南京農業大學 Nanjing Agricultural University 植物保护学院

昆虫分类与水生昆虫学实验室

Lab of Insect Taxonomy & Aquatic Insects

实验室简介

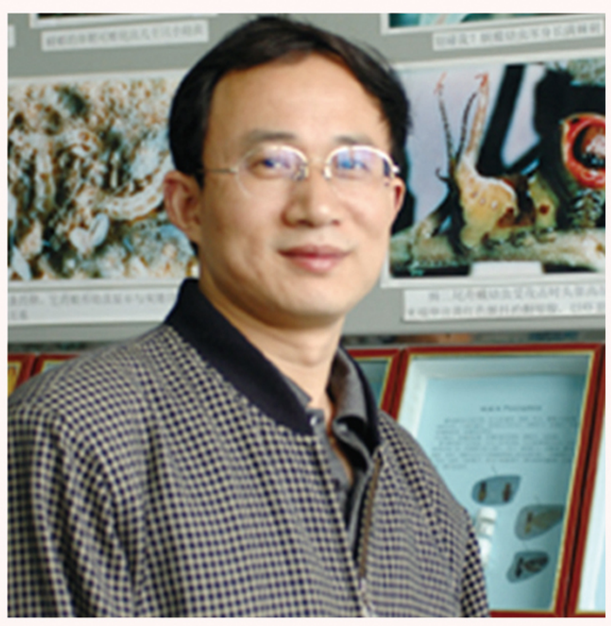
昆虫分类与水生昆虫学实验室主要从事毛翅目、半翅目（飞虱科）、弹尾纲等昆虫的分类和系统发育研究、地下害虫生态学和防治技术、以毛翅目昆虫为主的水生昆虫生物学、生态学和溪流生态学研究，以及淡水生态系统健康评价、水质生物监测与评价等应用研究。

团队负责人及团队成员

团队负责人：王备新教授; 团队成员：教师5人；在读研究生12人。

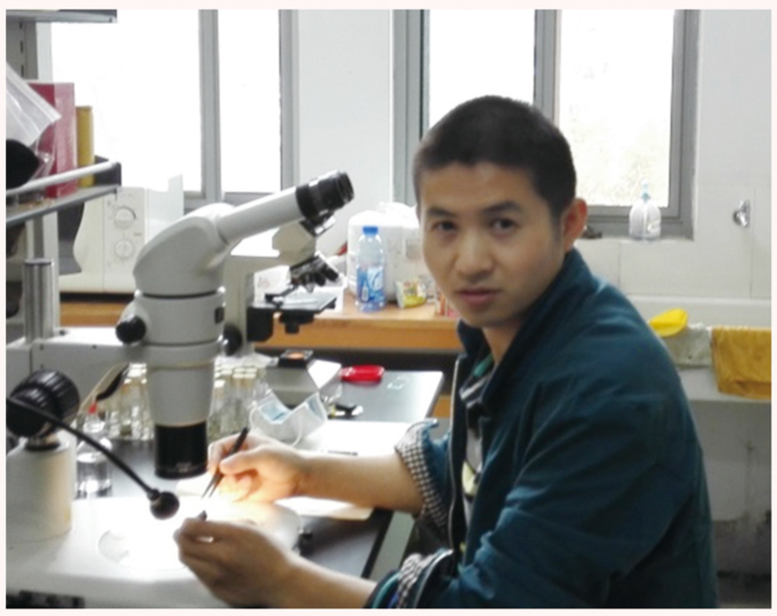
王备新 教授

张峰 副教授



孙长海 副教授

杨莲芳 教授



张杰

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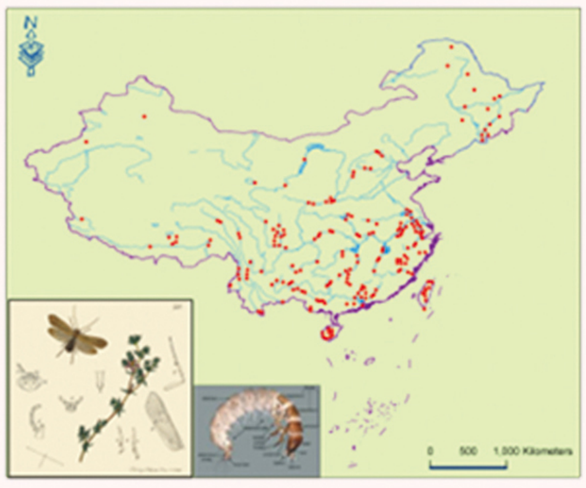
主要研究内容

1.毛翅目昆虫分类与系统发育

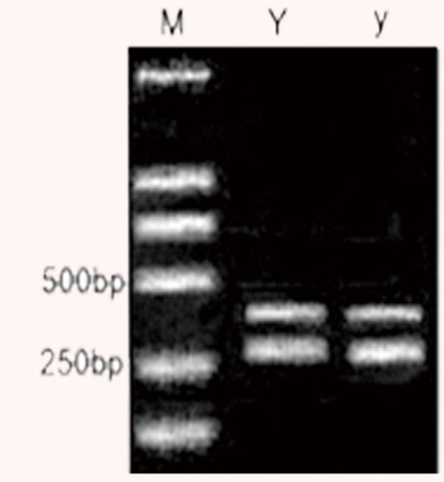
毛翅目昆虫（水生）系统分类研究内容，主要包括（1）毛翅目的物种多样性，系统演化及生物地理学：（2）毛翅目幼虫分类，及成、幼虫联系的分子生物学鉴定技术。

我校毛翅目昆虫研究起始于黄其林教授，共发表新种50个（1947-1977），该成果获农业部农业技术改进奖一等奖（1979年）。其后，由田立新、杨莲芳等教授继续主持完成“中国毛翅目昆虫系统分类研究”，共获近20余项国家自然科学基金或其他研究项目资助。自1990年至2005年五次组织水生昆虫国际合作采集活动，鉴定发表了近10个新属、600余个新种，及200余个新纪录种。将我国毛翅目种类由上世纪80年代的500余种，增加到目前的1300余种。共发表论文120余篇，主、参编书15部。1991-2001年荣获“中国毛翅目研究”国家教委科技进步二等奖等3个奖项。



毛翅目昆虫全国调查样点

褐纹石蛾Eubasilissa sp.



原双栖纹石蛾成幼虫PCR产物酶切图谱
(Y成虫；y—幼虫)

2.飞虱科分类研究

我校飞虱科分类研究起自1973年开始，1973年至1978年由黄其林教授主持，1978年后由丁锦华教授主持，1992年获批为“八五”重大项目。共发表论文70余篇，发现和命名50余新属，110余个新种，主编出版了飞虱科的中国动物志、中国经济昆虫志、3本地方志和《中国稻区常见飞虱原色图鉴》共6本专著，另参与编写昆虫区系研究的专著10册。共获国家教委科学技术进步二等奖“飞虱科分类研究获”（1987年）等4个奖项。

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3.弹尾纲形态和DNA分类、分子系统学、生物地理、物种分化及土壤动物生态

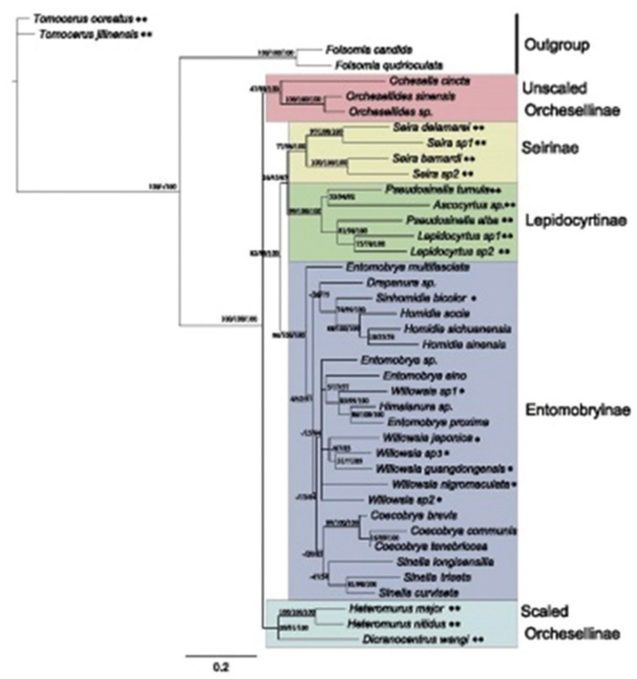


Fig. 2. Bayesian phylogeny of Entomobryidae based on concatenated dataset (16SrRNA + 18SrRNA + 28SrRNA). Node values represent parsimony bootstrap, likelihood bootstrap and posterior probabilities, respectively, with a – indicating nodes not compatible between the analyses. Species with both Iorga and dens scaled are marked with two asterisks (**). Scaled species but without dental scales are marked with an asterisk (*).

Table 3
Comparison of tree topology hypotheses using AU, SH and WSH tests in CONSEL. Monophyly constraints: (A) best tree without any constraints (Scaled Orchesellinae + (Entomobryinae + (Seirinae + Lepidocyrtinae))); (B) Orchesellinae; (C) Unscaled Orchesellinae + (Entomobryinae + (Seirinae + Lepidocyrtinae)); (D) Seirinae + Entomobryinae; (E) Willowsiini.

Hypotheses	AU	SH	WSH
A	0.508	0.930	0.517
B	0.511	0.875	0.483
C	0.444	0.847	0.450
D	2e−009	0.017	2e−004
E	3e−005	0	0

presence of scales as 0.76 and 0.45, respectively (Fig. 4). BI analysis has no related evidence. Reconstructions on some nodes are distinctly different from those on the ML tree. Several basal nodes show absolutely equivocal state.

4. Discussion

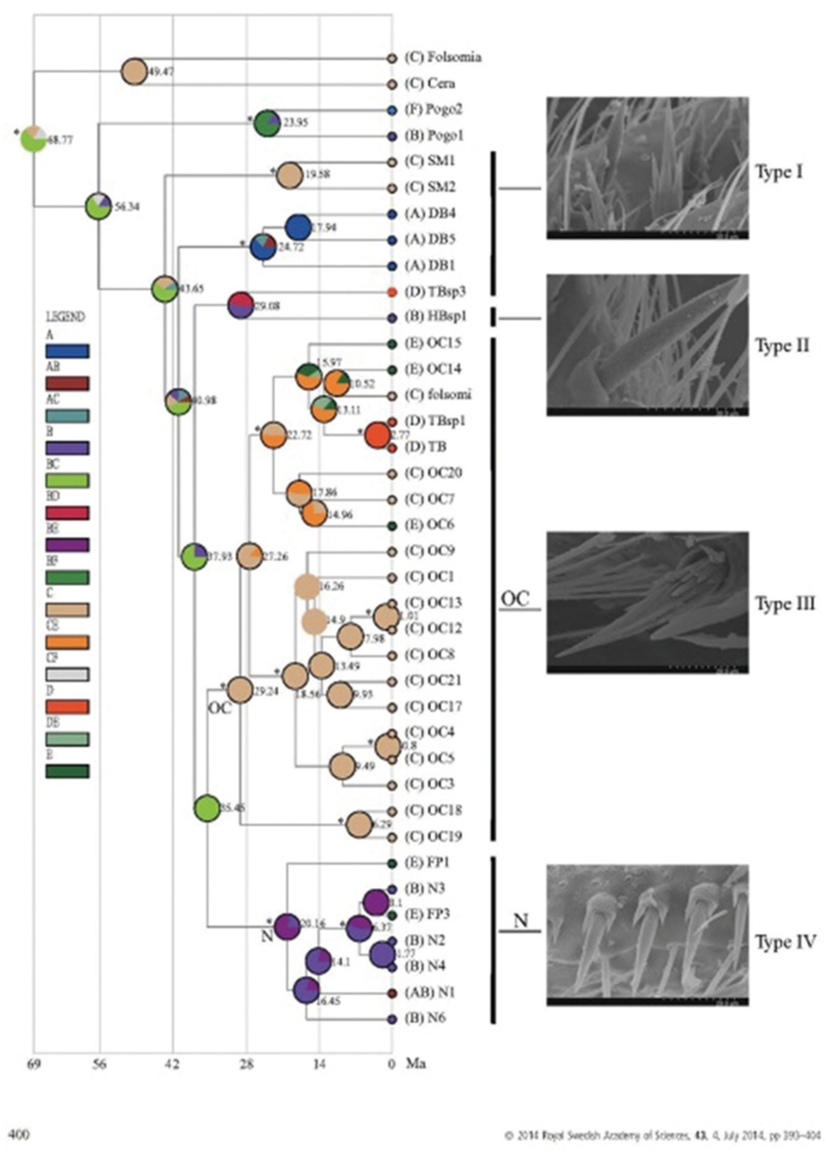
4.1. Systematics of Entomobryidae

Traditionally, groups among Entomobryidae are recognized by the ratio of abdominal segments and morphology of body scales. Ratio of abdominal segment IV/III at the midline is less than 1.8 in Orchesellinae, more than 2.0 in the other three subfamilies (Soto-Adames et al., 2008). Classification of Orchesellinae tribes mainly relies on the number of antennal segments, i.e. antennal segments 4 in Corynothricini, 5 in Heteromurini, 6 in Orchesellini. Both Heteromurini and Orchesellini have scaled and unscaled genera within them. Dental scales are absent in Entomobryinae, which is separated into Entomobryini and Willowsiini with tergal scales absent and present respectively. Both Seirinae and Lepidocyrtinae possess tergal and dental scales, with some scales pointed in the former and apically rounded in the latter. The present molecular phylogeny strongly challenges the traditional systematic viewpoints of Orchesellinae and Entomobryinae.

4.1.1. Orchesellinae

The tribal classification of Orchesellinae as widely accepted today was established by Mari-Mutt (1980a, b), with 4 tribes. Soto-Adames et al. (2008) further erected two more tribes (Bessoniellini and Nothobryini) and excluded *Capbrya* and *Hispanobrya* which were moved to a new subfamily Capbryinae. The subdivision of Orchesellinae s. l. depends on the number of antennal segments and number of chaetae on the trochanteral organ.

The molecular phylogeny presented here does not recover the monophyly of Orchesellinae in any unconstrained analysis



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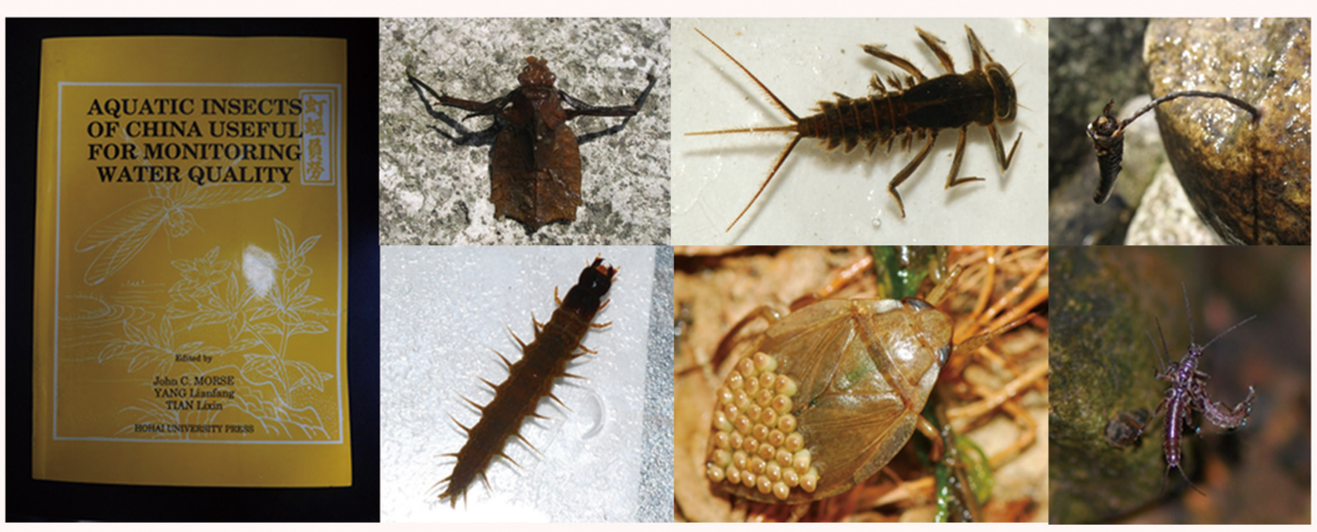
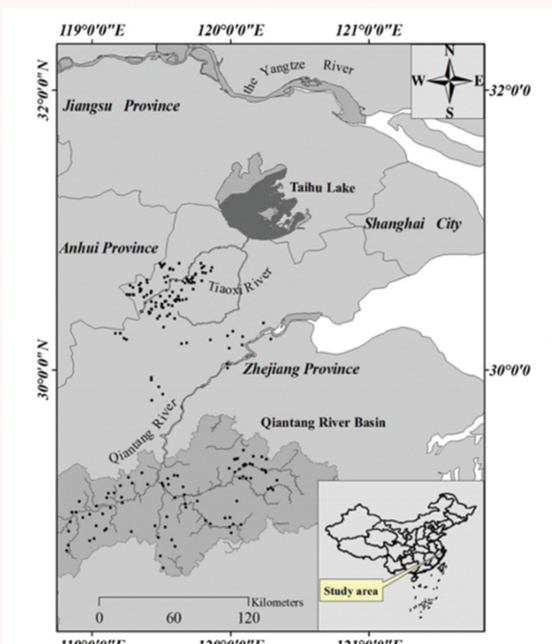
4.水质生物监测与溪流生态学研究

水生昆虫分布广、多样性高并极易采集和鉴定，具重要生态功能和较强的环境指示性，是世界上应用最广泛的水质生物评价和水生态健康评价的指示生物类群。本实验室作为国内最早开展水生昆虫水质生物监测的研究单位之一，在底栖动物耐污值、河溪生态健康评价和土地利用生态效应研究方面开展了深入研究。研究结果对我国水质生物监测与评价工作的发展起得了积极而重要的作用。



5.底栖动物耐污值研究

耐污值是表征水生昆虫环境指示性（清洁——重污染）的定量指标。采用定量（客观）的科学计算方法，建立了长三角地区204个物种（分类单元）耐污值。



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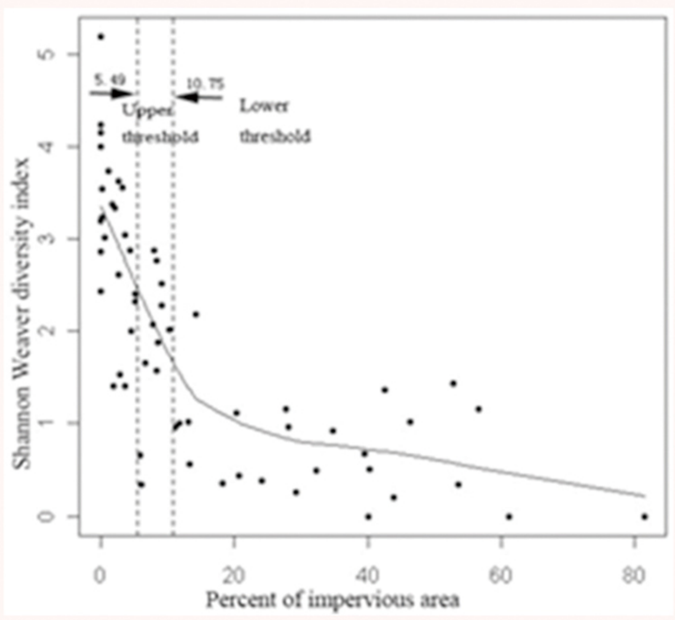
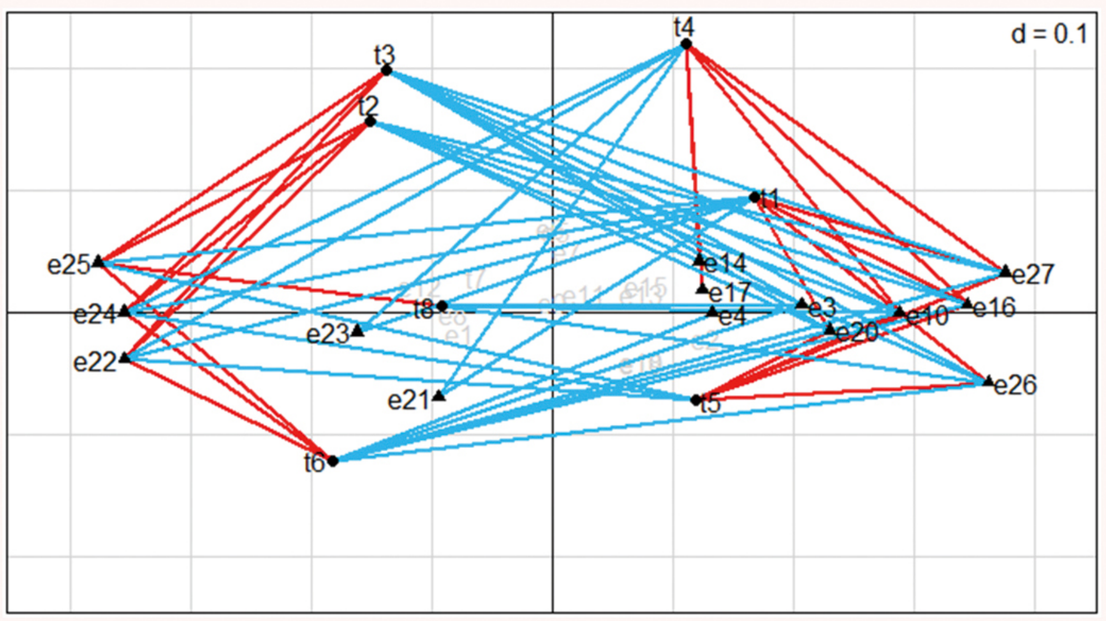
6.流域土地利用生态效应研究

流域土地利用变化是反映人类活动广度和强度的重要且关键指标。当森林或农业用地转变为城镇后即城镇化，其对河溪生态系统的影响是最强的。我们以钱塘江、苕溪流域和云南西双版纳为研究对象，提出了流域城镇化强度指标即不透水地表面积大于5.5%引起溪流生物群落的不可逆改变，以及底栖动物生物学属性对土地利用变化的响应。





底栖动物生物学属性和环境变量间的响应关系

7.溪流生态健康评价

应用底栖动物完整性指数B-IBI和“观察值/期望值（O/E）”指标评价河溪生态健康，先后完成了太湖、太湖上游苕溪流域、广西桂林漓江流域等的生态健康评价实践。

主要研究内容

国家自然科学基金项目土地利用影响溪流底栖动物群落特征的空间尺度效应研究

国家自然自然科学基金青年项目，基于形态和分子证据的长角跳科（弹尾纲）系统发育研究（31101622）

公益性行业（农业）科研专项“农田地下害虫综合防控技术研究与示范”

南京農業大學 Nanjing Agricultural University 植物保护学院

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代表性研究论文

1.Chun-Yan Qin, Jin Zhou, Yong Cao, Robert M.Hughes, Bei-Xin Wang. 2014. Quantitative tolerance values for common stream benthic macroinvertebrates in the Yangtze River Delta, Eastern China. Environ Monit Assess, 186 (9):5883-95

2.Kai Chen, Robert M. Hughes, Sheng Xu, Jie Zhang, Desuo Cai, Beixin Wang. 2014. Evaluating performance of macroinvertebrate-based adjusted and unadjusted multi-metric indices (MMI) using multi-season and multi-year samples. Ecological Indicators, Volume 36, January 2014, Pages 142-151

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7.Zhang F, Deharveng L, Greenslade P & Chen JX. 2009. Revision of Acanthocyrtus (Collembola: Entomobryidae), with description of a new genus from eastern Asia. Zoological Journal of the Linnean Society, 157: 495 2514. (SCI, 15% Zoology)

8.Zhang F.*, Yu D.Y. & Xu G.L. 2011. Transformational homology of the tergal setae during postembryonic development in the Sinella-Coecobrya group (Collembola: Entomobryidae). Contributions to Zoology, 80 (4): 213 2230. (SCI)

代表性成果（科研成果、教学成果、人才培养、社会服务）

主编出版专著10余部，相关论文发表在Frontiers in Ecology and the Environment, Hydrobiologia, International Review of Hydrobiology, Global Ecology and Biogeography, Aquatic Insects等。

建立长三角地区212个物种（分类单元）耐污值

国内最早应用底栖动物完整性指数B-IBI和“观察值/期望值（O/E）”模型评价河流（溪流）生态健康

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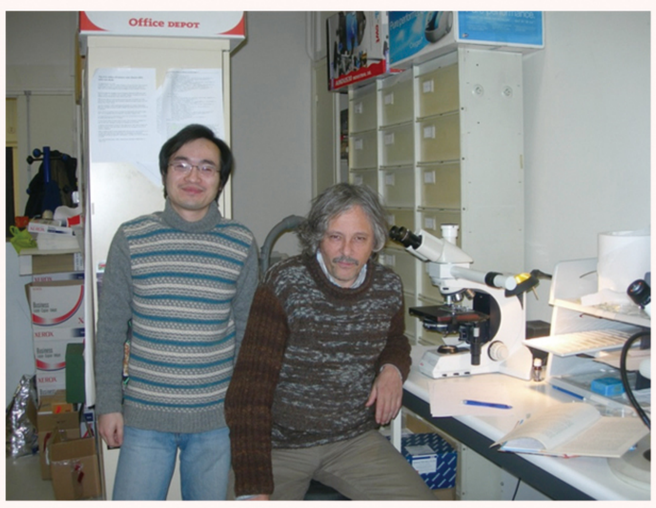
学术交流、合作情况

2010年发起并与江苏省环境监测中心、常州市环境监测中心举办了国内首届水质生物监测国际研讨会。 验室与美国、瑞典、加拿大和韩国等有着广泛的交流合作。

长期与法国国立自然历史博物馆、中科院北京动物

所等国际著名分类和进化实验室合作。



聘　书

LETTER OF APPOINTMENT

编　号：ZSXZⅣ040

兹聘任 张　峰 博士为“钟山学术新秀”，聘期四年，自 2013 年 9 月 1 日至 2017 年 8 月 31 日。

南京农业大学
校　长

南京农业大学
二〇一三年九月

Environ Monit Assess
DOI 10.1007/s10661-014-3826-2

Quantitative tolerance values for common stream benthic macroinvertebrates in the Yangtze River Delta, Eastern China

Chun-Yan Qin · Jin Zhou · Yong Cao · Yong Zhang · Robert M. Hughes · Bei-Xin Wang

Received: 7 November 2013 / Accepted: 8 May 2014

Abstract Aquatic organisms' tolerance to water pollution is widely used to monitor and assess freshwater ecosystem health. Tolerance values (TVs) estimated based on statistical analyses of species-environment relationships are more objective than those assigned by expert opinion. Region-specific TVs are the basis for developing accurate bioassessment metrics particularly in developing countries, where both aquatic biota and their responses to human disturbances have been poorly documented. We used principal component analysis to derive a synthetic gradient for four stressor variables (total nitrogen, total phosphorus, dissolved oxygen, and % silt) based on 286 sampling sites in the Taihu Lake and Qiantang River basins (Yangtze River Delta), China. We used the scores of taxa on the first principal component (PC1), which explained 49.8 % of the variance, to estimate the tolerance values (TV_r) of 163 macroinvertebrates taxa that were collected from at least 20 sites, 81 of which were not included in the Hilsenhoff TV lists (TV_h) of 1987. All estimates were scaled into the range of 1–10 as in TV_h. Of all the taxa with different TVs, 46.3 % of TV_r were lower and 52.4 % were higher than TV_h. TV_r were significantly ($p<0.01$, Fig. 2), but weakly ($r^2=0.34$), correlated with TV_h. Seven biotic metrics based on TV_r were more strongly correlated with the main stressors and were more effective at discriminating references sites from impacted sites than those based on TV_h. Our results highlight the importance of developing region-specific TVs for macroinvertebrate-based bioassessment and to facilitate assessment of streams in China, particularly in the Yangtze River Delta.

Keywords Bioassessment · Biomonitoring · Streams · Yangtze River · Macroinvertebrate

C.-Y. Qin · J. Zhou · Y. Zhang · B.-X. Wang (✉)
Laboratory of Aquatic Insects and Stream Ecology, Department of Entomology, Nanjing Agricultural University, Nanjing 210095 Jiangsu, People's Republic of China
e-mail: wangbeixin@njau.edu.cn

Y. Cao
Illinois Natural History Survey, Institute of Natural Resource Sustainability, University of Illinois at Urbana-Champaign, 1816 South Oak Street, Champaign, IL 61820, USA

R. M. Hughes
Amnis Opes Institute and Department of Fisheries and Wildlife, Oregon State University, 200 SW 35th Street, Corvallis, OR 97333, USA

Published online: 28 May 2014

Introduction

Bioassessment plays a key role in water resource and water quality management (Rosenberg and Resh 1993; Barbour et al. 1999; Birk and Hering 2006). Macroinvertebrate-based multimetric indices have been widely used for stream assessments (Rosenberg and Resh 1993; Karr and Chu 1999). Of these indices, biotic metrics based on the tolerance values (TVs) of taxa, such as those described by Armitage et al. (1983) and Hilsenhoff (1987), are among the most sensitive. Several macroinvertebrate TV lists have been applied beyond the region for which they were originally derived. For example, TVs derived for the USA and