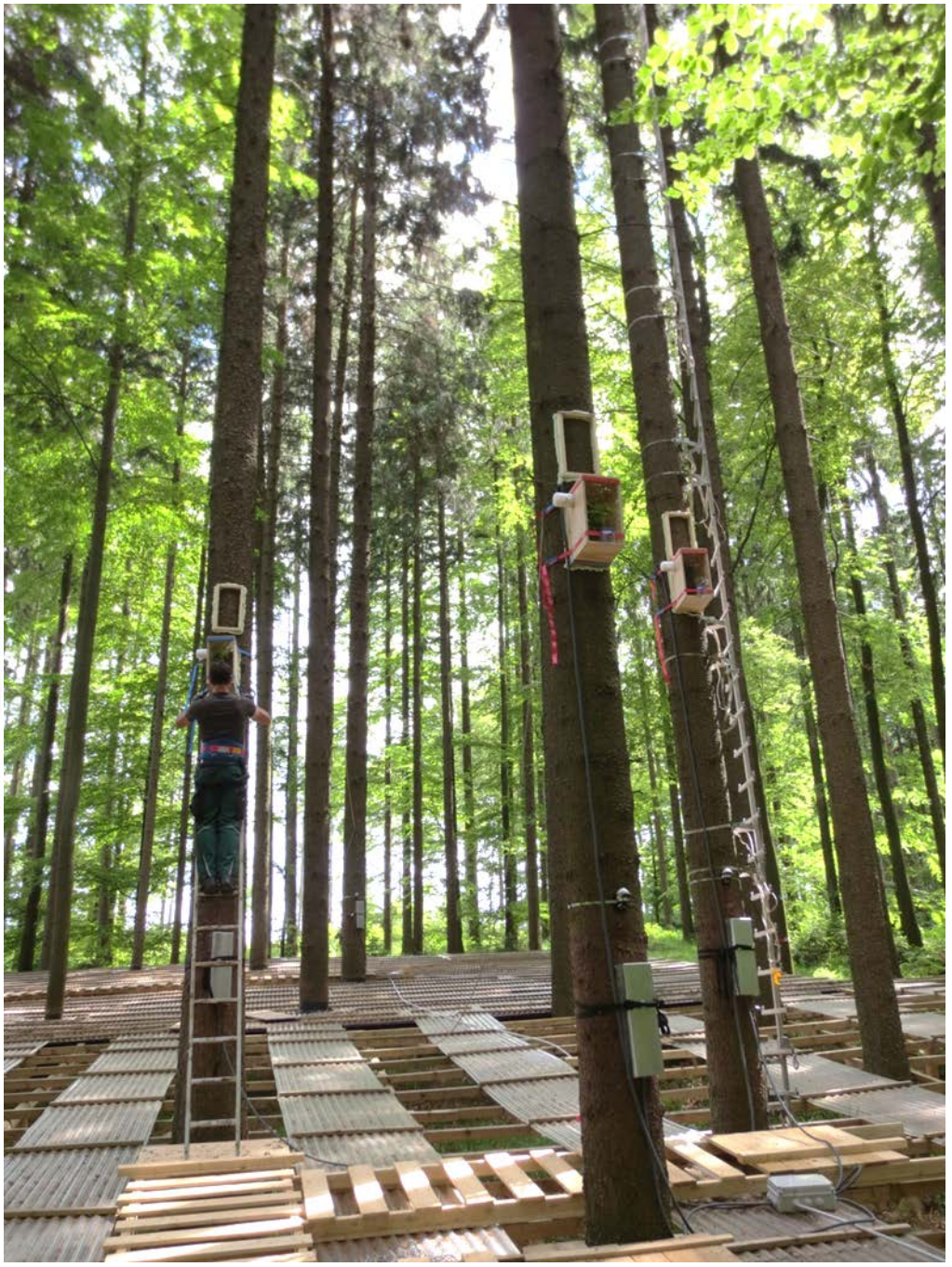


ROSALIA ROOF PROJECT

Trockenstress - Experiment

Modelling Dynamic Predisposition to Attacks by the Eurasian Spruce Bark Beetle *Ips typographus*

Attraktivität unterschiedlich wassergestresster Fichten für Buchdrucker (Einbohrverhalten)



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Do water-limiting conditions predispose Norway spruce to bark beetle attack?

Sigrid Netherer ✉, Bradley Matthews, Klaus Katzensteiner, Emma Blackwell, Patrick Henschke, Peter Hietz, Josef Pennerstorfer, Sabine Rosner, Silvia Kikuta, Helmut Schume, Axel Schopf

First published: 21 November 2014 Full publication history

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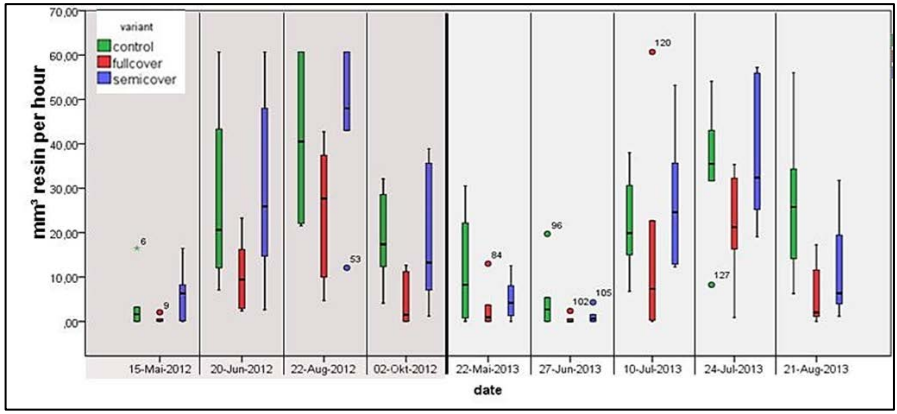

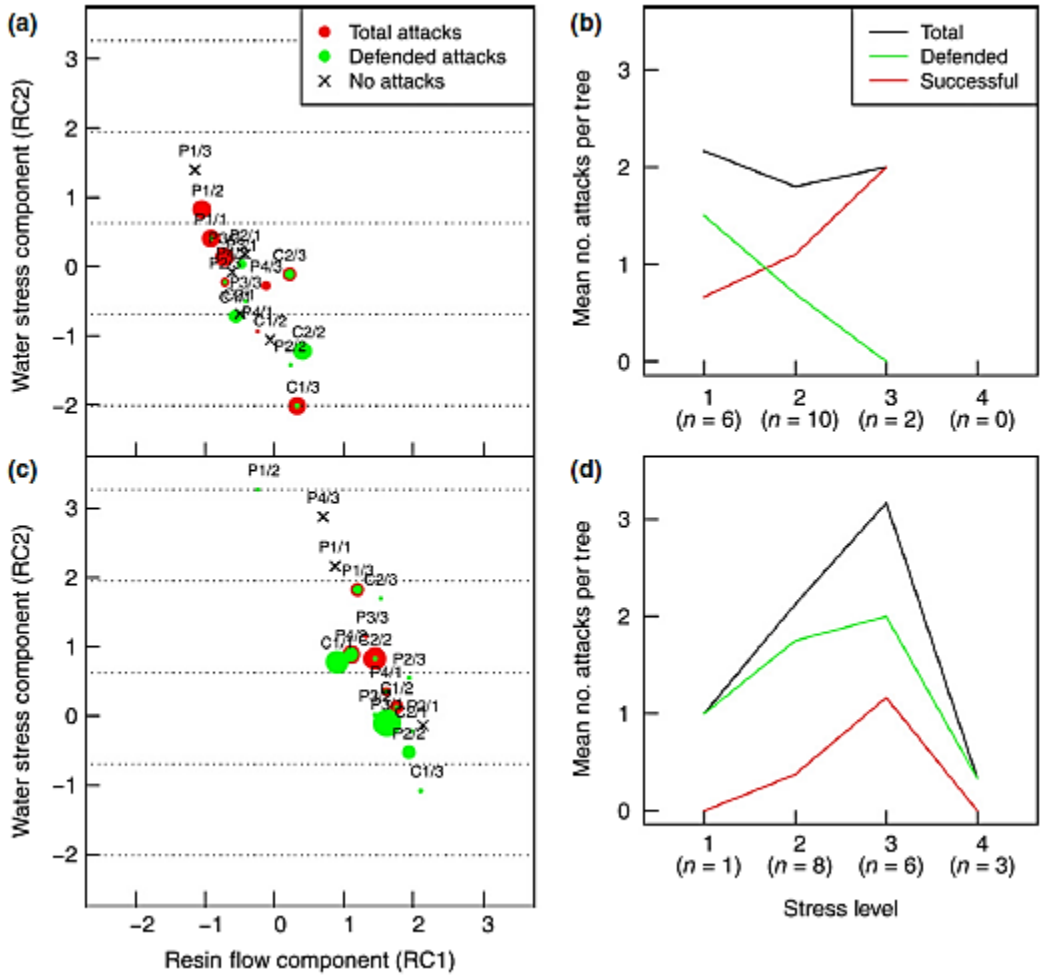

Fig. 7 Component scores of the individual Norway spruce (*Picea abies*) sample trees as calculated from a principal components analysis with subsequent component reduction and rotation plotted separately for period 1 (a) and period 3 (c). The sample trees are labelled with their code name, with the component scores marked by a cross, where no bark beetle (*Ips typographus*) attack was observed, or by a circle, if attack was recorded during the respective period. Red circles, total attacks; green circles, the proportion of attacks that were defended. The diameter of the circles corresponds to the respective numbers of attacks. Four water stress levels are delineated by horizontal dotted lines, with the mean number of total, successful and defended bark beetle attacks per stress level plotted on separate graphs for period 1 (b) and period 3 (d). Below the *x*-axis, the number (*n*) of sample trees per stress level is given in parentheses.

Modell-Framework

Freilanddaten

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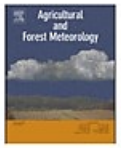

Transpiration deficits increase host susceptibility to bark beetle attack: Experimental observations and practical outcomes for *Ips typographus* hazard assessment

Bradley Matthews[a,*,1], Sigrid Netherer[b,1], Klaus Katzensteiner[a], Josef Pennerstorfer[b], Emma Blackwell[b], Patrick Henschke[c], Peter Hietz[c], Sabine Rosner[c], Per-Erik Jansson[d], Helmut Schume[a], Axel Schopf[b]

[a] Institute of Forest Ecology, Department of Forest- and Soil Sciences, University of Natural Resources and Life Sciences, Vienna (BOKU) Peter-Jordan-Straße. 82, 1190 Vienna, Austria
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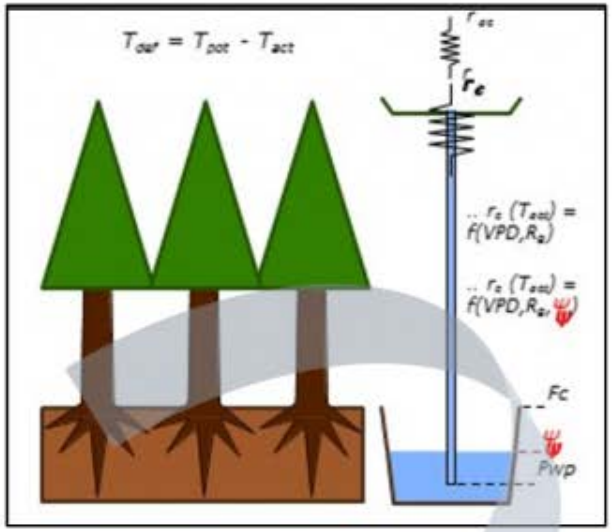
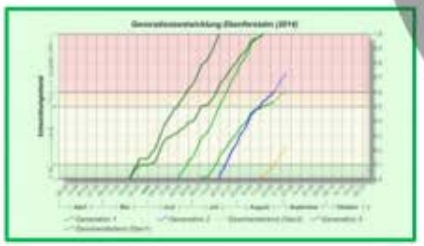
[d] Department of Land and Water Resources Engineering, Royal Institute of Technology (KTH), Brinellvägen 28, 100 44 Stockholm, Sweden



Wasserbilanz Modellierung

PHENIPS



PAS

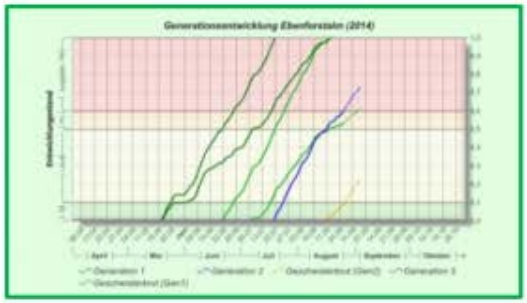
Standörtliche Wasserversorgung

Schwellenwerte für Befall

Trockenstress

Dynamic Assessment of Predisposition to *Ips typographus*

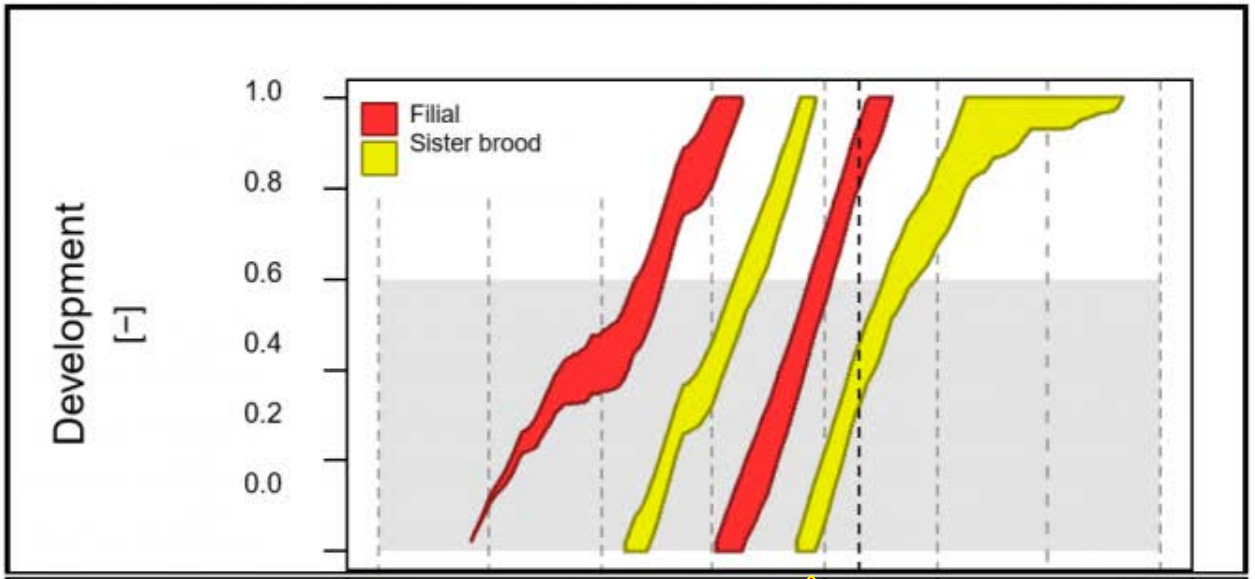
PHENIPS

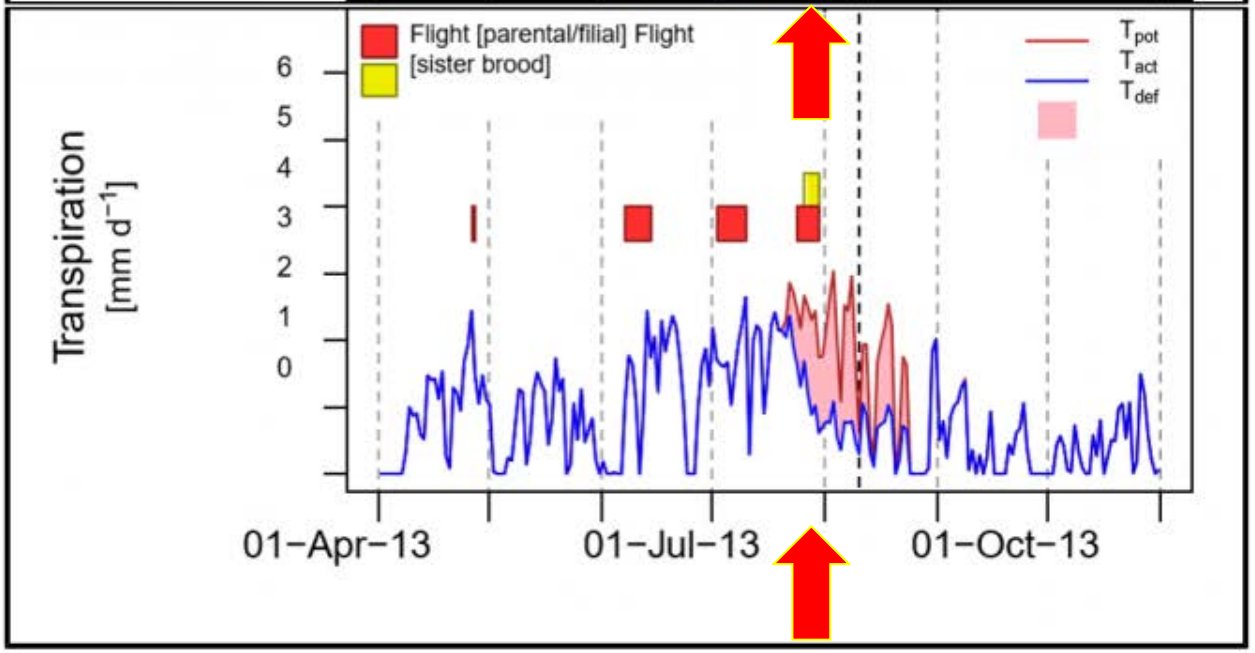
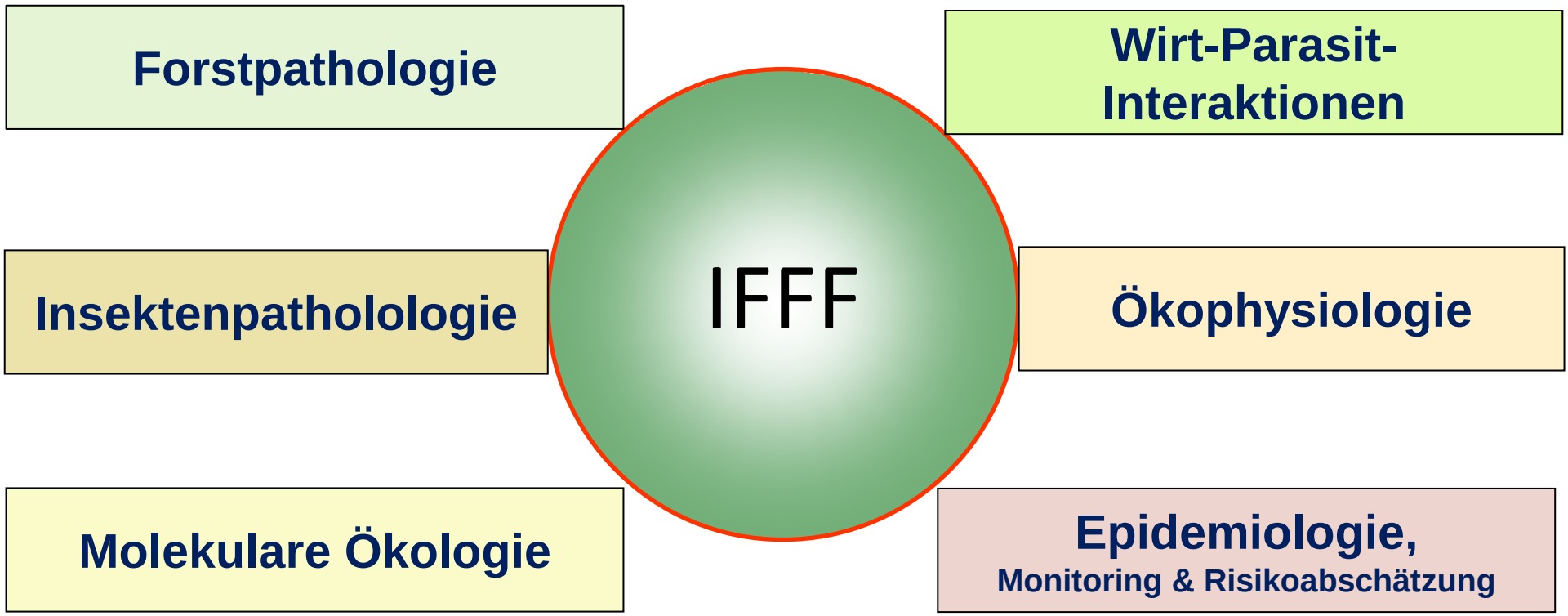


Standörtliche Wasserversorgung

Transpirations-Defizit

Bestand

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