

2019—2023 年天津市蚊生态学监测 及病毒携带情况分析

李世豪^{1,2}, 秦娜², 王伟², 李培羽², 朱红¹

1. 天津医科大学公共卫生学院流行病与卫生统计学系 天津市环境营养与人群健康重点实验室
环境营养与人群健康国际联合研究中心, 天津 300070; 2. 天津市疾病预防控制中心病媒生物科, 天津 300011

摘要:目的 了解天津市 2019—2023 年蚊种构成、密度、季节消长及蚊虫带毒情况, 为降低蚊密度和控制蚊传疾病提供参考依据。方法 依据《天津市病媒生物防制监测工作方案》, 每年 4—11 月在天津市 16 个区采用诱蚊灯法进行成蚊数量监测, 以居民区、公园、医院、牲畜棚、农户等生境类型作为监测点。此外, 6—10 月再采用诱蚊灯法、诱蚊诱卵器法等方法捕捉成蚊或蚊幼。运用反转录聚合酶链式反应(RT-PCR)技术检测样本中是否存在流行性乙型脑炎病毒及登革病毒。结果 2019—2023 年天津市共布放诱蚊灯 12 641 台次, 捕获雌蚊 54 870 只, 平均蚊密度 0.72 只/(台·h), 其中淡色库蚊 52 569 只(占 95.81%), 其次为白纹伊蚊 1 402 只(占 2.56%)。2019—2023 年间, 蚊密度总体呈下降趋势。每年以 7 月蚊密度最高, 整体呈单峰分布。各生境类型中, 以牲畜棚的蚊密度最高, 为 1.45 只/(台·h), 其次是农户 0.96 只/(台·h), 医院最低, 为 0.42 只/(台·h)。不同生境均以淡色库蚊为优势蚊种。淡色库蚊及白纹伊蚊中均未检出流行性乙型脑炎病毒及登革病毒。结论 天津市优势蚊种为淡色库蚊, 6—9 月为蚊虫密度控制的关键期。应重点改善牲畜棚的环境条件, 根据蚊虫种群分布、密度变化及季节消长规律实施有针对性的蚊媒控制策略。

关键词:蚊密度; 监测; 病毒携带; 天津市

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Monitoring of mosquito ecology and analysis of virus carriage in Tianjin from 2019 to 2023

LI Shi-hao*, QIN Na, WANG Wei, LI Pei-yu, ZHU Hong

*Department of Epidemiology and Health Statistics, School of Public Health, Tianjin Medical University; Tianjin Key Laboratory of Environmental Nutrition and Population Health; International Joint Research Center for Environmental Nutrition and Population Health, Tianjin 300070, China

Abstract: **Objective** To understand the species composition, density, seasonal fluctuation of mosquitoes and the virus-carrying situation in Tianjin from 2019 to 2023, and to provide a reference for reducing mosquito density and controlling mosquito-borne diseases. **Methods** According to the "Monitoring Work Plan for Vector Control in Tianjin", from April to November each year, the number of adult mosquitoes was monitored in 16 districts of Tianjin using the mosquito-attracting lamp method. Habitats such as residential areas, parks, hospitals, livestock sheds, and rural households were selected as monitoring sites. In addition, from June to October, adult mosquitoes or mosquito larvae were captured using methods such as the mosquito-attracting lamp method and the mosquito-and-egg trap method. Reverse transcription polymerase chain reaction (RT-PCR) technology was used to detect the presence of Japanese encephalitis virus and dengue virus in the samples. **Results** From 2019 to 2023, a total of 12 641 mosquito-attracting lamps were deployed in Tianjin, and 54 870 female mosquitoes were captured, with an average mosquito density of 0.72 mosquitoes/(lamp·h). Among them, 52 569 were *Culex pipiens pollens* (accounting for 95.81%), followed by 1 402 *Aedes albopictus* (accounting for 2.56%). From 2019 to 2023, the overall mosquito density showed a downward trend. The mosquito density was the highest in July each year, showing a single-peak distribution. Among different habitats, the mosquito density was the highest in livestock sheds, reaching 1.45 mosquitoes/(lamp·h), followed by rural households at 0.96 mosquitoes/(lamp·h), and the lowest in hospitals at

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作者简介:李世豪(1995—),男,本科,初级医师,研究方向:病媒生物防治

通信作者:朱红, E-mail: zhuhong@tmu.edu.cn

0.42 mosquitoes/(lamp·h). *Culex pipiens pollens* was the dominant mosquito species in all habitats. Neither Japanese encephalitis virus nor dengue virus was detected in *Culex pipiens pollens* or *Aedes albopictus*. **Conclusion** The dominant mosquito species in Tianjin is *Culex pipiens pollens*, and the key period for mosquito density control is from June to September. Priority should be given to improving the environmental conditions of livestock sheds, and targeted mosquito-vector control strategies should be implemented according to the mosquito population distribution, density changes, and seasonal fluctuation patterns.

Keywords: Mosquito density; Monitoring; Virus carriage; Tianjin

病媒生物是指能够直接或间接传播人类疾病的生物,其中蚊是危害最严重的病媒昆虫,它不仅骚扰吸血而且传播多种疾病,例如疟疾、登革热、乙脑、丝虫病等^[1-3]。近年来,随着全球气候变暖导致生态环境改变,蚊传疾病传播范围更加广泛^[4],世界范围内的虫媒传染病侵害不断加剧。在全球范围内,仅伊蚊传播的登革热疾病每年估计就有 3.9 亿人感染^[5],登革热也被世卫组织列为“全球十大健康威胁”之一^[6]。蚊虫及其传播的疾病是影响人类大多数人口的全球性公共卫生威胁^[7]。近些年,天津市登革热输入病例时有发生,易引发本土病例,并且作为乙脑的自然疫源地,发生过乙脑的本土病例,且缺乏相应的监测及病原背景资料。天津气候条件适合蚊虫孳生,为了控制蚊虫密度,及时发现病毒携带情况,减少蚊媒传染病的发生与流行,进一步科学开展密度监测及病毒检测,本文对天津市 2019—2023 年的蚊密度及病毒携带情况进行分析,结果如下。

1 材料与方法

1.1 蚊密度监测

1.1.1 数据来源 来自天津市疾病预防控制中心(简称中心)2019—2023 年病媒生物监测数据。

1.1.2 监测方法 依据《天津市病媒生物防制监测工作方案》,在天津的 16 个区使用《病媒生物密度监测方法蚊虫》GB/T 23797—2020 中规定的诱蚊灯法^[8]进行监测,蚊密度计算公式如下。

$$\text{蚊密度}[\text{只}/(\text{台}\cdot\text{h})]=\frac{\text{捕获雌蚊数}(\text{只})}{\text{布灯数}(\text{台})\times\text{诱蚊小时数}(\text{h})}$$

1.1.3 监测时间 每年 4—11 月开展监测,每月监测 2 次,分上下半月,2 次监测之间应大于等于 15 d,遇风力超过 5 级及下雨的天气,监测时间顺延直至符合作业条件。

1.2 病原学检测

1.2.1 标本采集 库蚊采集。每区每年 6—10 月,尽量选择养猪场及其周边水域丰富的环境作为采样点,如无养猪场,选择蚊密度监测点作为采样点。使用诱蚊灯或灭蚊磁在夜间诱捕成蚊,收集后置于 -20℃ 经冰冻,取出后迅速进行蚊种鉴定和分类计数,并剔除雄蚊。伊蚊采集。每区每年 6—10 月,选择白纹伊蚊(*Aedes albopictus*)的孳生地,如盆罐、竹节、树洞等。采

用诱蚊诱卵器、挥网法和勺捞法采集成蚊和蚊幼虫,经蚊种鉴定和分类计数,剔除雄蚊。

1.2.2 病毒检测 蚊虫标本收集后采用液氮保存送至中心微生物实验室,后者对标本进行研磨离心,并提取核酸,采用 RT-PCR 方法对登革热病毒及乙脑病毒进行检测并进行电泳分析,阳性结果进行基因测序或分类鉴定。

1.3 统计分析 使用 Excel 2007 软件进行数据录入,采用 SPSS 24.0 软件进行资料分析,采用 Fisher 确切概率法考察蚊种构成比是否存在年度差异,采用非线性回归分析蚊密度的影响因素,检验水准 $\alpha=0.05$ 。

2 结果

2.1 生态学监测结果

2.1.1 不同年份成蚊密度及蚊种构成 2019—2023 年天津市共布放诱蚊灯 12 641 台次,捕获雌蚊 54 870 只,其中,淡色库蚊(*Culex pipiens pallens*) 52 569 只,占 95.81%,其次是白纹伊蚊 1 402 只,占 2.56%,中华按蚊(*Anopheles sinensis*) 883 只,占 1.61%,三带喙库蚊(*Culex tritaeniorhynchus*) 16 只,占 0.02%。平均密度为 0.72 只/(台·h),2019 年蚊密度最高,为 0.91 只/(台·h),之后蚊密度逐年降低至 2022 年的 0.59 只/(台·h),2023 年蚊密度略有回升,为 0.65 只/(台·h)。不同年份蚊种构成比差异有统计学意义($P<0.001$),见表 1。

2.1.2 不同生境、季节成蚊密度及蚊种构成 5 类生境均以淡色库蚊为优势蚊种,次要蚊种牲畜棚为中华按蚊,其它 4 类生境为白纹伊蚊,见表 2。蚊密度从高到低依次为牲畜棚 1.52 只/(台·h)、农户 0.96 只/(台·h)、公园 0.65 只/(台·h)、医院 0.42 只/(台·h)、居民区 0.39 只/(台·h)。2019—2023 年天津市蚊密度季节消长总体呈现单峰分布,密度高峰集中在 6—9 月,见图 1;从蚊种角度看,淡色库蚊、三带喙库蚊的密度高峰出现在 7 月,白纹伊蚊密度高峰出现在 8 月,而中华按蚊密度高峰在 6—9 月,见图 2。月份与成蚊密度呈非线性关系,拟合非线性回归方程为 $\hat{y} = -804.92 - 548.99t - 94.45t^2 - 14.62t + 94.24\chi^2 - 1.85s_1 - 1.47s_2 - 1.85s_3 - 0.89s_4$, 其中 \hat{y} 为蚊密度的预测值, t 代表研究区间内的第几个月, x 为月份, s 代表生境类型(其中

以牲畜棚为参照, s_1 = 居民区, s_2 = 公园, s_3 = 医院, s_4 = 农户)。

表 1 天津市 2019—2023 年成蚊密度及蚊种构成

Table 1 Density and species composition of adult mosquitoes in Tianjin from 2019 to 2023

年份(年)	诱蚊灯数(台)	捕获雌蚊数(只)	密度[只/(台·h)]	捕获雌蚊数(只)及构成比(%)			
				淡色库蚊	白纹伊蚊	中华按蚊	三带喙库蚊
2019	2 576	14 062	0.91	13 191(93.81)	254(1.81)	611(4.35)	6(0.04)
2020	2 563	11 323	0.74	11 086(97.91)	202(1.78)	27(0.24)	8(0.07)
2021	2 512	10 845	0.72	10 198(94.03)	555(5.12)	92(0.85)	0(0)
2022	2 478	8 770	0.59	8 545(97.43)	166(1.89)	59(0.67)	0(0)
2023	2 512	9 870	0.65	9 549(96.75)	225(2.28)	94(0.95)	2(0.02)
合计	12 641	54 870	0.72	52 569(95.81)	1 402(2.56)	883(1.61)	16(0.02)

表 2 2019—2023 年天津市不同生境成蚊密度与蚊种构成

Table 2 Density and species composition of adult mosquitoes in different habitats in Tianjin from 2019 to 2023

生境	诱蚊灯数(台)	捕获雌蚊数(只)	密度只/(台·h)	捕获雌蚊数(只)及构成比(%)			
				淡色库蚊	白纹伊蚊	中华按蚊	三带喙库蚊
居民区	4 711	10 956	0.39	10 586(96.62)	368(3.36)	4(0.04)	2(0.02)
公园	2 665	10 394	0.65	10 032(96.52)	346(3.33)	0(0)	12(0.12)
医院	1 133	2 827	0.42	2 752(97.35)	75(2.65)	0(0)	0(0)
农户	2 066	11 904	0.96	11 270(94.67)	336(2.82)	298(2.50)	0(0)
牲畜棚	2 066	18 789	1.52	17 929(95.42)	277(1.47)	581(3.09)	2(0.01)
合计	12 641	54 870	0.72	52 569(95.81)	1 402(2.56)	883(1.61)	16(0.03)

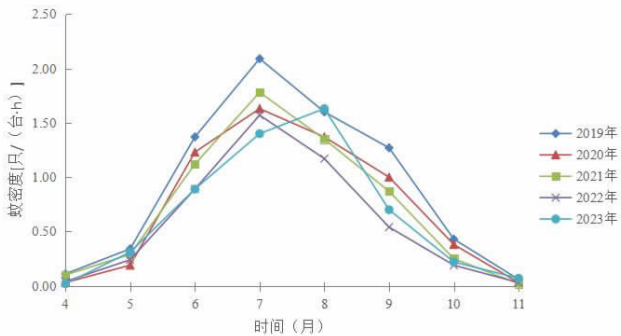


图 1 天津市 4—11 月蚊密度消长趋势

Figure 1 The trend of mosquito density in Tianjin from April to November

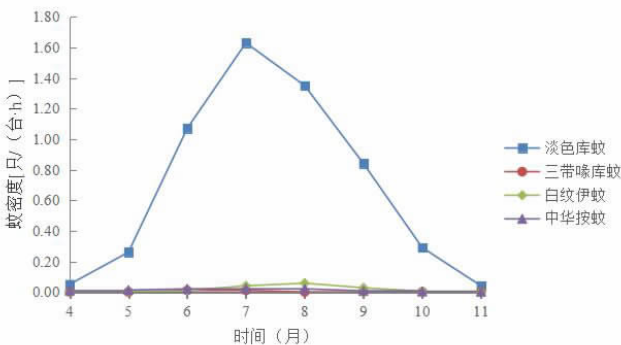


图 2 天津市 4—11 月不同蚊种密度季节消长趋势

Figure 2 Seasonal variation of mosquito species density in Tianjin from April to November

2.2 病毒携带情况 2019—2023 年共检测白纹伊蚊雌成蚊 16 000 只,登革病毒为阴性,淡色库蚊雌成

蚊 64 000 只,乙脑病毒为阴性。

3 讨论

本研究显示 2019—2023 年天津市共布放诱蚊灯 12 641 台次,捕获雌蚊 54 870 只,平均蚊密度为 0.72 只/(台·h)。2019 年最高为 0.91 只/(台·h),2022 年最低为 0.59 只/(台·h),优势蚊种均为淡色库蚊,与山东省^[9-10]、河南省^[11]、北京市^[12]的研究结果一致,而刘莹等^[13]的研究结果显示致倦库蚊最高,这符合淡色库蚊与致倦库蚊地理分布的特征^[14]。作为登革热和乙脑的主要传播媒介,白纹伊蚊和三带喙库蚊在天津地区捕获数量较少,可能与我们所采用的监测方法有关^[15],白纹伊蚊活动高峰时间为黄昏及黎明前后,本次监测时间为 18:00—24:00,三带喙库蚊主要孳生于水稻田、沼泽和池塘等生境中,本次监测生境主要是在居民区、公园、医院、农户和牲畜棚,因此导致这两类蚊虫构成比相对较少^[16]。但不能据此推断该类蚊媒传染病的发生和传播风险较低,应密切监测关注这类蚊虫密度的变化,尤其是伊蚊的变化,正从热带地区向暖温带地区扩展^[17]。

从蚊虫的生境构成来看,以牲畜棚最高,其次由高到低依次为农户、公园、医院和居民区。农户和牲畜棚的蚊虫数量占比大,这与刘全超等^[18]的研究结果相同。可能由于农村地区居民防蚊灭蚊意识差,周围积水环境未得到及时有效的清理。根据监测结果,我

们需要进一步改善农村地区的环境治理工作,增强健康教育的影响力,推广关于疾病防治的相关信息,鼓励全体人员积极参与到清理蚊虫孳生地的工作中来,与此同时,指导居民科学运用卫生杀虫剂以及安装纱门纱窗,挂蚊帐等方式,从而有效防止蚊传疾病的发生^[9]。淡色库蚊主要出现在居民区、公园、农户和牲畜棚,以牲畜棚最高,白纹伊蚊与淡色库蚊相似,但以居民区最高,而中华按蚊则以农户和牲畜棚为主,以牲畜棚最高。

2019—2023 年的病原学检测结果均未阴性,可能是由于天津市只对淡色库蚊及白纹伊蚊进行检测,而忽视了乙脑的主要传播媒介三带喙库蚊,未来,天津市将依据三带喙库蚊的捕获情况开展相应的病毒携带检测^[20]。

天津夏季炎热、雨水集中,有利于蚊虫的孳生。根据蚊密度监测结果及季节消长趋势,适时采取措施改善环境,如翻盆倒灌,及时清理家中及周围环境中的积水容器,并结合物理、化学、生物防治等方法,清除蚊虫孳生地,降低蚊密度,减少蚊媒传染病的发生与流行。

利益冲突声明 本研究不存在任何利益冲突

参考文献

- [1] 王英. 我国蚊媒防制策略及成就和挑战[J]. 中国热带医学, 2019, 19(9): 807-811.
Wang Y. Strategies, achievements and challenges of mosquito control in China [J]. China Tropical Medicine, 2019, 19 (9): 807-811.(In Chinese)
- [2] 张晓,李传霞,张彤,等. 2006-2019 年济南市农村环境蚊虫密度监测结果及变化趋势分析[J]. 中国农村卫生, 2021, 13(1): 16-18.
Zhang X, Li CX, Zhang T, et al. Analysis of monitoring results and trend of mosquito density in rural environment from 2006 to 2019 in Jinan City[J]. China Rural Health, 2021, 13(1): 16-18.(In Chinese)
- [3] 司晓熙,李晓叶,郑爱华. 中国蚊传疾病及其媒介蚊类研究进展[J]. 应用昆虫学报, 2023, 60(1): 1-12.
Si XX, Li XY, Zheng AH. Research progress on mosquito-borne diseases and vector mosquitoes [J]. Chinese Journal of Applied Entomology, 2023, 60(1): 1-12.(In Chinese)
- [4] 张海林. 新发和再肆虐虫媒病毒病是当前面临的重要公共卫生问题 [J]. 中国媒介生物学及控制杂志, 2011, 22(2): 101-102, 120.
Zhang HL. A public health problem on emerging and re-emerging arboviral diseases[J]. Chinese Journal of Vector Biology and Control, 2011, 22(2): 101-102, 120.(In Chinese)
- [5] Kumaran E, Doum D, Keo V, et al. Dengue knowledge, attitudes and practices and their impact on community-based vector control in rural Cambodia [J]. PLOS Neglected Tropical Diseases, 2018, 12(2): e0006268.
- [6] 高强,冷培恩. 登革热防控的现状与展望[J]. 中国热带医学, 2024, 24(1): 40-48.

- Gao Q, Leng PE. Current situation and prospect of dengue fever prevention and control [J]. China Tropical Medicine, 2024, 24(1): 40-48.(In Chinese)
- [7] Mataba GR, Kafula YA, Mwaijengo GN, et al. Keep your natural enemies close-native predators can maintain low mosquito densities in temporary ponds in a malaria expansion area in Northern Tanzania [J]. Science of the Total Environment, 2021, 10: 148606.
- [8] 崔倩,杨淑娟,赵益超,等. 江苏省盐城市 2016-2023 年蚊虫种群密度与季节消长监测结果分析[J]. 中国媒介生物学及控制杂志, 2024, 35(3): 312-315.
Cui Q, Yang SJ, Zhao YC, et al. Mosquito population density and seasonality based on surveillance analysis in Yancheng, Jiangsu Province, China, 2016-2023 [J]. Chinese Journal of Vector Biology and Control, 2024, 35(3): 312-315.(In Chinese)
- [9] 杜俊,王延东,郑加玉,等. 山东省淄博市 2022 年重要病媒生物生态学监测状况分析 [J]. 中国媒介生物学及控制杂志, 2024, 35(1): 36-41.
Du J, Wang YD, Zheng JY, et al. Analysis of the ecological surveillance of important vectors in Zibo City in 2022 [J]. Chinese Journal of Vector Biology and Control, 2024, 35 (1): 36-41.(In Chinese)
- [10] 李曰进,许艳,王龙江,等. 2021 年山东省媒介蚊虫种群及按蚊密度监测结果分析[J]. 中国病原生物学杂志, 2024, 19(1): 52-55.
Li YJ, Xu Y, Wang LJ, et al. Analysis of monitoring results of vector population and density of Anopheles mosquitoes in Shandong Province in 2021 [J]. Journal of Parasitic Biology, 2024, 19(1): 52-55.(In Chinese)
- [11] 樊金星,张叶,岳思宁,等. 2022 年河南省病媒生物生态学监测分析[J]. 现代疾病预防控制, 2023, 34(12): 890-894.
Fan JX, Zhang Y, Yue SN, et al. A vector ecological surveillance and analysis of Henan province, China, 2022 [J]. Modern Disease Control and Prevention, 2023, 34(12): 890-894.(In Chinese)
- [12] 阎婷,李静,许秀燕,等. 2022 年北京市主要病媒生物监测结果分析[J]. 寄生虫与医学昆虫学报, 2023, 30(2): 95-102.
Yan T, Li J, Xu XY, et al. Surveillance of important vector and pests in Beijing, in 2022 [J]. Acta Parasitology et Medica Entomologica Sinica, 2023, 30(2): 95-102.(In Chinese)
- [13] 刘莹,吴群,刘璞瑜,等. 海南省 2020-2022 年蚊虫生态学监测结果分析[J]. 中国媒介生物学及控制杂志, 2024, 35(1): 26-31.
Liu Y, Wu Q, Liu PY, et al. Analysis of mosquito ecological surveillance results in Hainan Province, China, 2020-2022 [J]. Chinese Journal of Vector Biology and Control, 2024, 35 (1): 26-31.(In Chinese)
- [14] 陆润泽,刘起勇,吴海霞,等. 2014 年中国淡色库蚊/致倦库蚊种群地理分布特征分析 [J]. 中国媒介生物学及控制杂志, 2016, 27(2): 107-111.
Lu RZ, Liu QY, Wu HX, et al. Distribution characteristics of Culex pipiens pallens/Culex quinquefasciatus population in China in 2014 [J]. Chinese Journal of Vector Biology and Control, 2016, 27(2): 107-111.(In Chinese)
- [15] 曹淦,王晗,田诚,等. 2018-2022 年常州市蚊虫密度调查与季节消长分析[J]. 寄生虫与医学昆虫学报, 2023, 30(2): 83-87.
Cao G, Wang H, Tian C, et al. The analysis result of mosquito surveillance in Changzhou from 2018 to 2022[J]. Acta Parasitology et

- [8] Zhang YY, Liu FH, Wang YL, et al. Associations between peripheral whole blood cell counts derived indexes and cancer prognosis: An umbrella review of meta-analyses of cohort studies [J]. *Critical Reviews in Oncology/Hematology*, 2024, 204: 104525.
- [9] Pruc M, Peacock FW, Rafique Z, et al. The prognostic role of Platelet-to-Lymphocyte ratio in acute coronary syndromes: a systematic review and Meta-Analysis [J]. *J Clin Med*, 2023, 12(21): 6903-6913.
- [10] Li JH, Wang XY, Jia WJ, et al. Association of the systemic immuno-inflammation index, neutrophil-to-lymphocyte ratio, and platelet-to-lymphocyte ratio with diabetic microvascular complications[J]. *Frontiers in Endocrinology*, 2024, 15: 1367376.
- [11] Wen HJ, Yu H. Correlation analysis of carotid plaque in young patients with newly diagnosed type 2 diabetes and platelet-to-lymphocyte ratio and neutrophil-lymphocyte ratio [J]. *Vascular*, 2023, 31(1): 90-97.
- [12] Zhang KX, Ding S, Lyu X, et al. Correlation between the platelet-to-lymphocyte ratio and diabetic foot ulcer in patients with type 2 diabetes mellitus [J]. *Journal of Clinical Laboratory Analysis*, 2021, 35(4): e23719.
- [13] Song YJ, Lin ZY, He JN, et al. Association of platelet-to-lymphocyte ratio levels with the risk of cardiac adverse events in People with type 2 diabetes undergoing percutaneous coronary intervention: A large-scale prospective cohort study [J]. *Diabetes & Metabolic Syndrome*, 2024, 18(3): 102987.
- [14] Seo IH, Lee YJ. Usefulness of complete blood count (CBC) to assess cardiovascular and metabolic diseases in clinical settings: a comprehensive literature review [J]. *Biomedicines*, 2022, 10(11): 2697.
- [15] Huo YQ, Schober A, Forlow SB, et al. Circulating activated platelets exacerbate atherosclerosis in mice deficient in apolipoprotein E[J]. *Nature Medicine*, 2003, 9(1): 61-67.
- [16] Stakos DA, Tziakas DN, Stellos K. Mechanisms of platelet activation in acute coronary syndromes [J]. *Current Vascular Pharmacology*, 2012, 10(5): 578-588.
- [17] Chung HY, Kim DH, Lee EK, et al. Redefining chronic inflammation in aging and Age-Related diseases: proposal of the senoinflammation concept[J]. *Aging and Disease*, 2019, 10(2): 367-382.
- [18] Chung HY, Sung B, Jung KJ, et al. The molecular inflammatory process in aging [J]. *Antioxidants & Redox Signaling*, 2006, 8(3/4): 572-581.
- [19] Goliash G, Forster S, El-Hamid F, et al. Platelet count predicts cardiovascular mortality in very elderly patients with myocardial infarction[J]. *European Journal of Clinical Investigation*, 2013, 43(4): 332-340.
- [20] Trakarnwijit I, Li B, Adams H, et al. Age modulates the relationship between platelet-to-lymphocyte ratio and coronary artery disease[J]. *International Journal of Cardiology*, 2017, 248: 349-354.
- [21] Li L, Ma Y, Geng XB, et al. Platelet-to-lymphocyte ratio relates to poor prognosis in elderly patients with acute myocardial infarction[J]. *Aging Clinical and Experimental Research*, 2021, 33(3): 619-624.
- [22] Kazem N, Hofer F, Koller L, et al. The age-specific prognostic impact of the platelet-to-lymphocyte ratio on long-term outcome after acute coronary syndrome[J]. *Eur Heart J Open*, 2022, 2(1): oead031.
- [23] Wang HL, Li L, Ma Y. Platelet-to-lymphocyte ratio a potential prognosticator in acute myocardial infarction: A prospective longitudinal study[J]. *Clinical Cardiology*, 2023, 46(6): 632-638.

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(上接第 941 页)

- Medica Entomologica Sinica*, 2023, 30(2): 83-87.(In Chinese)
- [16] 王纯玉, 张家勇, 白玉银, 等. 辽宁省 2020-2022 年蚊虫种群密度与季节消长监测结果分析[J]. *中国媒介生物学及控制杂志*, 2024, 35(2): 161-165.
- Wang CY, Zhang JY, Bai YY, et al. An analysis of mosquito density and seasonal fluctuations in Liaoning Province, 2020-2022 [J]. *Chinese Journal of Vector Biology and Control*, 2024, 35 (2): 161-165.(In Chinese)
- [17] Mantilla-Granados JS, Castellanos JE, Velandia-Romero ML. A tangled threesome: understanding arbovirus infection in *Aedes* spp. and the effect of the mosquito microbiota [J]. *Frontiers in Microbiology*, 2023, 14: 1287519.
- [18] 刘全超, 朱丁, 邹亚明, 等. 江苏省无锡市 2012-2021 年蚊虫生态学监测结果分析[J]. *中国媒介生物学及控制杂志*, 2023, 34 (4): 513-517.
- Liu QC, Zhu D, Zou YM, et al. An analysis of mosquito ecological surveillance results in Wuxi, Jiangsu Province, China, 2012-2021[J]. *Chinese Journal of Vector Biology and Control*, 2023, 34 (4): 513-517.(In Chinese)
- [19] 侯海光, 李培羽, 秦娜, 等. 2015-2018 年天津市蚊虫密度监测结果分析[J]. *医学动物防制*, 2020, 36(8): 798-800.
- Hou HG, Li PY, Qin N, et al. Analysis of mosquito density surveillance results in Tianjin from 2015 to 2018 [J]. *Journal of Medical Pest Control*, 2020, 36(8): 798-800.(In Chinese)
- [20] 赵怡双, 菅越, 尤晓杰, 等. 浙江省台州市 2017-2022 年媒介蚊虫生态学监测及病毒携带状况调查[J]. *中国媒介生物学及控制杂志*, 2023, 34(5): 622-627, 653.
- Zhao YS, Jian Y, You XJ, et al. Ecological monitoring and virus carrying status of mosquitoes in Taizhou, Zhejiang Province, China, 2017-2022[J]. *Chinese Journal of Vector Biology and Control*, 2023, 34(5): 622-627, 653.(In Chinese)

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