

基于图像处理的散产虫卵计数方法的改进

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摘要:【目的】为满足昆虫虫卵计数需求, 解决传统的手工计数效率低的问题, 探究基于图像处理的散产虫卵自动计数方法, 在误差在允许范围内提高计数效率。【方法】以桃蛀果蛾和梨小食心虫的虫卵为研究对象, 通过卵卡的观察和图片获取, 得到较为清晰的原始图像; 从采集的 50 张卵卡中随机抽取 10 张卵卡, 通过图像处理软件进行调色, 去噪声处理以及灰度化和二值化处理, 找到最佳阈值, 进而将目标和背景区分; 应用图像处理软件的自动计数功能, 基于二分法逐步优化 pixel^2 参数, 以期寻找最合适的识别范围; 计数结果与人工计数进行对比, 对散产虫卵进行计数。【结果】系统测量表明, 桃蛀果蛾的卵直径为 25.00–50.00 pixels, 平均直径为 36.66 pixels, 每张卵卡最小卵直径的均值为 29.00 pixels; 梨小食心虫的卵直径为 50.00–85.00 pixels, 平均直径为 73.31 pixels, 最小卵直径的均值为 61.40 pixels。随着 pixel^2 值逐渐增大, 自动计数工具所统计到卵的数量逐渐减小; 当 pixel^2 取最大值或者平均值时, 统计卵数小于实际卵数; 当 pixel^2 取卵直径的最小值时, 虫卵计数准确率为 52–54%; 当 pixel^2 取卵直径的最小值的 1/2 时, 准确率为 90–92%; 当 pixel^2 取卵直径的最小值的 1/4 时, 准确率为 80–84%。因此, 当 pixel^2 取最小值的 1/2 时, 准确率最高。当图像处理达到图像背景和目标卵完全区分且毫无杂质时, 计数结果准确率可达 100%。【结论】利用图像处理软件可以实现对散生虫卵的自动计数, 图像处理软件的 pixel^2 是重要的调节参数, 对于散产的虫卵需要 pixel^2 取值稳定在一定的范围之内, 并需要计算和筛选多个准确度来确定散生卵的实际数量。

关键词: 图像处理; 散产虫卵; 自动计数; 二分法

Improvement of Scattered Eggs Counting Method Based on Image-processing

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Abstract: 【Objective】In order to meet the needs of insect fine feeding and related insect research for egg counting, the traditional manual counting method has the problems of low accuracy and low efficiency. Therefore, this experiment explores the automatic counting method of scattered eggs based on image-processing, which improves the counting efficiency and reduces the cost within the allowable error range. 【Methods】Taking the eggs of *Carposina sasakii* Matsumura and *Grapholitha molesta* (Busck) as the research object, the egg card was observed, sampled and photographed by stereoscope to obtain a clearer original image. Ten egg cards were randomly selected from the collected 50 egg cards. The image was grayed and binarized by Photoshop software, de-noised and Image J software to find the best threshold, and then the target and background were distinguished. The automatic analysis tool was used to gradually optimize the pixel^2 parameters based on the dichotomy, in order to find the most suitable recognition range and automatically count the scattered eggs. The accuracy of the counting results was compared with

基金项目: 国家自然科学基金项目 (32171806); 山西基础研究计划 (自由探索类) 项目 (20210302123392, 20210302124155); 山西省回国留学人员科研资助项目 (2021-067)

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the manual counting. 【Results】 The system measurement showed that the egg diameter of *C.sasakii* was 25.00-50.00 pixels, the average diameter was 36.66 pixels, and the average minimum egg diameter of each egg card was 29.00 pixels. The egg diameter of *G.molesta* was 50.00-85.00 pixels, the average diameter was 73.31 pixels, and the mean value of the minimum egg diameter was 61.40 pixels. As the pixel² value gradually increases, the number of eggs counted by the automatic counting tool gradually decreases. When pixel² takes the maximum or average value, the statistical egg number is less than the actual egg number; When pixel² takes the minimum value of egg diameter, the accuracy of egg card counting of *C.sasakii* and *G.molesta* is 52-54%. When pixel² is 1/2 of the minimum egg diameter, the accuracy is 90-92%. When pixel² is 1/4 of the minimum egg diameter, the accuracy is 80-84%. When pixel² is 1/5 of the minimum egg diameter, the accuracy of the statistical results is 42-44%. Therefore, when pixel² takes 1/2 of the minimum value, the accuracy is the highest. 【Conclusion】 When the image-processing achieves a complete distinction between the image background and the target egg and there is no impurity, the accuracy of the counting result can reach 100%. When pixel² is used, if the value of pixel² is stable within a certain range, the actual number of eggs can be determined by calculating and screening multiple accuracy. The automatic counting method of this experiment can realize the automatic counting of insect eggs to a large extent, and ensure that the error is within the controllable range ; this counting method is not suitable for severely adhered eggs and stacked egg masses.

Key words: Image-processing; Scattered eggs; Automatic counting ; The dichotomy