

第57卷 | 第2期 | Vol.57 | No. 2

CHINESE JOURNAL OF  
APPLIED ENTOMOLOGY



QK2023748

双月刊

2

# 应用昆虫学报

全国中文核心期刊 / 全国科技核心期刊

2020



ISSN 2095-1353



03>



中国科学院动物研究所 / 中国昆虫学会 主办  
福建农林大学植物保护学院 / 广东省生物资源应用研究所 协办

万方数据

# 应用昆虫学报 (YINGYONG KUNCHONG XUEBAO)

第 57 卷 第 2 期 Chinese Journal of Applied Entomology 2020 年 3 月 26 日

## 目 次

### 中国昆虫学 70 年前沿与综述专栏

233 农业害虫跨越渤海的迁飞规律与控制策略 周 燕 张浩文 吴孔明	363 短时高温对绿豆象各虫态生长发育的影响 张天浩 惠 琴 赵义涛 张仙红
244 中国入侵昆虫预防与控制研究进展 彭 露 万方浩 侯有明	371 小菜蛾成虫对健康和机械损伤薄荷的嗅觉反应 王志宇 郝 赤 王琛柱 闫喜中
259 中国 70 年来蜜蜂生物学研究进展 曾志将	379 不同地理种群红棕象甲前胸背板色斑分析 王桂花 周宇轩 林 成 侯有明
265 昆虫翅多型的分子调控机制研究进展 袁一杨 陈 新 王竹承 戈 峰	392 茶翅蝽生长发育、繁殖及若虫各龄期形态特征研究 詹海霞 陈菊红 米倩倩 李文敬 张 峰 张金平
272 植物介导的昆虫内共生菌水平传播及其对宿主生物学特性的影响 刘 媛 凡泽云 栗 颖 彭 晶 陈心怡 邱宝利	400 棉露尾甲在不同饲料上的生长发育及繁殖力比较 梁潇以 黄 青 赵 鹏 蔡万伦 华红霞 赵 景
284 中国𫌀 目昆虫系统分类研究进展 杜予州	406 广重粉蝶对烟粉虱的捕食作用研究 罗小龙 韩阅叶 梁建锋 周 镇 王兴民
298 昆虫色素研究进展 孙明霞 殷海玮 王京霞 梁爱萍	413 草履蚧对五种网蝽捕食作用研究 罗 优 肖 峰 赵如娜 殷郑艳 李太美 郭 峰 吴学三 陈文龙

### 研究论文

310 飞蝗载脂蛋白受体基因 <i>LmLPR</i> 的表达及功能分析 赵艺妍 赵小明 杨 洋 马恩波 张建珍 刘卫敏	427 杀虫剂亚致死浓度对普通大丽马繁殖的影响 罗亚丽 施 丹 乔雪莹 但建国
321 蜂王上颚腺信息素对中华蜜蜂、意大利蜜蜂雄蜂选择行为的影响 刘俊峰 何玉珠 廖 蓉 谢昌林 何旭江 曾志将	434 十种杀螨剂对朱砂叶螨不同发育阶段的毒力比较 高德良 宋化稳 庄治国 徐娜娜 胡尊纪 庄占兴
329 飞蝗对两种禾本科植物挥发物的触角电位和行为反应 刘永梅 李瑞莹 张学尧 张建珍 马恩波 吴海花	442 嗜虫书虱种群增长模型的研究 王争艳 何梦婷 鲁玉杰
337 迁飞性昆虫甜菜夜蛾遗传分化研究 滕海媛 袁永达 张澍 常晓丽 王冬生	450 贺兰山榆跳象幼虫空间分布特征及影响因子分析 李欣芸 冯亚萍 安 旭 杨贵军
348 梨小食心虫与苹果蠹蛾为害对苹果果实防御酶活性的影响 母小庆 林 萍 李 贞 李亦松	460 超高效液相色谱-串联质谱法检测小菜蛾血清中的 $\beta$ -蜕皮激素 孙诗晴 王念猛 薛超彬
355 寄主植物对亚洲玉米螟生长发育及雄蛾保护酶活性的影响 魏 鑫 陈日翌	466 昆虫蜜露研究方法 张蓓蓓 张泽龙 何海芳 李静静 白素芬 闫凤鸣

封面照片:草地贪夜蛾 *Spodoptera frugiperda* (Smith)成虫-----张润志 摄,文(328)



# Contents

Vol. 57 No. 2 March 2020

## Special Column

- 233 Frequency of migration of agricultural pests across the Bohai Sea in northern China and a control strategy for these species  
ZHOU Yan, ZHANG Hao-Wen, WU Kong-Ming
- 244 Research progress on prevention and control of invasive insects in China  
PENG Lu, WAN Fang-Hao, HOU You-Ming
- 259 Advances in honeybee biology in China over the past 70 years  
ZENG Zhi-Jiang
- 265 Molecular regulatory mechanism of wing polymorphism in insects  
YUAN Yi-Yang, CHEN Xin, WANG Zhu-Cheng, GE Feng
- 272 Plant-mediated horizontal transmission of insect endosymbionts and their biological effects on recipients  
LIU Yuan, FAN Ze-Yun, LI Ying, PENG Jing, CHEN Xin-Yi, QIU Bao-Li
- 284 Advances in Plecoptera systematics in China  
DU Yu-Zhou
- 298 Progress in research on insect pigments  
SUN Ming-Xia, YIN Hai-Wei, WANG Jing-Xia, LIANG Ai-Ping

## Research Articles

- 310 Expression and functional analysis of the *Locusta migratoria* lipophorin receptor gene, *LmLPR*  
ZHAO Yi-Yan, ZHAO Xiao-Ming, YANG Yang, MA En-Bo, ZHANG Jian-Zhen, LIU Wei-Min
- 321 Effects of queen mandibular pheromone on the behavioral responses of *Apis cerana cerana* and *Apis mellifera ligustica* drones  
LIU Jun-Feng, HE Yu-Zhu, LIAO Rong, XIE Chang-Lin, HE Xu-Jiang, ZENG Zhi-Jiang
- 329 Electroantennogram and behavioral responses of *Locusta migratoria* to two graminaceous plant volatiles  
LIU Yong-Mei, LI Rui-Ying, ZHANG Xue-Yao, ZHANG Jian-Zhen, MA En-Bo, WU Hai-Hua
- 337 Genetic differentiation among populations of the migratory insect *Spodoptera exigua*  
TENG Hai-Yuan, YUAN Yong-Da, ZHANG Tian-Shu, CHANG Xiao-Li, WANG Dong-Sheng
- 348 Effects of damage by *Grapholitha molesta* and *Cydia pomonella* on host plant defensive enzyme activity  
MU Xiao-Qing, LIN Pin, LI Zhen, LI Yi-Song
- 355 Effects of host plants on the development and protective enzyme activity of *Ostrinia furnacalis*  
WEI Xin, CHEN Ri-Zhao
- 363 Effects of short-term heat stress on different developmental stages of *Callosobruchus chinensis* (L.) (Coleoptera: Bruchidae)  
ZHANG Tian-Hao, HUI Qin, ZHAO Yi-Tao, ZHANG Xian-Hong

- 371 Olfactory responses of *Plutella xylostella* adults to intact and mechanically damaged *Mentha spicata* plants  
WANG Zhi-Yu, HAO Chi, WANG Chen-Zhu, YAN Xi-Zhong
- 379 Distribution of the pronotum spot pattern in different geographical populations of *Rhyncophorus ferrugineus* (Olivier)  
WANG Gui-Hua, ZHOU Yu-Xuan, LIN Chen, HOU You-Ming
- 392 Development, fecundity and nymph morphology of the brown marmorated stink bug *Halyomorpha halys* (Stål)  
ZHAN Hai-Xia, CHEN Ju-Hong, MI Qian-Qian, LI Wen-Jing, ZHANG Feng, ZHANG Jin-Ping
- 400 The development and reproduction of *Haptoncus luteolus* on three different diets  
LIANG Xiao-Yi, HUANG Qing, ZHAO Peng, CAI Wan-Lun, HUA Hong-Xia, ZHAO Jing
- 406 Predation of *Semidalis aleyrodiiformis* (Stephens) on *Bemisia tabaci* (Gennadius)  
LUO Xiao-Long, HAN Yue-Ye, LIANG Jian-Feng, ZHOU Zhen, WANG Xing-Min
- 413 Predation on five species of Tingidae (Hemiptera) by *Stethoconus japonicus*  
LUO You, XIAO Feng, ZHAO Ru-Na, YIN Zheng-Yan, LI Tai-Mei, GUO Feng, WU Xue-San, CHEN Wen-Long
- 421 Distribution of *Wolbachia* in *Trialeurodes ricini* Misra  
SONG Yue, FAN Yong-Liang, WU Li-Juan, ZHANG Zhan-Feng, LIU Xiao-Feng, CAO Jing-Yang, LIU Shu-Min, LIU Tong-Xian
- 427 Sublethal effect of insecticides on reproduction of *Megalurothrips usitatus* (Bagrall) (Thysanoptera: Thripidae)  
LUO Ya-Li, SHI Dan, QIAO Xue-Ying, DAN Jian-Guo
- 434 Relative toxicity of ten acaricides against different developmental stages of *Tetranychus cinnabarinus*  
GAO De-Liang, SONG Hua-Wen, ZHUANG Zhi-Guo, XU Na-Na, HU Zun-Ji, ZHUANG Zhan-Xing
- 442 A population growth model for *Liposcelis entomophila* (Enderlein) (Pscooptera: Liposcelididae)  
WANG Zheng-Yan, HE Meng-Ting, LU Yu-Jie
- 450 Spatial distribution pattern of the larvae of *Orchestes alni* and influence factors in Helan Mountains  
LI Xin-Yun, FENG Ya-Ping, AN Xu, YANG Gui-Jun
- 460 A method for using UPLC-MS/MS to measure  $\beta$ -ecdysone in *Plutella xylostella*  
SUN Shi-Qing, WANG Nian-Meng, XUE Chao-Bin

## Techniques and Methods

- 466 Review of insect honeydew research methods  
ZHANG Bei-Bei, ZHANG Ze-Long, HE Hai-Fang, LI Jing-Jing, BAI Su-Fen, YAN Feng-Ming



# Contents

Vol. 57 No. 2 March 2020

## Special Column

- 233 Frequency of migration of agricultural pests across the Bohai Sea in northern China and a control strategy for these species  
ZHOU Yan, ZHANG Hao-Wen, WU Kong-Ming
- 244 Research progress on prevention and control of invasive insects in China  
PENG Lu, WAN Fang-Hao, HOU You-Ming
- 259 Advances in honeybee biology in China over the past 70 years  
ZENG Zhi-Jiang
- 265 Molecular regulatory mechanism of wing polymorphism in insects  
YUAN Yi-Yang, CHEN Xin, WANG Zhu-Cheng, GE Feng
- 272 Plant-mediated horizontal transmission of insect endosymbionts and their biological effects on recipients  
LIU Yuan, FAN Ze-Yun, LI Ying, PENG Jing, CHEN Xin-Yi, QIU Bao-Li
- 284 Advances in Plecoptera systematics in China  
DU Yu-Zhou
- 298 Progress in research on insect pigments  
SUN Ming-Xia, YIN Hai-Wei, WANG Jing-Xia, LIANG Ai-Ping

## Research Articles

- 310 Expression and functional analysis of the *Locusta migratoria* lipophorin receptor gene, *LmLPR*  
ZHAO Yi-Yan, ZHAO Xiao-Ming, YANG Yang, MA En-Bo, ZHANG Jian-Zhen, LIU Wei-Min
- 321 Effects of queen mandibular pheromone on the behavioral responses of *Apis cerana cerana* and *Apis mellifera ligustica* drones  
LIU Jun-Feng, HE Yu-Zhu, LIAO Rong, XIE Chang-Lin, HE Xu-Jiang, ZENG Zhi-Jiang
- 329 Electroantennogram and behavioral responses of *Locusta migratoria* to two graminaceous plant volatiles  
LIU Yong-Mei, LI Rui-Ying, ZHANG Xue-Yao, ZHANG Jian-Zhen, MA En-Bo, WU Hai-Hua
- 337 Genetic differentiation among populations of the migratory insect *Spodoptera exigua*  
TENG Hai-Yuan, YUAN Yong-Da, ZHANG Tian-Shu, CHANG Xiao-Li, WANG Dong-Sheng
- 348 Effects of damage by *Grapholitha molesta* and *Cydia pomonella* on host plant defensive enzyme activity  
MU Xiao-Qing, LIN Pin, LI Zhen, LI Yi-Song
- 355 Effects of host plants on the development and protective enzyme activity of *Ostrinia furnacalis*  
WEI Xin, CHEN Ri-Zhao
- 363 Effects of short-term heat stress on different developmental stages of *Callosobruchus chinensis* (L.) (Coleoptera: Bruchidae)  
ZHANG Tian-Hao, HUI Qin, ZHAO Yi-Tao, ZHANG Xian-Hong

- 371 Olfactory responses of *Plutella xylostella* adults to intact and mechanically damaged *Mentha spicata* plants  
WANG Zhi-Yu, HAO Chi, WANG Chen-Zhu, YAN Xi-Zhong
- 379 Distribution of the pronotum spot pattern in different geographical populations of *Rhyncophorus ferrugineus* (Olivier)  
WANG Gui-Hua, ZHOU Yu-Xuan, LIN Chen, HOU You-Ming
- 392 Development, fecundity and nymph morphology of the brown marmorated stink bug *Halyomorpha halys* (Stål)  
ZHAN Hai-Xia, CHEN Ju-Hong, MI Qian-Qian, LI Wen-Jing, ZHANG Feng, ZHANG Jin-Ping
- 400 The development and reproduction of *Haptoncus luteolus* on three different diets  
LIANG Xiao-Yi, HUANG Qing, ZHAO Peng, CAI Wan-Lun, HUA Hong-Xia, ZHAO Jing
- 406 Predation of *Semidalis aleyrodiiformis* (Stephens) on *Bemisia tabaci* (Gennadius)  
LUO Xiao-Long, HAN Yue-Ye, LIANG Jian-Feng, ZHOU Zhen, WANG Xing-Min
- 413 Predation on five species of Tingidae (Hemiptera) by *Stethoconus japonicus*  
LUO You, XIAO Feng, ZHAO Ru-Na, YIN Zheng-Yan, LI Tai-Mei, GUO Feng, WU Xue-San, CHEN Wen-Long
- 421 Distribution of *Wolbachia* in *Trialeurodes ricini* Misra  
SONG Yue, FAN Yong-Liang, WU Li-Juan, ZHANG Zhan-Feng, LIU Xiao-Feng, CAO Jing-Yang, LIU Shu-Min, LIU Tong-Xian
- 427 Sublethal effect of insecticides on reproduction of *Megalurothrips usitatus* (Bagrall) (Thysanoptera: Thripidae)  
LUO Ya-Li, SHI Dan, QIAO Xue-Ying, DAN Jian-Guo
- 434 Relative toxicity of ten acaricides against different developmental stages of *Tetranychus cinnabarinus*  
GAO De-Liang, SONG Hua-Wen, ZHUANG Zhi-Guo, XU Na-Na, HU Zun-Ji, ZHUANG Zhan-Xing
- 442 A population growth model for *Liposcelis entomophila* (Enderlein) (Pscooptera: Liposcelididae)  
WANG Zheng-Yan, HE Meng-Ting, LU Yu-Jie
- 450 Spatial distribution pattern of the larvae of *Orchestes alni* and influence factors in Helan Mountains  
LI Xin-Yun, FENG Ya-Ping, AN Xu, YANG Gui-Jun
- 460 A method for using UPLC-MS/MS to measure  $\beta$ -ecdysone in *Plutella xylostella*  
SUN Shi-Qing, WANG Nian-Meng, XUE Chao-Bin

## Techniques and Methods

- 466 Review of insect honeydew research methods  
ZHANG Bei-Bei, ZHANG Ze-Long, HE Hai-Fang, LI Jing-Jing, BAI Su-Fen, YAN Feng-Ming