

南京地区外来植物一年蓬上访花昆虫的多样性及其访花选择性的影响因素分析

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Flower-visiting insect diversity of the alien plant *Erigeron annuus* (Asteraceae) in Nanjing, southeastern China and an analysis of factors influencing their foraging preference

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摘要 为揭示外来植物一年蓬 *Erigeron annuus* 上的本土访花昆虫多样性和影响访花行为的因素, 本研究在南京郊区进行了连续2年的野外调查, 采用跨栏模型分析了环境因素如何影响昆虫的访花选择性, 即接受概率(测度是否接受一年蓬花)和访问频数(测度接受一年蓬花的程度)。调查发现, 访问一年蓬花的昆虫共计9目54科145种, 其中, 科丰富度占优势的是膜翅目、鳞翅目和鞘翅目(均占总科数的20.75%), 其次是双翅目(18.87%)和半翅目(13.21%); 物种丰富度占优势的是双翅目(26.39%), 其次是膜翅目(18.75%)、半翅目(18.75%)、鞘翅目(17.36%)和鳞翅目(15.38%)。多数目的物种丰富度在6-7月最高, 9月最低, 仅双翅目(食蚜蝇为主)在5月最高。运用跨栏模型对物种优势度最大的半翅目、膜翅目和双翅目等的访花个体数量及其影响因素的分析结果表明: 影响半翅目和膜翅目对一年蓬花访问倾向(接受概率)的因素多于影响其访问频数的因素, 由此预测这些访花昆虫可能参考较多因素做出是否接受一年蓬花, 而依据较少线索做出访问程度的访花行为决策; 一年蓬植株密度影响半翅目和膜翅目昆虫的接受概率, 而花密度影响半翅目和双翅目昆虫的接受概率和访问频数, 说明靶标植物花的特性可能对访花昆虫的访花行为决策起主要作用。

关键词: 外来植物 一年蓬 访花昆虫 访花偏好 跨栏模型

Abstract: To investigate the diversity of native insects visiting flowers of the alien plant *Erigeron annuus* (Asteraceae) and factors affecting flower-visiting preferences, a two-year field survey using a random sampling method was undertaken in the suburb of Nanjing, southeastern China, and the hurdle model was used to analyze environmental factors that influence foraging for and selection of flowers by estimating the acceptance probability (measuring whether the visitation happens or not) and the visit frequency (measuring the extent of visits if the visitation happens). The survey uncovered 145 species from 54 families in nine insect orders, among which Hymenoptera, Lepidoptera and Coleoptera were rich in number of families each accounting for 20.75% of all families, respectively, followed by Diptera (18.87%) and Hemiptera (13.21%). Diptera was the highest in species richness accounting for 26.39% of all species, followed by Hymenoptera (18.75%), Coleoptera (17.36%), and Lepidoptera (15.38%), respectively. The species richness of most insect orders was higher in June and July and less in September, with the exception of Diptera which had higher species richness in May. The analysis of the influence of environmental factors on the acceptance probability and the visit frequency of the three most dominant insect orders, *i.e.*, Hemiptera, Diptera and Hymenoptera, using the hurdle model showed that the factors affecting the tendency of hemipterans and hymenopterans to accept *E. annuus* flowers were more than those influencing their visit frequency, suggesting that in these insects multiple environmental clues may be required to make a behavioral decision for the acceptance of the flower but fewer factors for the visitation extent of the flower. Plant density influenced the acceptance probability of hemipterans and hymenopterans, while flower density affected the acceptance probability and the visit frequency of hemipterans and dipterans, suggesting that characteristics of *E. annuus* flowers may play an important role in the visiting behavioral decision in these groups of native insects.

Key words: Alien plant *Erigeron annuus* flower-visiting insects flower preference hurdle model

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