Bait-lamina test

история, теория, практика

Е.Л.Воробейчик

ИЭРиЖ
ИНСТИТУТ ЭКОЛОГИИ РАСТЕНИЙ И ЖИВОТНЫХ

ЛАБОРАТОРИЯ ЭКОТОКСИКОЛОГИИ ПОПУЛЯЦИЙ И СООБЩЕСТВ
Laboratory of Population and Community Ecotoxicology

BLT: история

Pedobiologia **34**, 89–101 (1990)
VEB Gustav Fischer Verlag Jena

Assessing feeding activities of soil-living animals

I. Bait-lamina-tests

EKKEHARD VON TÖRNE

With 3 figures

АКАДЕМИЯ НАУК СССР
Б С КА
по естественным наукам

1. Prefatory note

Small, laminated baits were used to test feeding activity of soil-living animals. This method has been developed to enable everyone to monitor indefinite biotic (microbial and zootic) processes in the soil without time consuming and detailed investigations. Although approved methods for estimating decomposition rates (incl. feeding activity of soil invertebrates) are available (reviews resp. references eg in DUNGER & FIEDLER, 1989; HARRISON *et al.*, 1988; HEATH *et al.*, 1964, 1966; SEASTEDT, 1984; SZEGI, 1988) such a method is needed because a survey of spatio-temporal structuring of biogenic processes in soil areas is one of necessary premises on which a successful pedobiological sampling strategy and ecological analysis must be based.

The bait-test preliminarily described by TÖRNE (1989) is based upon visual assessment of feeding traces on small portions of thin laminated bait substrata exposed to edaphic processes in soil.

Nevertheless some procedures of the original bait-lamina-test, described in this paper, were changed and simplified in the meanwhile (TÖRNE, 1990; the following presentation of the method, problems and results may be of fundamental ecological interest.[1])

Some results (obtained from more than a thousand bait-lamina-tests) were selected to illustrate procedures and to demonstrate the suitability of such tests for screening undefined feeding activities of soil animals.

Selection of results followed a base-line of ecological problems, to which investigators of forest soils should have regard:

- changing vertical differences in biotic activities suggest a dynamic vertical stratification of soils (functional layers).
- the functional surface of plant-covered soils is dynamically impressed by changeable living conditions.
- edaphic processes are significantly influenced by plant-cover.
- due to grazing game, in open places the change of plant-cover follows changing humus-forms with a considerable delay of several years. This discrepancy causes a considerable variation of humus quality and edaphic processes under similar plant-cover.

2. Method, materials and sites

2.1. Methodology

Series of thin **bait-laminae** consisting of a mixture of pulverized substances and water (and supported by perforated plastic strips) were inserted into the soil (or individual soil layers) and thus exposed to animal feeding activity. After a given time of exposure (ranging from 4 to 120 h and depending as well on soil temperature and moisture as on intensity of animal feeding activity), positions and numbers of pierced bait-laminae on each strip were recorded. These data then furnished the parameters of estimating feeding activity in the litter and/or soil layers of interest.

[1]) More detailed and critical information on bait-tests and on the production of the necessary tools can be obtained from the author. Information will be available in German language and will be kept up to date, for 3 years, incorporating any future practical and theoretical experience obtained by the author.

2.2. Materials and preparation of strips

Narrow strips of thin PVC plates (6 mm × 150 mm × 0.5 mm thick), with a line of 16 perforations (1.8 mm diameter) down the centre, were used to support the baits (fig. 1). The end of the strip is hooked to engage on a knife used to insert the strips into the soil. The **bait substrate** (as used for below mentioned tests only!) was made upon a gravimetric basis of 83% sieved (100 µm mesh) chernozem soil with 5% gypsum (Plaster of Paris) as a binding agent, 5% powdered bran flakes, 4.7% powdered milk, 2% peptone (peptic blood peptone) and 0.3% mannitose. The materials were mixed dry and stored as a stock medium. For use a small quantity of the medium was mixed with water

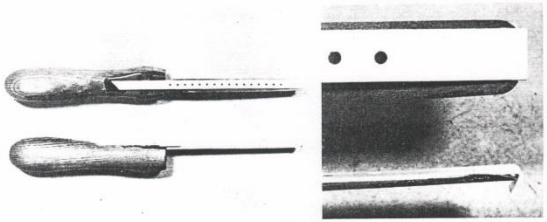

Fig. 1. Thin plastic support strips bearing a series of small holes. Perforations were furnished with threaded edges to hold the bait-laminae securely in place. The rabbeted end of the strips functioned as a catch for a special stiletto knife used to push the strips into the soil, so that the upper bait-laminae became exposed beneath the soil surface. The blade of the knife juts out to the same length as the under part of the perforated strips.

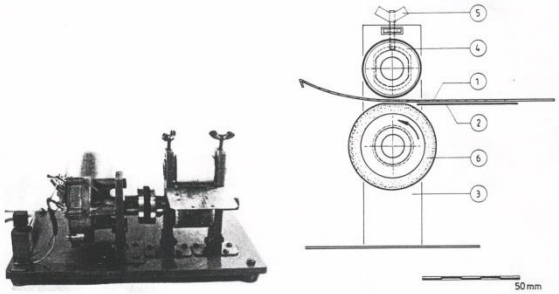

Fig. 2. Mangle-type roller for compressing bait-laminae by passing the strips between the rollers. Strips (1) must be inserted above the dish (2) with the rabbeted end uppermost. Details of construction: two cylindrical rollers are bedded one upon another in supports made of PVC (3). The upper roller (4) is made of unwettable PTFE, is spring-loaded and can be pressed down by tightening the wing-nuts (5). The lower roller (6) is covered by a gummy elastic layer, and can be continuously driven by a windshield-wiper-motor, connected by a flexible fixed clutch.

BLT: история

Ekkehard von Törne (1925–2017)

BLT: история

Braunschw. naturkdl. Schr. • 4 • Heft 3 • 647-651 • Braunschweig, Oktober 1994

Aus dem Zoologischen Institut der Technischen Universität Braunschweig
und dem Institut für Tierphysiologie der Freien Universität Berlin

Köderstreifen-Workshop in Braunschweig
— ein Resümee —*

Bait-lamina workshorp in Braunschweig
— a summing up —

Von

OTTO LARINK und WERNER KRATZ

Summary

The bait-lamina-test was introduced by v. TÖRNE in 1990. It is a tool to get quick informations about the biotic activity of soils and especially about the feeding activity of the mesofauna. There are only a dozen papers yet, but the interest in this new method is growing. Thus we organized a workshop to get more informations from users and to try a standardization of the application.

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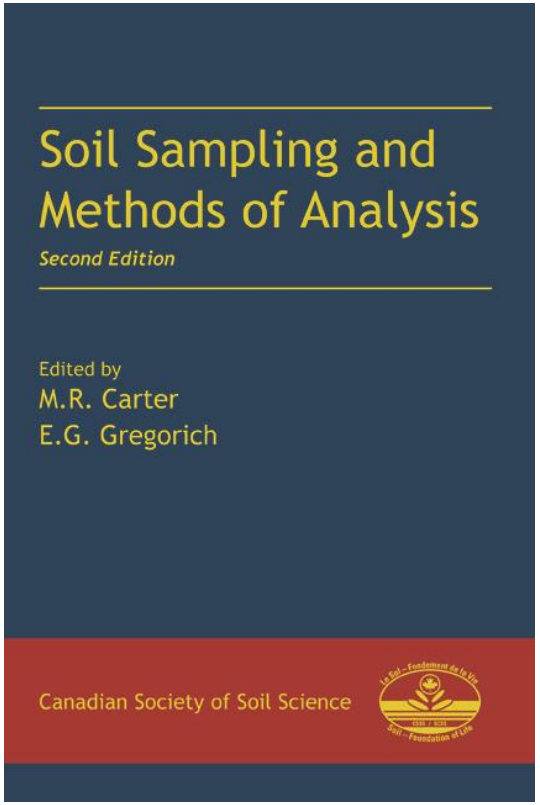

2008

Chapter 40
Assessment of Soil Biological Activity

R.P. Beyaert
Agriculture and Agri-Food Canada
London, Ontario, Canada

C.A. Fox
Agriculture and Agri-Food Canada
Harrow, Ontario, Canada

P. 527-545

40.3 BAIT-LAMINA PROCEDURE

Bait-lamina strips are used to monitor the overall feeding activity of soil organisms for accessing a carbon source introduced into the soil. Originally designed by von Törne (1990) and applied by others (Larink 1993; Kratz 1998), the bait-lamina strip consists of a thin strip of plastic (approximately 6 mm wide by 15 cm long) with a total of 16 drilled 2 mm diameter

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INTERNATIONAL STANDARD

ISO 18311

First edition
2016-01-15

Soil quality — Method for testing effects of soil contaminants on the feeding activity of soil dwelling organisms — Bait-lamina test

Reference number
ISO 18311:2016(E)

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2018

nature climate change

LETTERS

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Reduced feeding activity of soil detritivores under warmer and drier conditions

Madhav P. Thakur[1,2]*, Peter B. Reich[3,4], Sarah E. Hobbie[5], Artur Stefanski[3], Roy Rich[3], Karen E. Rice[3], William C. Eddy[6] and Nico Eisenhauer[1,2]

Anthropogenic warming is projected to trigger positive feedbacks to climate by enhancing carbon losses from the soil[1]. While such losses are, in part, due to increased decomposition of organic matter by invertebrate detritivores, it is unknown how detritivore feeding activity will change with warming[2], especially under drought conditions. Here, using four-year manipulation experiments in two North American boreal forests, we investigate how temperature (ambient, ambient + 1.7 °C and ambient + 3.4 °C) and rainfall (ambient and −40% of the summer precipitation) perturbations influence detritivore feeding activity. In contrast to general expectations[1,3], warming had negligible net effects on detritivore feeding activity at ambient precipitation. However, when combined with precipitation reductions, warming decreased feeding activity by −14%. Across all plots and dates, detritivore feeding activity was positively associated with bulk soil microbial respiration. These results suggest slower rates of decomposition of soil organic matter and thus reduced positive feedbacks to climate under anthropogenic climate change.

Furthermore, our understanding of soil detritivore acclimatization to warming is extremely limited as most of the evidence of their greater activity at higher temperature comes from short-term laboratory incubation studies[23,24], which may not be of sufficient duration to allow thermal acclimatization in detritivores. The second constraint involves potential resource limitation for ectothermic organisms in warmed conditions. Warming could reduce the activity of ectothermic detritivore organisms when warming increases resource or substrate depletion in soil[25–27], such as warming-induced reduction in soil water. In fact, climate warming seems to increase soil microbial activity only in soils with sufficiently moist conditions[1,28]. An increasing frequency of summer drought in terrestrial biomes[29] thus could also reduce the expected increase of detritivore feeding activity at higher temperatures, as demonstrated for soil microorganisms[28,30].

In this study, we report the feeding activity of soil detritivores in response to climate warming using a highly resolved temporal dataset (more than 40 time points) spanning across four years. Furthermore, we investigate the interactive effects of climate warm-

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the same for both lineage-specific traits; their Figure 1). Here, the lineage-specific trait can be any character a researcher suspects might affect the propensity for biogeographical dispersal.

The authors recognise that few phylogenetic data sets will be large enough to estimate the large numbers of parameters that matrices of this size define. This poses a challenge to the enterprise of combining biogeographical and lineage-specific traits, and the authors suggest several remedies. A computational approach they do not discuss is reversible-jump Markov chain Monte Carlo (RJ-MCMC). RJ-MCMC [2] can be used in the circumstance the authors describe automatically and correctly to reduce the number of parameters in the Markov transition matrix to the number that the data will support. Users need not constrain parameters *a priori*; RJ-MCMC methods converge on a properly defined Bayesian posterior solution automatically. Box 1 illustrates how RJ-MCMC would work for the case of *n* geographical areas and a lineage-specific trait with *k* states.

Elsewhere I have described the application of RJ-MCMC to the continuous-time Markov transition model Discrete [3,4], and we have used it in the setting of linguistic evolution to analyse an approximately 60 × 60 matrix of transition probabilities [5]. It is available in the BayesTraits software package (www.evolution.reading.ac.uk). Matzke [6] also uses RJ-MCMC in a biogeographical context.

3. Pagel, M. (1994) Detecting correlated evolution on phylogenies: a general method for the comparative analysis of discrete characters. *Proc. R. Soc. B* 255, 37–45
4. Pagel, M. and Meade, A. (2006) Bayesian analysis of correlated evolution of discrete characters by reversible-jump Markov chain Monte Carlo. *Am. Nat.* 167, 808–825
5. Hruschka, D. *et al.* (2015) Detecting regular sound changes in linguistics as events of concerted evolution. *Curr. Biol.* 25, 1–9
6. Matzke, N.J. (2014) Model selection in historical biogeography reveals that founder-event speciation is a crucial process in island clades. *Syst. Biol.* 63, 951–970

Forum

The Dark Side of Animal Phenology

Nico Eisenhauer,[1,2,5,*] Sylvie Herrmann,[3,1,5] Jes Hines,[1,2] François Buscot,[3,1] Julia Siebert,[1,2] and Madhav P. Thakur[4]

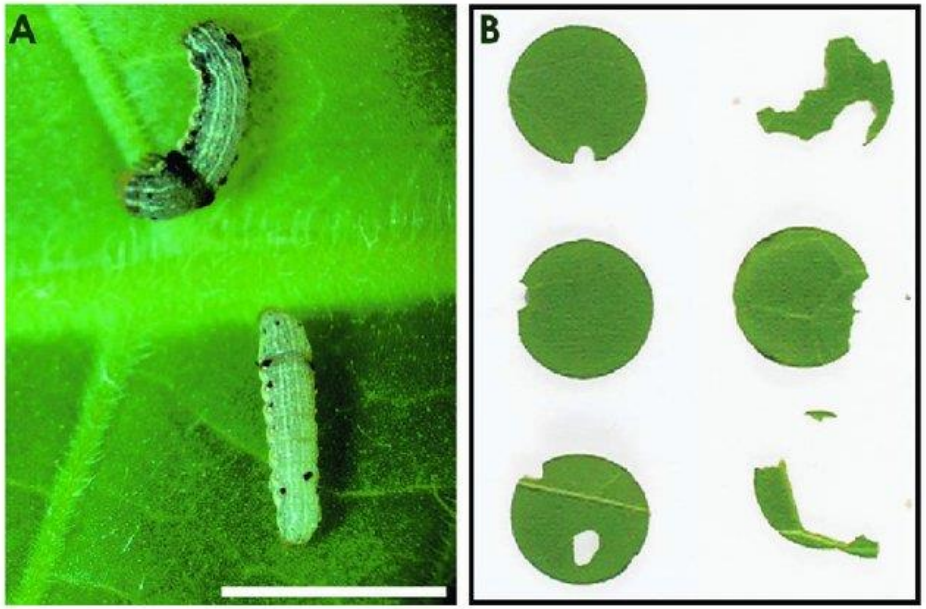
Research exploring the timing of recurring biological events has shown that anthropogenic climate change dramatically alters the phenology of many plants and animals. However, we still lack studies on how climate change might alter the phenology of soil invertebrates as well as how this can subsequently affect ecosystem functions.

Climate Change, Phenological Shifts, and Ecosystem Consequences

the local community [2], and how global changes alter the temporal dynamics of both factors. For instance, plant growth often peaks in spring, but the onset of activity by particular species can be advanced or delayed by changes in local environmental conditions [2]. Strong phenological shifts of key organisms are bound to alter the biotic interactions that drive ecosystem functions like resource uptake and production of biomass. For example, reduced temporal synchrony between consumer and resource species, when a resource species tracks the seasonal shifts and consumers do not, can lead to demographic changes, species extinctions, and altered ecosystem productivity [3]. Two recent global syntheses on phenological shifts in plants (reviewed in [4]) and animals (meta-analysis in [5]) confirmed that climate variables, namely temperature and precipitation, which determine the seasonality in a given region, are central to driving phenological shifts in species. Presumably due to their inaccessibility, soil invertebrate animals (soil animals hereafter) have rarely been incorporated into phenological research [5] despite of their sensitivity to both temperature and precipitation [6], and their crucial roles in driving multiple ecosystem functions [6–8]. Here, we highlight the importance of studying the phenology of soil animals for improving our understanding of global change impacts on ecosystem functioning in terrestrial environments.

The 'Black Box' of Soil Animal Phenology

BLT: предыстория



Leaf disc choice test

Ogita S., Uefuji H., Morimoto M., Sano H. Metabolic engineering of caffeine production // Plant Biotechnol. 2005. V. 22. P. 461-468.

BLT: предыстория

МИКРОБИОЛОГИЯ

Т. XXX 1961 Вып. 4

ОПРЕДЕЛЕНИЕ БИОЛОГИЧЕСКОЙ АКТИВНОСТИ ПОЧВЫ РАЗЛИЧНЫМИ МЕТОДАМИ

И. С. Востров и А. Н. Петрова

Принцип данного приема исследования, в основе которого лежат ранее применявшиеся рядом исследователей приемы закладки целлюлозы в почву, был доложен в 1959 г. на одном из заседаний III комиссии Всесоюзного общества почвоведов. Он опубликован в 1961 г. в журнале «Микробиология». В дальнейшем изложении данный прием исследования мы будем называть «методом аппликации».

К сожалению, в появившейся публикации сотрудников Почвенного института (Рыбалкина и Кононенко, 1961) не отмечается авторства данного метода, предложенного Востровым и Петровой.

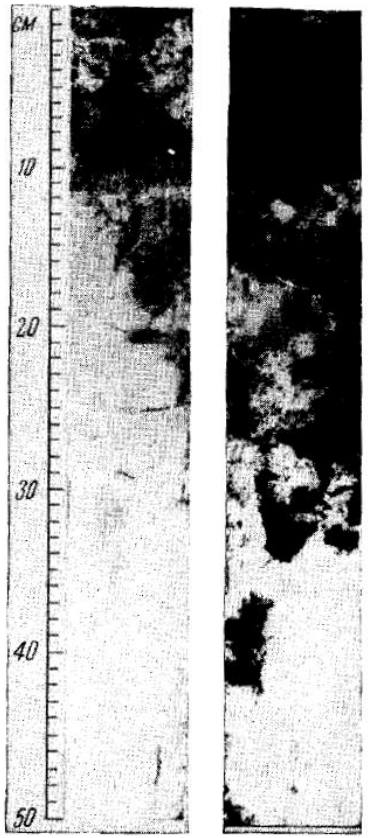


Рис. 1. Распад льняной ткани за 2 мес. во влажном 1958 г.

а — 1 мес.; *б* — 2 мес.

BLT: предыстория

Golley F.B. An index to the rate of cellulose decomposition in the soil // Ecology. **1960.** V. 41. № 3. P. 551-552.

The technique used was modified from that described by Tribe (1957) for studying succession of soil microorganisms on cellulose sheet. The method involved placing a square of cellulose 5 x 5 cm between a folded rectangle of aluminum screen and placing the screen and cellulose vertically in the soil, the upper edge at the soil surface. Pure, regenerated cellulose was used—this was entirely alpha cellulose with approximately 6-7% water[2]. Tribe reported that he affixed cellulose to glass slides by wetting it before placing it against the glass. I was unable to do this and was informed by E. I. Dupont de Nemours & Company that a special bonding agent would be necessary to cement cellulose to glass. The aluminum screen may have influenced the soil organisms in some way, but since all strips were treated alike, this does not invalidate the comparative data. After a certain time the strip was removed from the soil and an estimate was made of the rate of cellulose breakdown by computing the remaining area of the original sheet.

References

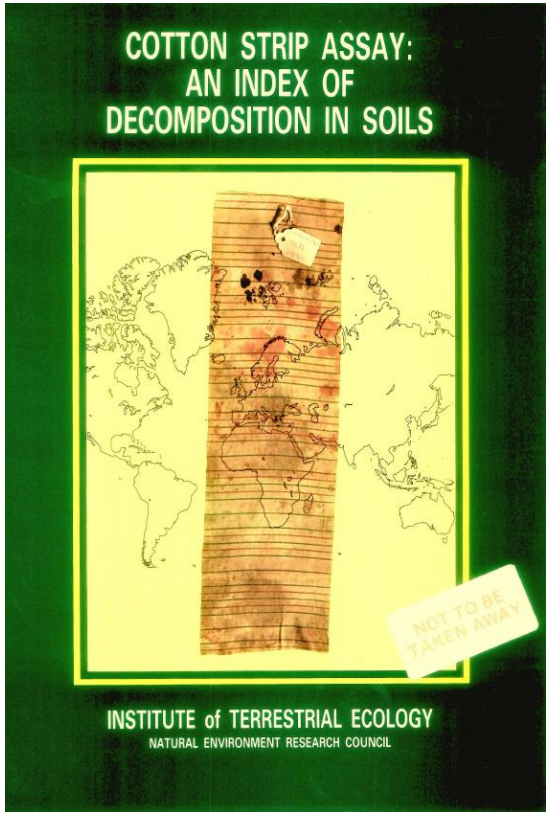
Golley, F. B. 1958. Energy dynamics of a food chain of the old-field community. Ph.D. Thesis, Michigan State University. 102 pp.

Tribe, H. T. 1957. Microorganisms in soils as observed during their development upon buried cellulose film. *In* Symposium of Soc. for General Microbiology **7**: 287-298.

Frank B. Golley

BLT: предыстория

1988

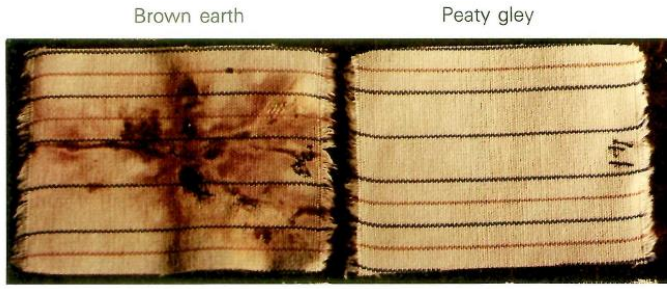


Soil burial textile test

Thaysen A.C., Bunker H.J. The microbiology of cellulose, hemicelluloses, pectin and gums. London: Oxford University Press, 1927.

Siu R.G.H. Microbial decomposition of cellulose. New York: Reinhold, 1951.

The Shirley Soil Burial Test Fabric



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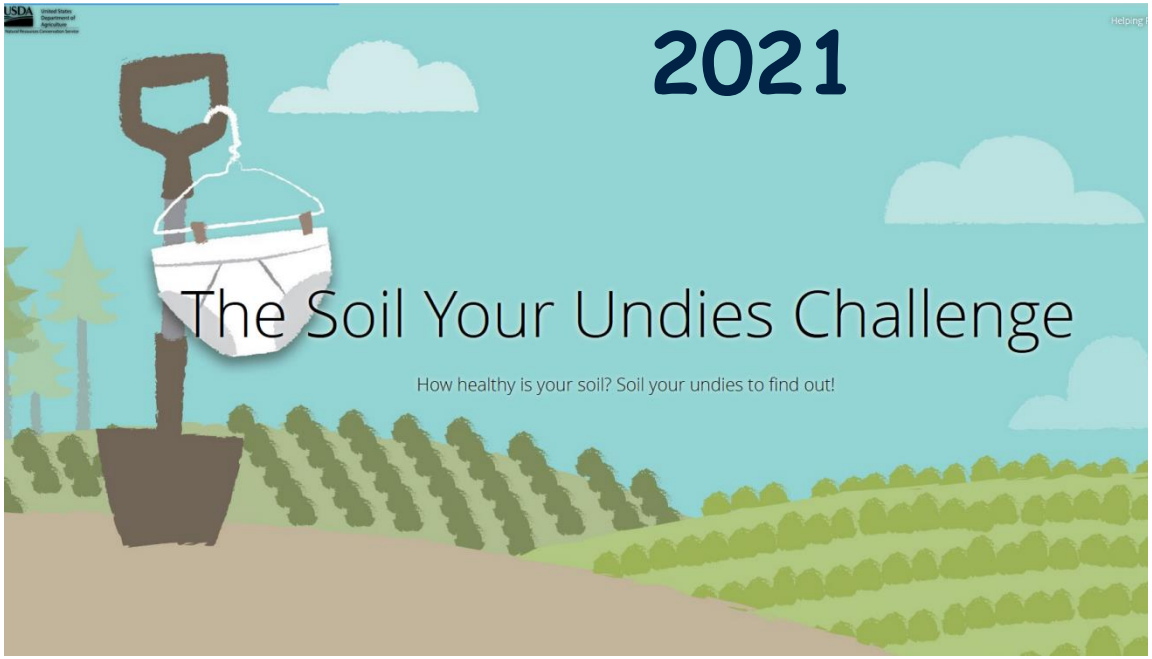

BLT: почему столь важен?

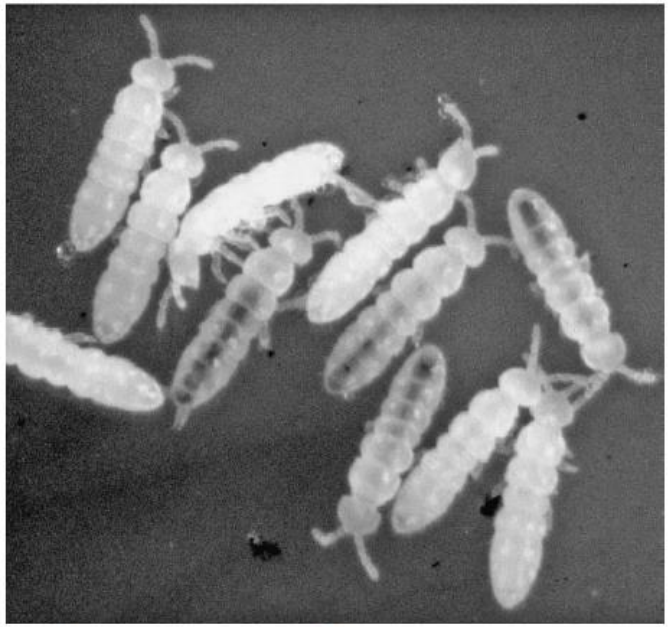

Fig. 1. Group of *Folsomia candida* removed from a test chamber by flotation. Four individuals have the ingested waste clearly visible in their gut.

Domene X., Natal-da-Luz T., Alcañiz J.M. et al. Feeding inhibition in the soil collembolan *Folsomia candida* as an endpoint for the estimation of organic waste ecotoxicity // Environ. Toxicol. Chem. 2007. V. 26. № 7. P. 1538–1544.

BLT: почему столь важен?

Ecological Indicators 69 (2016) 213–223

Contents lists available at ScienceDirect

Ecological Indicators

journal homepage: www.elsevier.com/locate/ecolind

Selecting cost effective and policy-relevant biological indicators for European monitoring of soil biodiversity and ecosystem function

B.S. Griffiths[a,*], J. Römbke[b], R.M. Schmelz[b], A. Scheffczyk[b], J.H. Faber[c], J. Bloem[c], G. Pérès[d], D. Cluzeau[e], A. Chabbi[f], M. Suhadolc[g], J.P. Sousa[h], P. Martins da Silva[h], F. Carvalho[h], S. Mendes[h], P. Morais[h], R. Francisco[h], C. Pereira[h], M. Bonkowski[i], S. Geisen[i], R.D. Bardgett[j], F.T. de Vries[j], T. Bolger[k], T. Dirilgen[k], O. Schmidt[l], A. Winding[m], N.B. Hendriksen[m], A. Johansen[m], L. Philippot[n], P. Plassart[n], D. Bru[n], B. Thomson[o], R.I. Griffiths[o], M.J. Bailey[o], A. Keith[p], M. Rutgers[q], C. Mulder[q], S.E. Hannula[r], R. Creamer[s], D. Stone[s]

5. Conclusion

For undertaking a large-scale biological indicator programme this study has shown that standardisation of methods is an absolute necessity, otherwise it is not possible to properly compare results. This would include an inter-laboratory comparison for the small number of indicators finally selected (i.e. Creamer et al., 2009). It would also necessitate accurate prescription of sampling appropriate for the land uses and edaphic conditions within the monitoring area. An easily accessible database needs to be established to detect temporal changes, so that the results can show a trajectory of system improvement or decline rather than just being a point measure of status. A suite of complementary indicators is necessary, ideally linking biodiversity to soil functioning to give a more meaningful outcome. The ongoing developments in nucleic acid based analyses of biodiversity are likely to improve the throughput and resolution of biodiversity indicators, which need to cover both microbial and faunal groups. Indicators for ecosystem functions related to the services of water regulation, C-sequestration and nutrient provision would include a minimum suite of: earthworms; microbial functional genes; and bait lamina.

BLT: почему столь важен?

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DOI: 10.1002/ece3.2997

ORIGINAL RESEARCH

WILEY Ecology and Evolution Open Access

Towards the co-ordination of terrestrial ecosystem protocols across European research infrastructures

Les G. Firbank[1] | Chiara Bertora[2] | David Blankman[3] | Gemini Delle Vedove[4] | Mark Frenzel[5] | Carlo Grignani[2] | Elli Groner[6] | Miklós Kertész[7] | Eveline J. Krab[8] | Giorgio Matteucci[9] | Christina Menta[10] | Carsten W. Mueller[11] | Jutta Stadler[5] | William E. Kunin[1]

3.4 | Decomposition

Decomposition is relevant to ecological integrity elements "matter budget" and "energy budget" and indicates matter loss and nutrient cycling. It is influenced by both abiotic parameters (including soil chemistry, temperature, and moisture) and biotic factors (e.g., litter substrate quality and the range of decomposer organisms) (Cornelissen, 1996). Litter bags and bait lamina are appropriate for assessing decomposition in both terrestrial and aquatic ecosystems, with litter bags more sensitive to microbial activity and bait lamina to soil fauna; they can therefore be used together (van Gestel et al., 2009).

BLT: почему столь важен?

Ecological Indicators 97 (2019) 100–110

Contents lists available at ScienceDirect

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Original Articles

Biofunctool®: a new framework to assess the impact of land management on soil quality. Part A: concept and validation of the set of indicators

Alexis Thoumazeau[a,b,c,d,*], Cécile Bessou[a], Marie-Sophie Renevier[b,d,e], Jean Trap[b], Raphaël Marichal[a], Louis Mareschal[b], Thibaud Decaëns[f], Nicolas Bottinelli[g,h], Benoît Jaillard[b], Tiphaine Chevallier[b], Nopmanee Suvannang[d], Kannika Sajjaphan[i], Philippe Thaler[b,c], Frédéric Gay[b,c], Alain Brauman[b,d]

Table 1

List of the twelve indicators selected for the Biofunctool® framework. Each indicator is linked to a soil function following Kibblewhite et al. (2008) framework. The core set of indicators included ten indicators and the two last add-on indicators are related to of the carbon transformation function in the case of perennial crops. The protocols are available in the Appendix A following the order of the last column in the table.

Soil function (Kibblewhite et al., 2008)	Indicator genericity	Indicator name	Measured variables	References	Detailed protocol linked (Appendix A)
Structure Maintenance	Core set	AggSoil	Aggregate stability (2-10cm)	Herrick et al., 2001	Protocol A
Structure Maintenance	Core set	AggSurf	Aggregate stability (0-2cm)		
Structure Maintenance	Core set	Beerkan	Infiltration potential	Adapted from : Lassabatère et al., 2006 Also applied in : Grimaldi et al., 2014	Protocol B
Structure Maintenance	Core set	VESS	Visual evaluation of soil structure	Guimarães et al., 2011	Protocol C
Nutrient Cycling	Core set	AEMNO3	NO_3^- fixed on anion exchange membrane	Qian and Schoenau, 2002; Saggar et al., 1990	Protocol D
Nutrient Cycling	Core set	NminSoil	Soil available nitrogen (NO_3^- and NH_4^+)	Maynard and Kalra, 1993	Protocol E
Carbon Transformation	Core set	Cast	Cast density	Thomas et al., 2008	Protocol F
Carbon Transformation	Core set	Lamina	Bait Lamina	Von Törne, 1990 ; Gestel et al., 2003	Protocol G
Carbon Transformation	Core set	POXC	Permanganate OXidizable Carbon	Culman et al., 2012; Weil et al., 2003	Protocol H
Carbon Transformation	Core set	SituResp	Basal soil respiration	Thoumazeau et al., 2017	Protocol I
Carbon Transformation	Add-on	Fragment	Litter index	Adapted from (Loranger et al., 2002; Ponge et al., 2002; Zanella et al., 2017)	Protocol F
Carbon Transformation	Add-on	Skeleton	Litter index		

BLT: практика

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Последствия вселения растений-инвайдеров
Влияние пожаров
Сравнение разных сельскохозяйственных практик
Влияние пестицидов
Влияние урбанизации
Влияние загрязнения металлами
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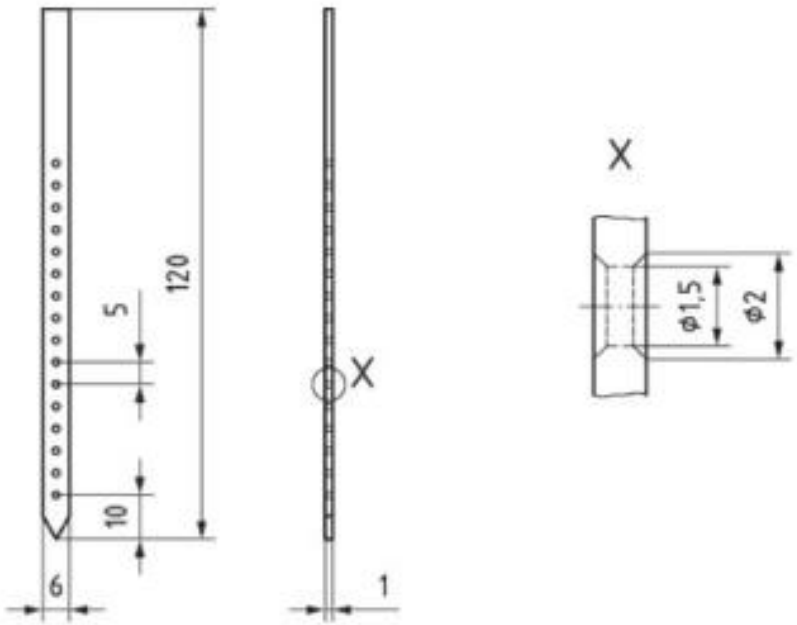

Figure 1 — Schematic view of individual bait-lamina strips[24]

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Figure 2 — Three individual materials (left: activated carbon; above: finely ground wheat bran; below: cellulose) and the mixture of the three components at right: the bait

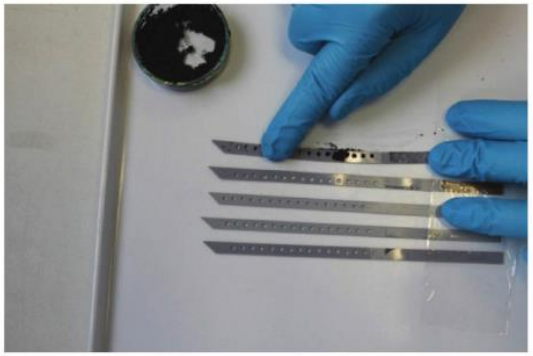


Figure 3 — Filling of bait-material into the bait-lamina strips

Figure 4 — Bait-lamina strips at a forest site, showing how deeply they were inserted and their marking by a band (height of the litter layer: 2 cm to 3 cm)

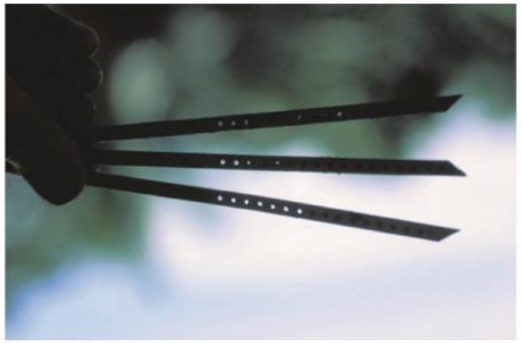


Figure 5 — Visual examination of an individual bait-lamina strip at the end of a test (Photograph: H. Hoefer)

BLT: практика

www.terra-protecta.de/en/index.html

Legal Notice Privacy

About Bait Lamina System Your Order

Price-List, delivery conditions and order form

Price-list / new prices valid from May 15th 2021

You can purchase the bait-lamina-strip test system with or without filling.

So you can fill the drill holes of a bait-lamina-strip test with you own bait substrate.

Cleaning and refill 3,00 Euro per bait-lamina-stripe.

Bait-lamina-test strips with bait substrate - Art.Nr. 2410a

Number bait-lamina-test strips	Price per strip
1 - 250	4.50 €
251 - 500	4.40 €
501 - 1000	4.30 €
1001 - 5000	4.20 €

Bait-lamina-test strips without bait substrate - Art.Nr. 2410b

Number bait-lamina-test strips	Price per strip
1 - 250	4,00 €
251 - 500	3,90 €
501 - 1000	3,80 €
1001 - 5000	3,70 €

130%

TERRA PROTECTA

BLT: практика

	Состав приманки
von Törne, 1990	Разные составы: пшеничные отруби, порошковое молоко, пептон, манитоза, целлюлоза, листья вейника, листья крапивы, гипс, почва (чернозем)
Bait-lamina workshop in Braunschweig (1994)	Целлюлоза – 65 % Пшеничные отруби – 10 % Агар-агар – 10 % Бентонитовый клей – 10 %
ISO 18311 и terra protecta GmbH	Целлюлоза – 70% Пшеничные отруби – 25 % Активированный уголь – 5 %
Многие авторы	Микрокристаллическая целлюлоза – 70% Листья крапивы – 30%

BLT: практика

ELSEVIER

Applied Soil Ecology 7 (1998) 207–212

Applied Soil Ecology

A comparison of feeding activity of collembolan and enchytraeid in laboratory studies using the bait-lamina test

Beate Helling *, Gesa Pfeiff, Otto Larink

Institute of Zoology, Technical University, 38092 Braunschweig, Germany

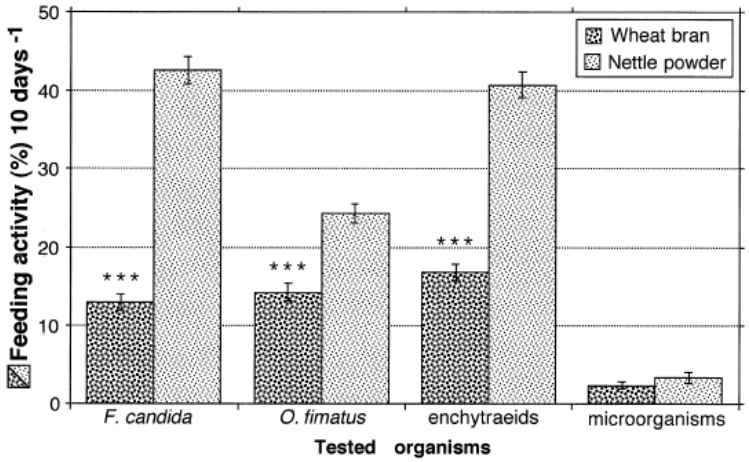


Fig. 1. Mean feeding activity (% per 10 days, ±standard deviation) in defaunated arable soil with baits of nettle powder and wheat bran. * :significant difference of the feeding activity (* * * $P < 0.001$) between the two bait substances associated with the presence of each tested organism.

BLT: практика

Applied Soil Ecology 82 (2014) 78–81

Contents lists available at ScienceDirect

Applied Soil Ecology

journal homepage: www.elsevier.com/locate/apsoil

Organic textile dye improves the visual assessment of the bait-lamina test

Nico Eisenhauer [a,1,2,*], Daniela Wirsch [b], Simone Cesarz [a,1,2], Dylan Craven [a,1], Peter Dietrich [a,1,2], Julia Friese [a], Juliane Helm [a], Jes Hines [a,1,2], Madlen Schellenberg [a], Pascal Scherreiks [a], Benjamin Schwarz [a], Christin Uhe [a], Kristin Wagner [a], Katja Steinauer [a,1,2]

[a] Institute of Ecology, Friedrich-Schiller-University Jena, Dornburger Str. 159, 07743 Jena, Germany
[b] Institute of Geosciences, Friedrich-Schiller-University Jena, Burgweg 11, 07749 Jena, Germany

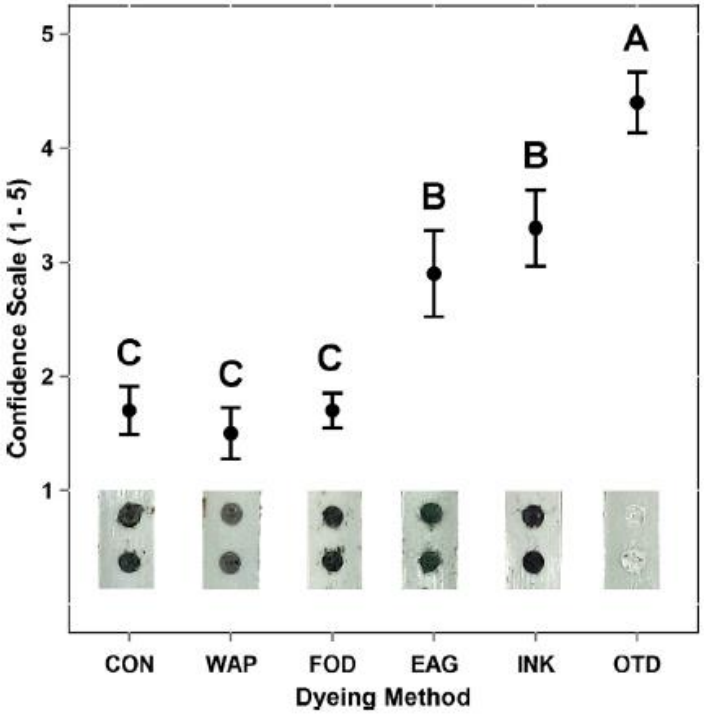


Fig. 1. Measure of confidence of visual assessment of decomposer activity using bait-lamina stripes as affected by dyeing method (WAP = wall paint, FOD = food dye, EAG = Easter Grass, INK = ink, OTD = textile dye). The precision of visual assessment was evaluated by ten university students using a scale from one (not distinguishable) to five (easy to distinguish) to assess whether bait-lamina substrate was distinguishable from soil. Means with standard errors. Bars with different letters vary significantly (Tukey's HSD test, $p < 0.05$).

BLT: практика

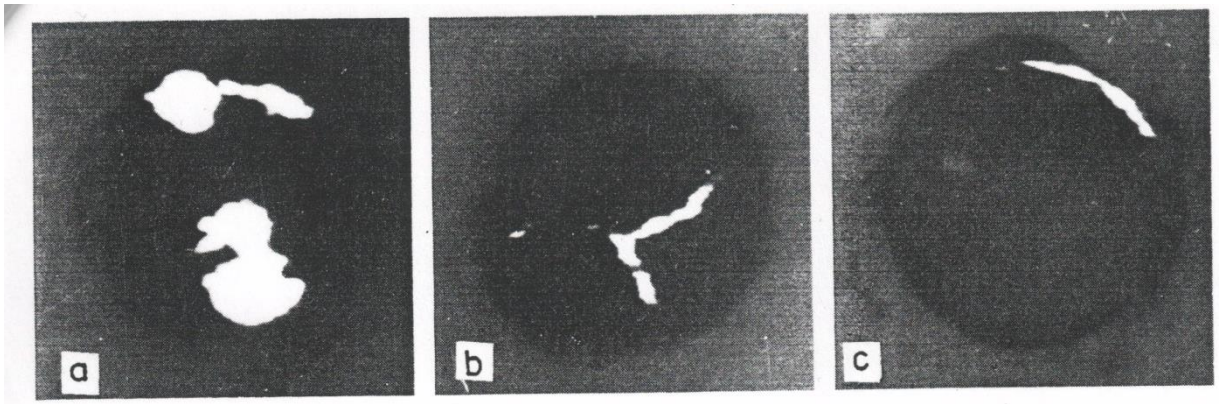
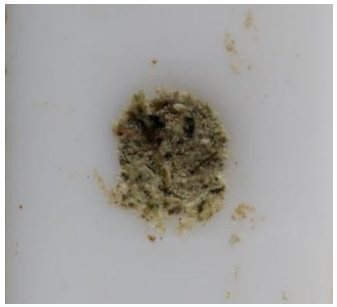
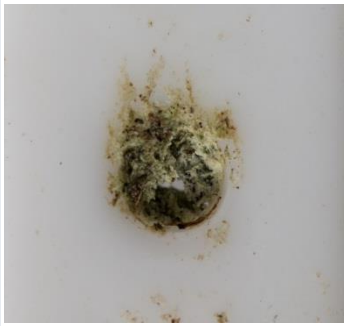
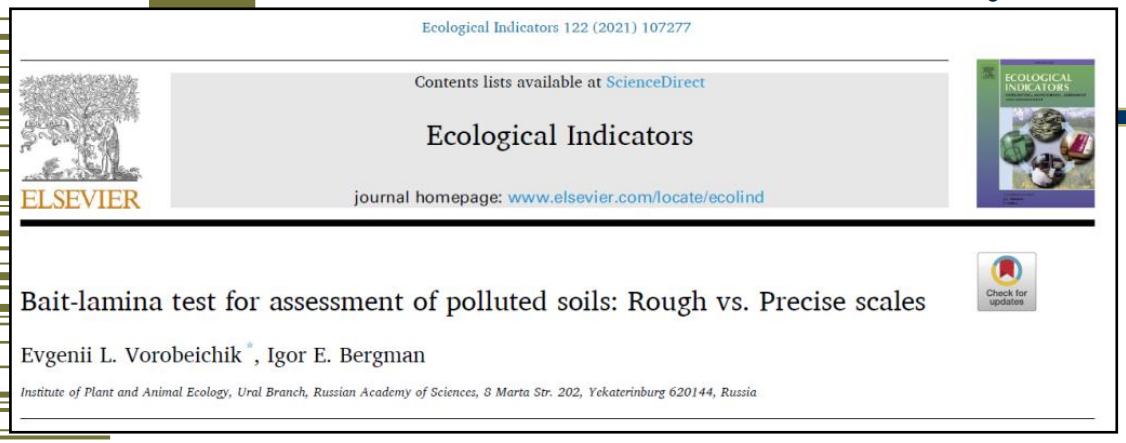


Fig. 3. Examples of scored bait-laminae: pierced by animal feeding (a), cracked by friction and/or by shrinkage (b and c).

von Törne E. Assessing feeding activities of soil-living animals. 1. Bait-lamina-tests // Pedobiologia. 1990. V. 34. P. 89–101.

				
0	0.25	0.5	0.75	**1**

BLT: практика


Ecological Indicators 122 (2021) 107277

Contents lists available at ScienceDirect

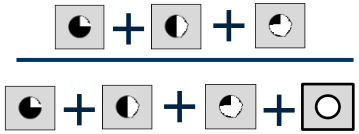
Ecological Indicators

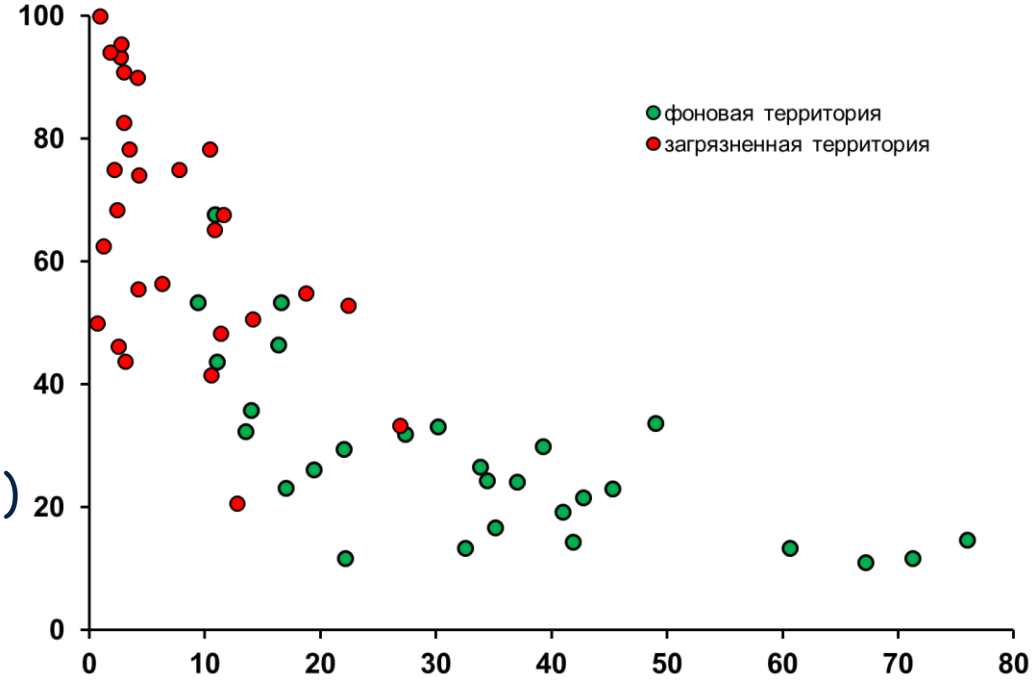
journal homepage: www.elsevier.com/locate/ecolind

Bait-lamina test for assessment of polluted soils: Rough vs. Precise scales

Evgenii L. Vorobeichik *, Igor E. Bergman

Institute of Plant and Animal Ecology, Ural Branch, Russian Academy of Sciences, 8 Marta Str. 202, Yekaterinburg 620144, Russia

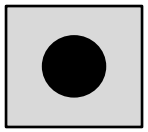
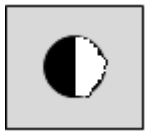
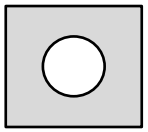




5 лет (2015-2019 гг.)
X 1-2 тура
X 4 площадки
X 2 территории
= 56 точек

трофическая активность, % за 7 дней

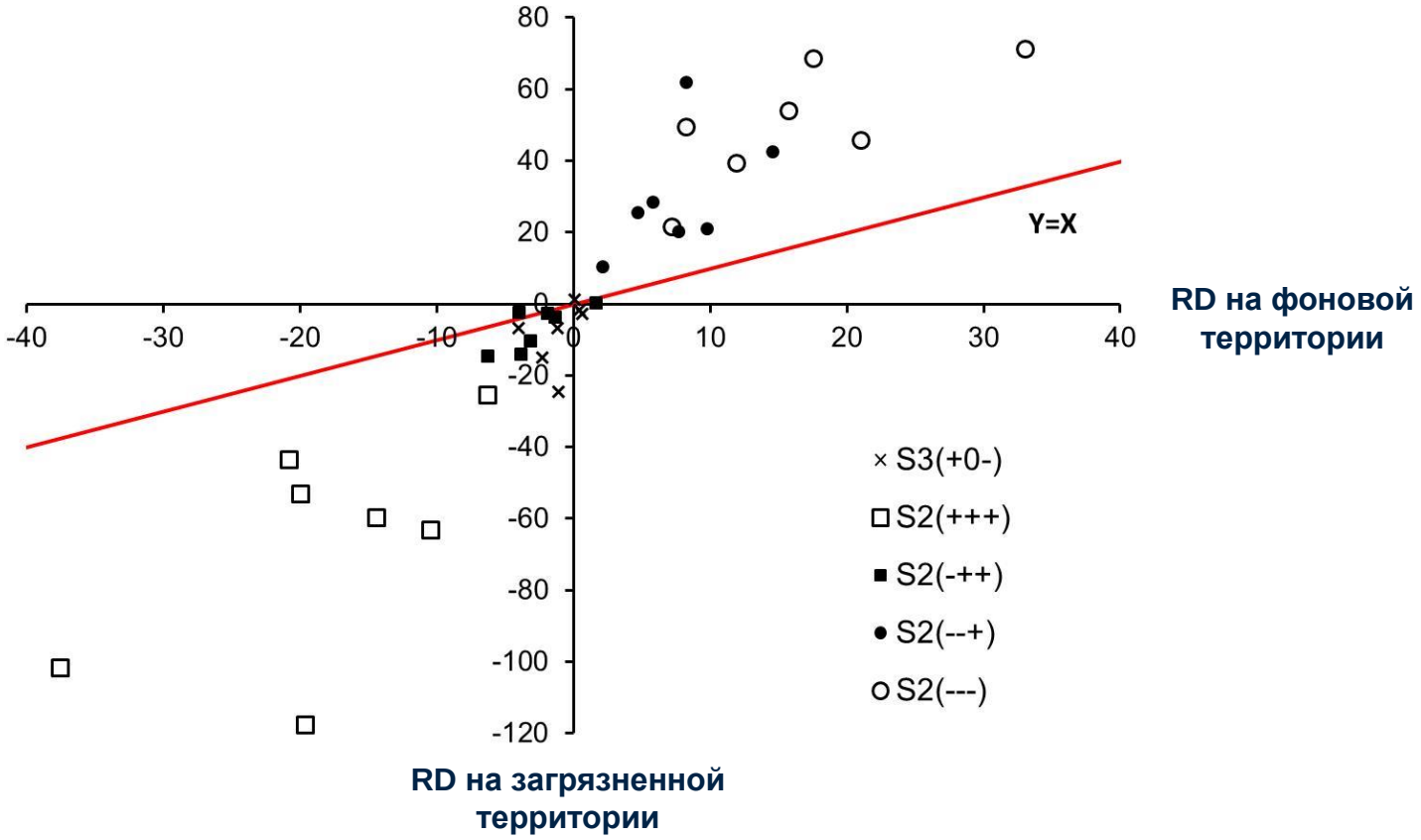
BLT: практика

Грубые шкалы						
		0	0.25	0.5	0.75	**1**
Siebert et al., 2019, Thakur et al., 2018	S3(+0-)	**0**	0.5	0.5	0.5	**1**
	S3(-0+)	**0**	0	0.5	1	**1**
von Törne, 1990	S2(+++)	**0**	1	1	1	**1**
ISO 18311	S2(-++)	**0**	0	1	1	**1**
?	S2(--+)	**0**	0	0	1	**1**
Podgaiski et al., 2014	S2(---)	**0**	0	0	0	**1**

BLT: практика

S3(+0-) = S3(-0+) ≈ S2(-++) > S2(--+) > S2(---) ≈ S2(+++)

RD = (точная шкала - грубая шкала) / точная шкала * 100 %

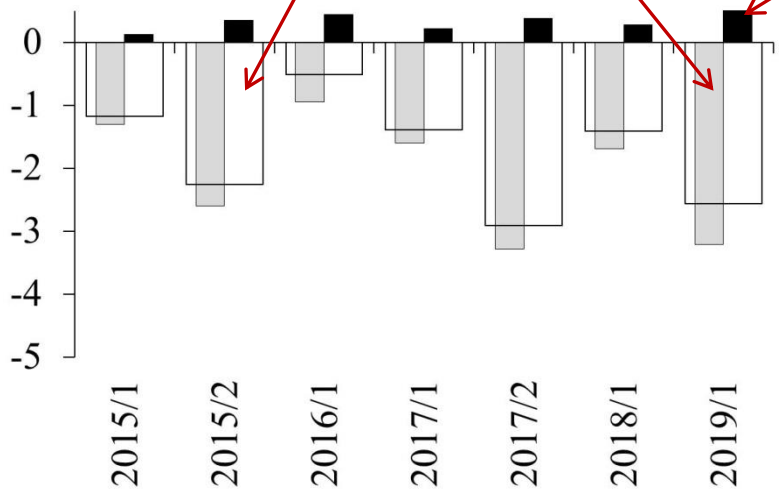


BLT: практика

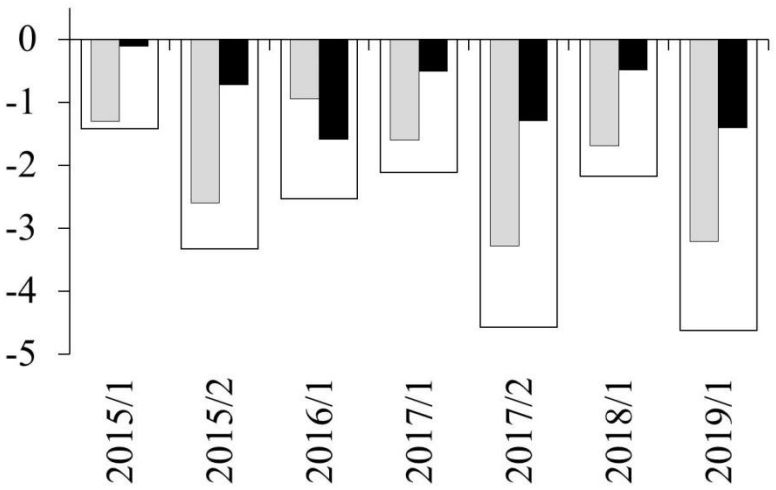
RR = log(загрязненная территория / фоновая территория)

Грубая шкала = Точная шкала * (1- RD)

RR(грубая шкала) = RR(точная шкала) + RR(1-RD).

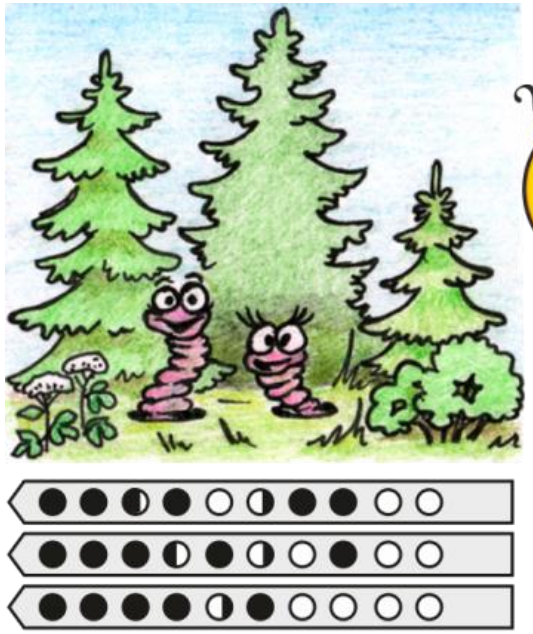


S2(+++)



S2(---)

BLT: практика



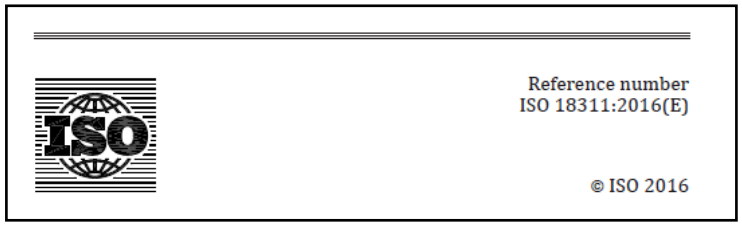
Feeding activity

	The two-point scale	The five-point scale
Control area	50%	45%
Polluted area	50%	15%

BLT: практика

автор	длительность экспонирования
von Törne, 1990	4 ч. 13 ч. 22 ч. 44 ч. 120 ч.
многие авторы - тропики	4-8 дней
многие авторы – умеренный климат	от 7-10 до 14-20 дней
Niklińska, Klimek, 2011	33 дня
Rozen et al., *2010*	40 дней
Niemeyer et al., *2018*	42 дня
Hamel et al., *2007*	66 дней
Welsch et al., *2019*	90 дней

BLT: практика


Reference number
ISO 18311:2016(E)

© ISO 2016

Выбор – на основе предварительного эксперимента

Активность на контрольном участке – не менее 30%

…но и не более 80-90%

BLT: практика

ЭКОЛОГИЯ, 2020, № 5, с. 354–364

УДК 574.4:631.468:[504.5:669.2/.8]+502.05

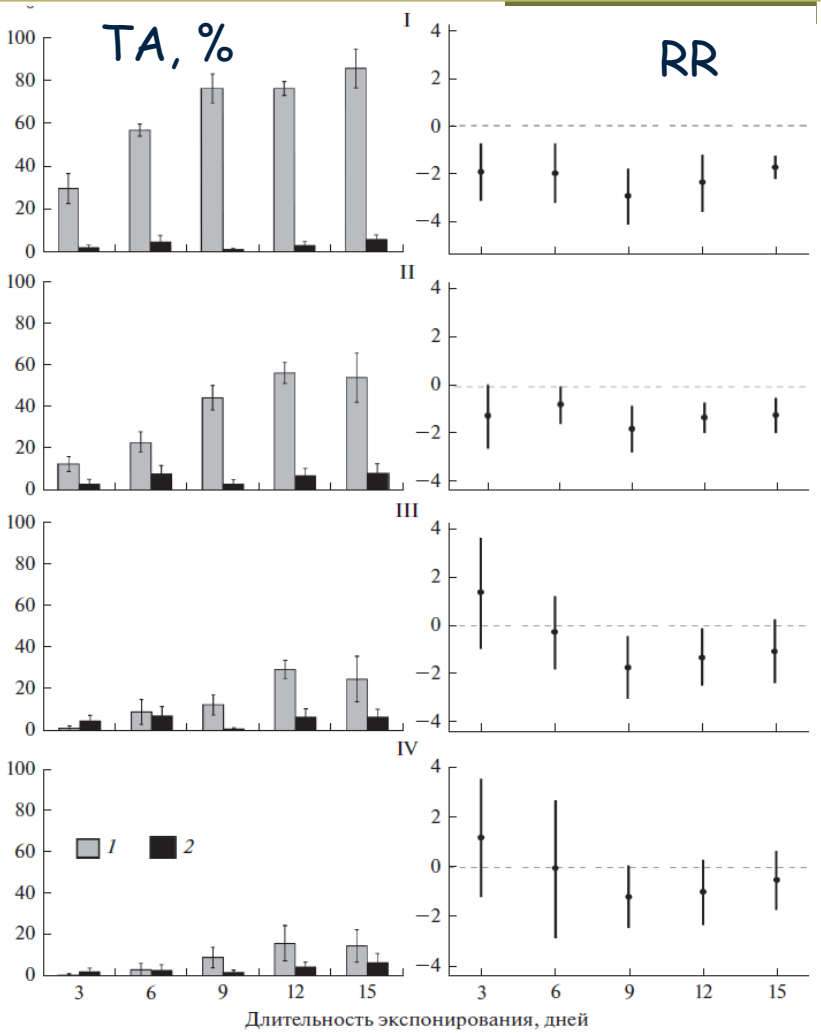
BAIT-LAMINA TEST В ОЦЕНКЕ ЗАГРЯЗНЕННЫХ ПОЧВ: ВЫБОР ДЛИТЕЛЬНОСТИ ЭКСПОНИРОВАНИЯ

© 2020 г. Е. Л. Воробейчик[a], *, И. Е. Бергман[a]

Следует выбирать оптимальную длительность

Пересчитывать на «стандартную» длительность можно только на линейном участке

Реальная	Пересчитанная	
% / 15-43 дн.	% / 10 дн.	*Helling et al., 1998*
% / 33-42 дн.	% / 28 дн.	*Rozen et al., 2010*



1 – фоновая, 2 - загрязненная

BLT: практика

Вертикальное распределение

Как измерить?

- активность по 4 слоям
- активность по 2 половинам
- активность по горизонтам
- средневзвешенная глубина (индекс Ван Страалена)

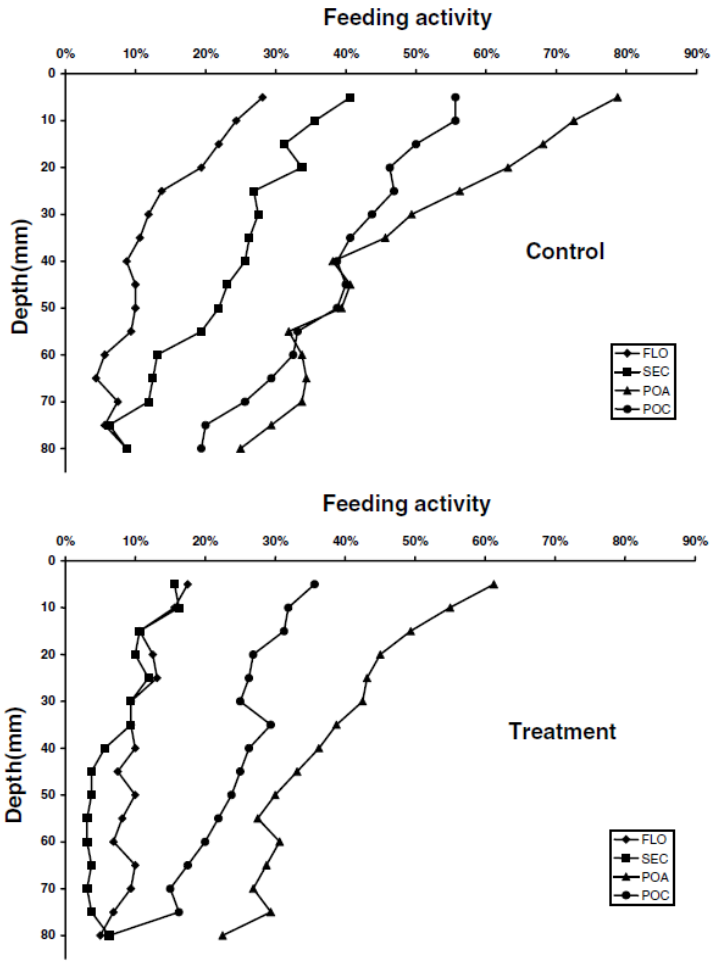


Figure 4. Vertical distribution of the feeding activity in the litter removal test: Controls (upper half) and treatments (lower half). The number of fed apertures per soil depth (0–80 mm) in per cent of the total number of apertures is given for the four study sites (primary forest (FLO), secondary forest (SEC) and two forestry plantations (POA, POC)).

Römbke J., Höfert H., Garcia M.V.B., Martius C. Feeding activities of soil organisms at four different forest sites in Central Amazonia using the bait lamina method // J. Trop. Ecol. 2006. V. 22. № 3. P. 313–320.

BLT: практика

Сколько и как?

von Törne, 1990 16 полосок в «точке»

«точка» - сетка ~ 50 x 50 см или линия через ~ 15 см

3-4 «точки» на площадку (либо в два раза больше)

BLT: практика

Сколько и как?

Ecological Indicators 102 (2019) 401–409

Contents lists available at ScienceDirect

Ecological Indicators

journal homepage: www.elsevier.com/locate/ecolind

Original Articles

How many samples? Soil variability affects confidence in the use of common agroecosystem soil indicators

Johannes Welsch[a,d,1], Cao Songling[b,c,1], Hannah L. Buckley[c], Niklas J. Lehto[d], E. Eirian Jones[d], Bradley S. Case[c,*]

Table 3
The main drivers of variability for the ten soil indicators examined in this study, and indicative samples sizes for estimating population mean values for each indicator to within 10% of the true mean with a confidence level of 95% or higher. The figures presented are based on the sites investigated in this study and we recommend that pilot studies always be carried out to inform sampling designs in any new situation.

Soil indicator	Main influences on indicator variability	Indicative sample size range (*n*)	
		Field soils	Shelterbelt soils
Moisture	Soil physical properties, rainfall, sampling method, and time of year sampled	70–130	10–20
pH	Soil physico-chemical properties, vegetation, management practices	2–5	5–10
Bulk density	Soil physical properties, vegetation, management practices	15–20	10–15
Organic C	Soil physico-chemical properties, moisture (rainfall, topography), vegetation, and management practices	50–90	100–180
POX C	Soil physico-chemical properties, temperature, moisture, vegetation, management practices	40–60	80–100
Total C	Soil physico-chemical properties, vegetation, soil temperature and moisture, management practices	10–20	50–90
Total N	Soil physico-chemical properties, vegetation, management practices	10–15	30–60
TBI	Soil physico-chemical properties, soil moisture and temperature, vegetation, management practices	150–250	40–70
DHA	Soil physico-chemical properties, soil moisture and temperature, vegetation, management practices	60–100	400–700
BLP	Soil physico-chemical properties, soil moisture and temperature, vegetation, management practices	130–230	30–50

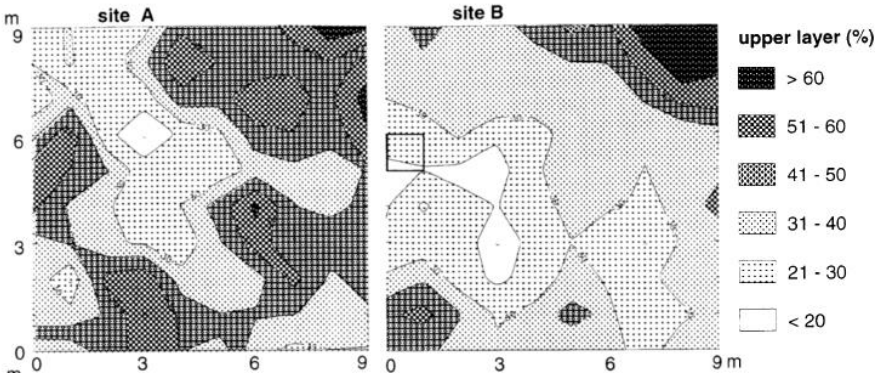
BLT: практика

Сколько и как?

Pedobiologia **42**, 102–108 (1998)
Gustav Fischer Verlag Jena

Spatial heterogeneity of biotic activity in the soil of a beech wood and consequences for the application of the bait-lamina-test

Ulrich Irmler



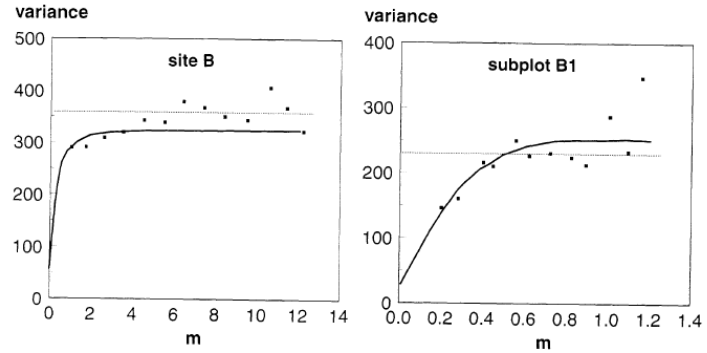
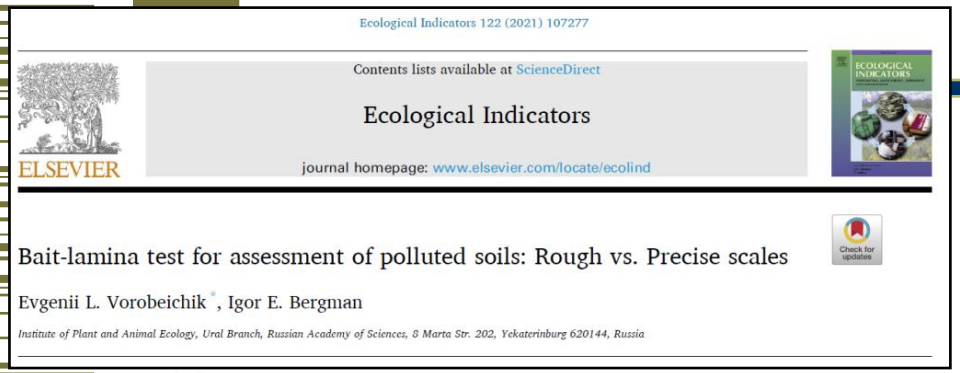


Fig. 1. Variograms for feeding activities of the upper layer at site B and its smaller subsite B1. Dotted lines indicate overall sample variance

Меньше в «точке» (5 полосок),
но больше «точек» на площадку (~10-12)

BLT: теория


Ecological Indicators 122 (2021) 107277

Contents lists available at ScienceDirect

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journal homepage: www.elsevier.com/locate/ecolind

ELSEVIER

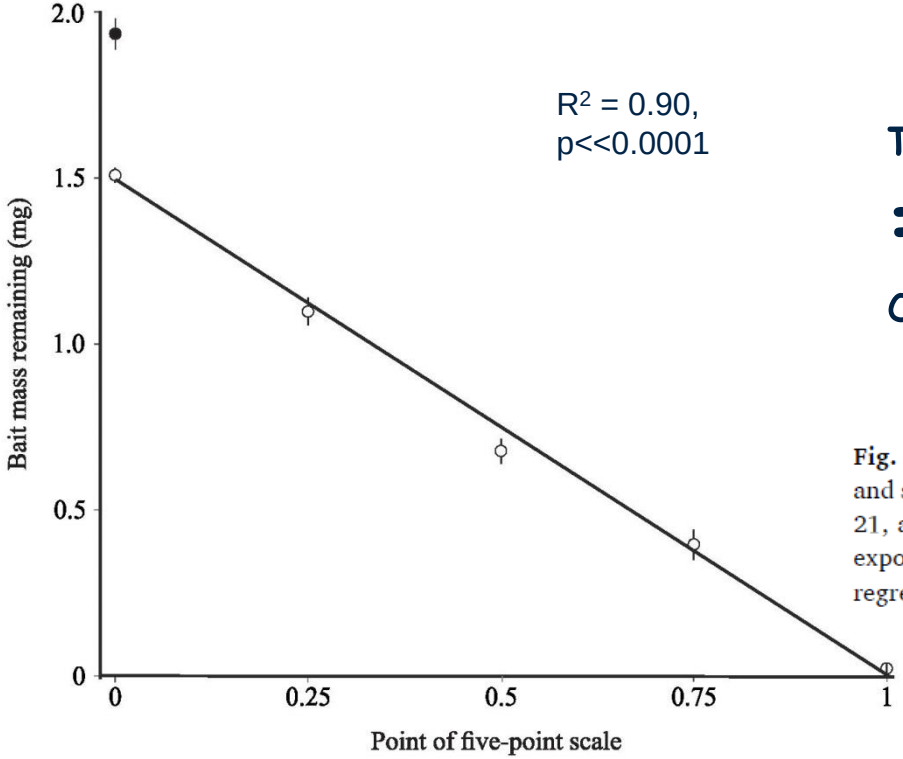
Bait-lamina test for assessment of polluted soils: Rough vs. Precise scales

Evgenii L. Vorobeichik *, Igor E. Bergman

Institute of Plant and Animal Ecology, Ural Branch, Russian Academy of Sciences, 8 Marta Str. 202, Yekaterinburg 620144, Russia

оставшаяся масса (г) = (1.497±0.015)+ (-1.498±0.031)*активность (балл)

потеря массы (%) = активность (%)



трофическая активность

=

скорость потребления приманки

Fig. 1. Relationships between bait mass remaining (average ± standard error) and score of five-point scale (for scores 0, 0.25, 0.5, 0.75, and 1 $n = 147$, 31, 30, 21, and 41, respectively). The filled dot represents the initial bait mass before exposure ($n = 60$); empty dots represent bait mass after exposure. The linear regression curve obtained for bait mass after exposure is illustrated.

BLT: теория

Кто ест? Беспозвоночные + ~~микроорганизмы~~

Collembola, Oribatida

Enchytraeidae

Lumbricidae

Isopoda

Diplopoda

Tipulidae, Limoniidae, Bibionidae, Chironomidae, Sciaridae, Cecidomyiidae

Elateridae

Ectobius spp.

Mollusca

BLT: теория

ELSEVIER

Applied Soil Ecology 7 (1998) 207–212

Applied Soil Ecology

A comparison of feeding activity of collembolan and enchytraeid in laboratory studies using the bait-lamina test

Beate Helling *, Gesa Pfeiff, Otto Larink

Institute of Zoology, Technical University, 38092 Braunschweig, Germany

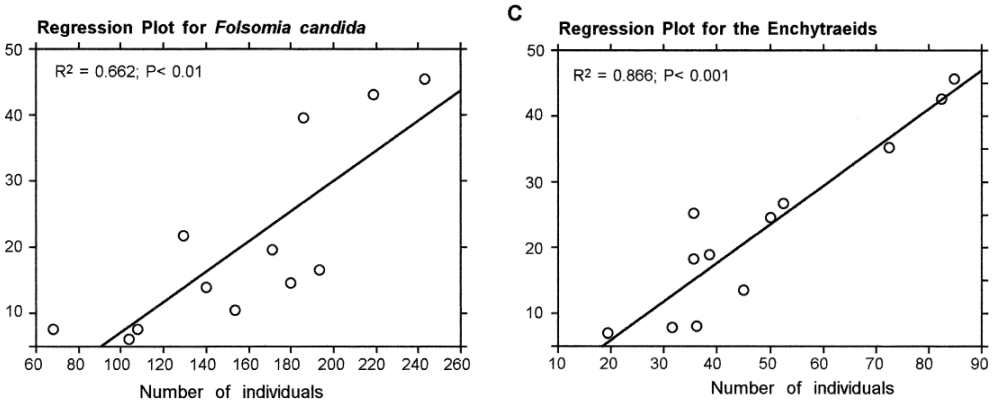


Fig. 3. Relationship between the number of individuals of: (A) *F. candida*, (B) *O. fimatus*, (C) the Enchytraeids and the feeding activity in percent per 10 days. R^2: regression coefficient.

Ecotoxicology, 13, 129–141, 2004
© 2004 Kluwer Academic Publishers. Manufactured in The Netherlands.

Ring-testing and Field-validation of a Terrestrial Model Ecosystem (TME) – An Instrument for Testing Potentially Harmful Substances: Effects of Carbendazim on Organic Matter Breakdown and Soil Fauna Feeding Activity

BERNHARD FÖRSTER,[1,*] CORNELIS A.M. VAN GESTEL,[2] JOSÉE E. KOOLHAAS,[2] GERRIT NENTWIG,[1] JOSÉ M.L. RODRIGUES,[3] J. PAULO SOUSA,[4] SUSAN E. JONES[5] AND THOMAS KNACKER[1]

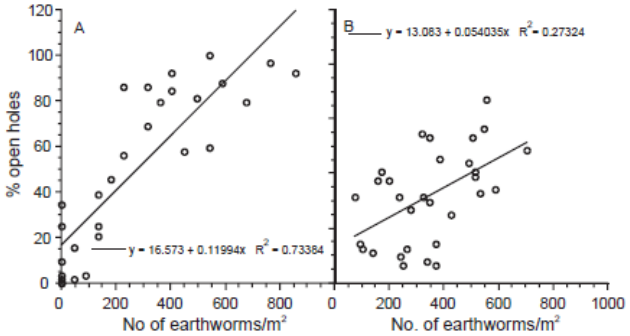
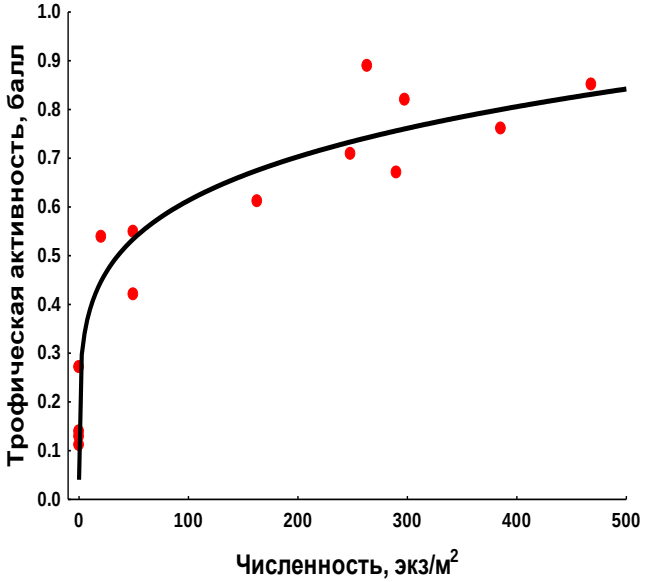
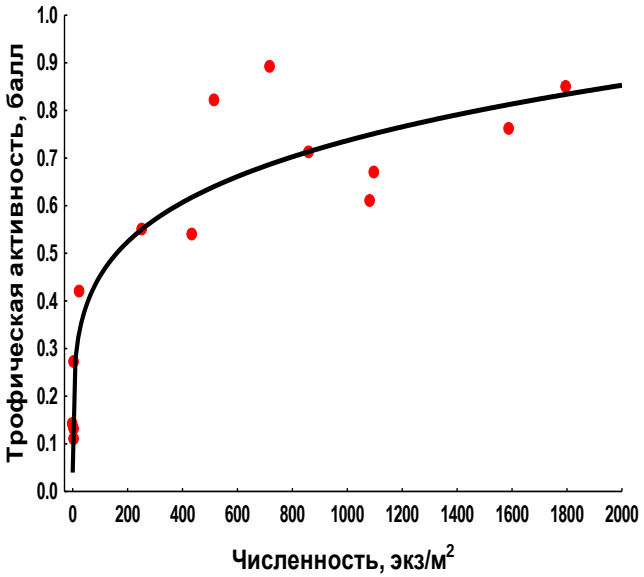
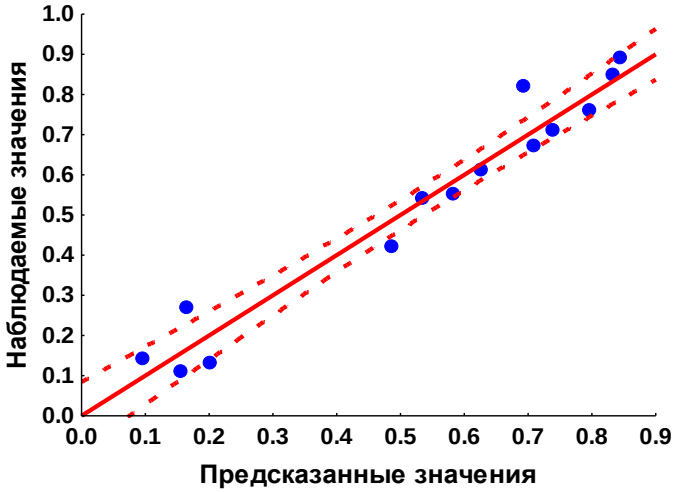


Figure 4. Correlation between bait-lamina feeding activity, expressed as the % of open holes after a 2 week incubation period, and the abundance of earthworms (numbers per m^2) in the test soils. A (left). In the Amsterdam TME ring test. B (right). In the Amsterdam field-validation study. Both graphs show data for the sampling 16 weeks after treatment with carbendazim and include all treatment levels.

BLT: теория







СУМЗ,
градиент загрязнения
14 площадок, 2014 г.

TA = -0,4 + 0,16 Log(Lumbricidae) + 0.29 Log(Elateridae) + 0.06Log(Enchytraeidae), R^2=0.95

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Applied Soil Ecology 25 (2004) 111–122
Applied Soil Ecology
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Stratification and dynamics of bait-lamina perforation in three forest soils along a north–south gradient in Russia

Konstantin B. Gongalsky*, Andrei D. Pokarzhevskii, Zhanna V. Filimonova, Fyodor A. Savin

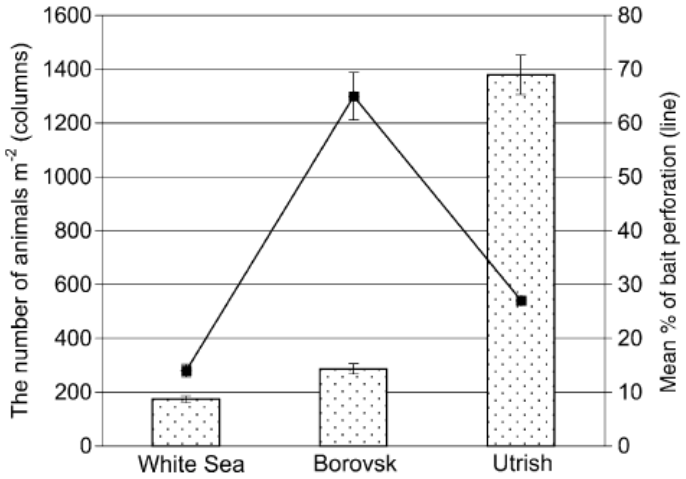

Fig. 5. Mean (±S.E.) bait-lamina perforation ($n = 40$) and soil macrofaunal abundance ($n = 144$) in three studied sites along a north–south gradient.

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Effects of soil temperature and moisture on the feeding activity of soil animals as determined by the bait-lamina test

Konstantin B. Gongalsky [a,], Tryggve Persson [b], Andrei D. Pokarzhevskii [a,1]*

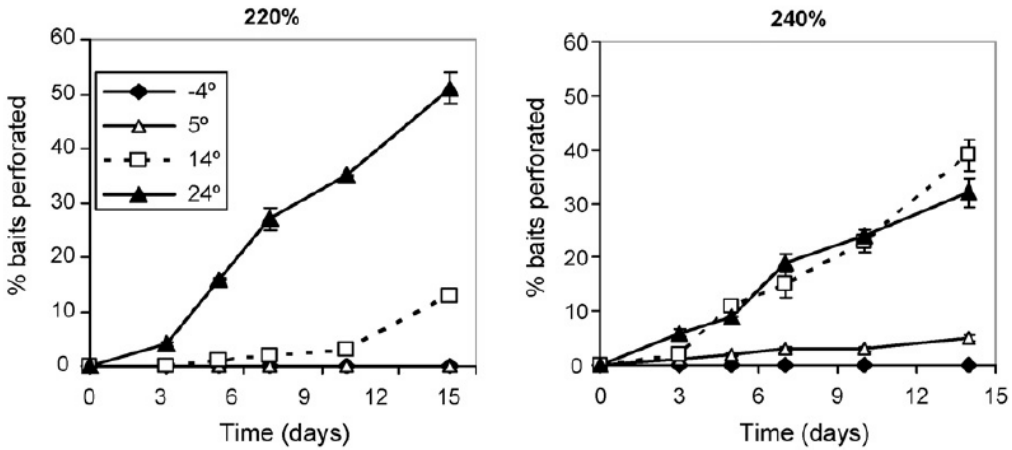


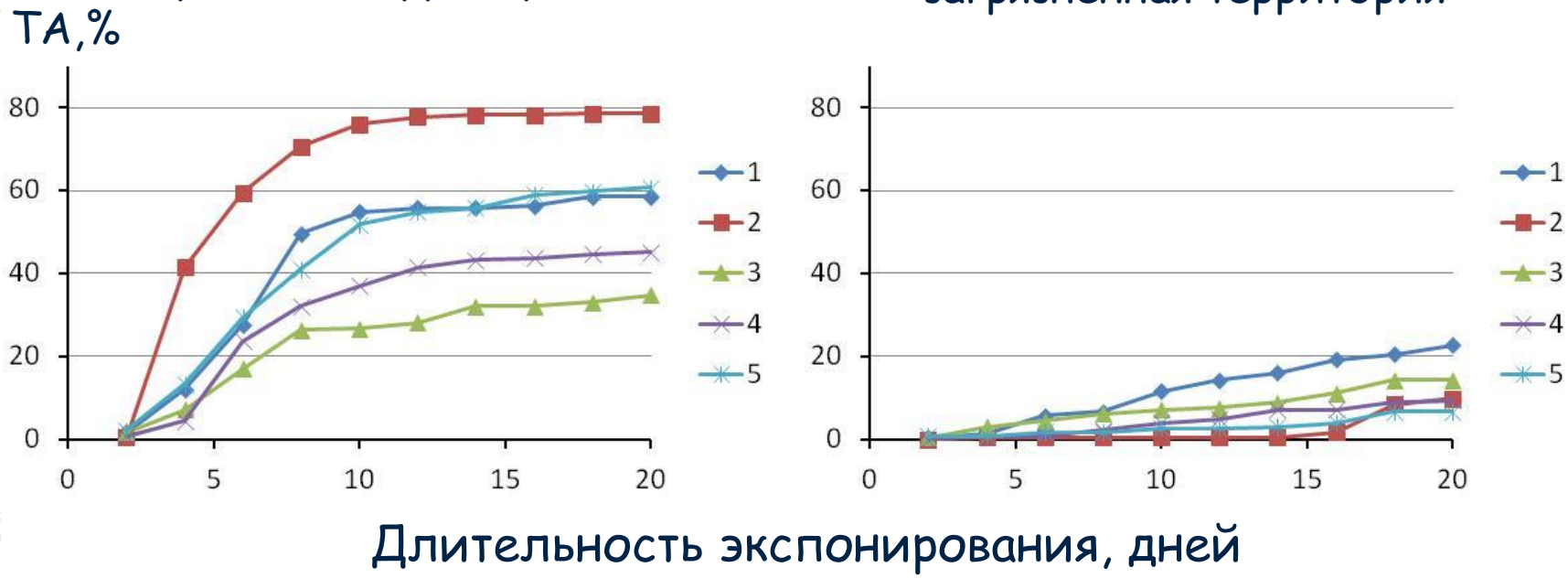
Fig. 2 – Bait-lamina test perforation (% of baits ± S.E.) at −4, 5, 14 and 24 °C and two moisture levels (water content in % of dry weight) in experiment 2 with indigenous fauna. No activity was observed at −4 °C.

BLT: теория

Временная зависимость

фоновая территория

загрязненная территория



СУМЗ, июль 2020 г., 10 сроков через 2 дня

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детритофаги

состав и структура сообщества

обилие

пространственное распределение

почва

текстура и структура

твердость, каменистость

поля концентраций репеллентов и аттрактантов

BLT

альтернативные «приманки»

погодные условия

температура

влажность

BLT: теория

Возможна ли модель?

Для каждой группы надо знать:

характерные дистанции перемещения

характерные дистанции обнаружения приманки

зависимость дистанций от разных факторов

вероятности переключения направления при обнаружении приманки

BLT: теория

The Canadian Entomologist

Vol. 107 Ottawa, Canada, December 1975 No. 12

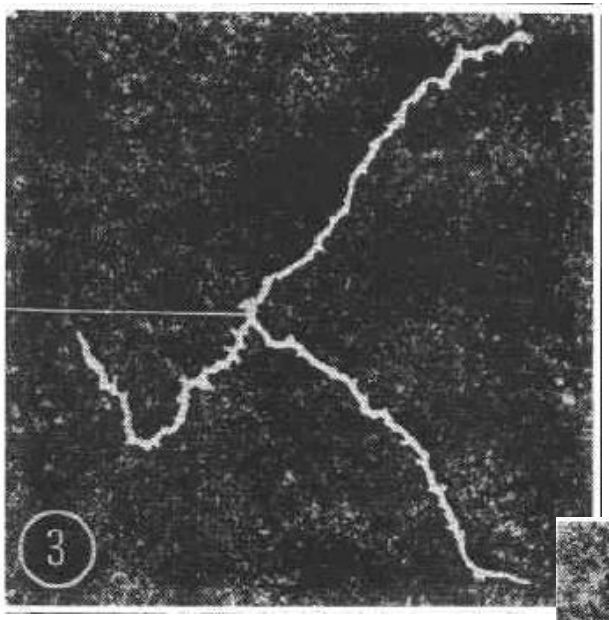
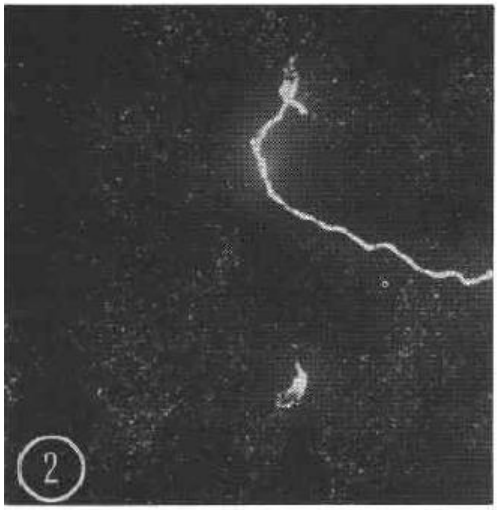
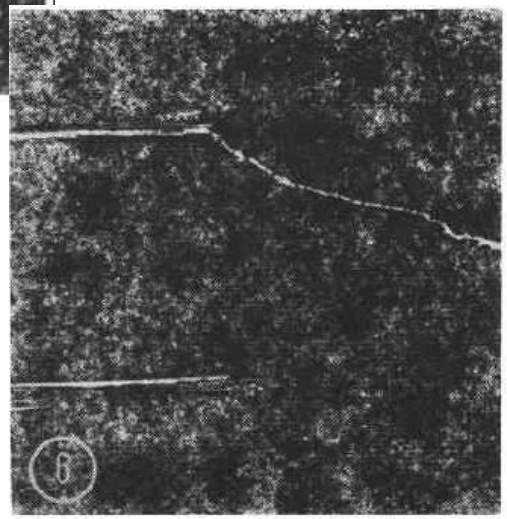
THE ORIENTATION RESPONSE OF *CTENICERA DESTRUCTOR* AND OTHER WIREWORMS (COLEOPTERA: ELATERIDAE) TO GERMINATING GRAIN AND TO CARBON DIOXIDE[1]

J. F. DOANE,[2] Y. W. LEE,[2] J. KLINGLER,[3] and N. D. WESTCOTT[2]

Abstract

Can. Ent. 107: 1233–1252 (1975)

Several species of wireworms were attracted to germinating wheat, air from flasks of germinating wheat, decomposing oatmeal, commercial CO_2 and, in addition, germinating seeds of eight other cultivated plant species. Larvae located a biological or experimental source of CO_2 by a directed movement along CO_2 gradients, from distances up to 20 cm.

Methods and apparatus for measuring small CO_2 gradients, using gas chromatography and mass spectrometry, are described. *Ctenicera destructor* (Brown) larvae apparently responded to CO_2 gradients between glass plates, that ascended on the average by 0.002% (soil) and 0.005% (agar)/cm over a distance of from 12 to 16 cm. The "sensitivity threshold" was calculated as being 1–2 ppm over the distance involved in one deflection of the head during klinotactic orientation. Attractancy was observed within a range of CO_2 concentration from about 0.036% to 1.5%. Repellent effects did not appear to be only related to concentration, but possibly were due to steepness of the gradient and(or) previous exposure to CO_2.

Passing an air stream from germinating grain over a KOH solution eliminated the attractancy of the grain by removing the CO_2 and possibly other undetected attractants. A small percentage of *C. destructor* larvae apparently oriented to an ethylene source, but it was concluded the CO_2 was the most important if not the only attractant from germinating wheat seeds.