

Pollen Comparison From Insect Visitors to *Stylisma pickeringii* (Convolvulaceae), an Endangered Plant of Illinois Sand Prairies

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ABSTRACT

Stylisma pickeringii flowers are white, funnel-shaped, and have an average corolla diameter of 1.9 cm. During summer 2001, eighteen genera of insects visiting flowers of *S. pickeringii* were collected. The collections of *Heterostylum croceum*, *H. robustum*, and *Neorhyncocephalus volaticus* were records in the state of Illinois. The purpose of this study was to determine if the six most frequent insect visitors (from most to least frequent: *Apis mellifera*, *H. croceum*, *Agapostemon splendens*, *Dialictus sp.*, *Perdita sp.*, and *Toxomerus marginatus*) to *S. pickeringii* flowers were carriers of its pollen. Pollen collected from *S. pickeringii* flowers preserved in FAA was compared to pollen collected from bodies of the insect visitors. Pollen was observed using light microscopy at 100 and 400X. *S. pickeringii* pollen is white or yellow-tinted and spheroidal with an average diameter of $53.7 \pm 6.5 \mu\text{m}$. Pollen collected from the insects also had the same color and shape. The average diameters of pollen collected were 53.7 ± 8.6 , 51.4 ± 2.0 , 50.9 ± 3.3 , 50.0 ± 2.8 , 49.6 ± 3.9 , and $49.5 \pm 3.3 \mu\text{m}$ from *H. croceum*, *A. splendens*, *Perdita sp.*, *A. mellifera*, *Dialictus sp.*, and *T. marginatus*, respectively. Although average pollen diameters varied, it appears that pollen collected from bodies of all insects is that of *S. pickeringii*. Thus, these six insects are carriers of *S. pickeringii* pollen, and are expected to pollinate its flowers.

INTRODUCTION

Illinois sand prairies are limited throughout the state; however, many unique plant and animal species are found in these areas. Management and reintroduction efforts are hampered by a lack of information regarding these unique sand prairie species. In fall 1998, a study on the endangered plant, *Stylisma pickeringii* (Torr. ex M.A. Curtis) Gray var. *pattersoni* (Fern. & Schub.) Myint, Patterson bindweed (Convolvulaceae), of sand prairies in Mason County, Illinois, was initiated. Although information has been gathered about this species regarding its seed and seedling biology (Todd et al., 2002; Todd et al., 2001a,b; Todd et al., 2000; Heisler et al., 1999), very little is known about its pollination requirements. The knowledge this research has provided about the seed biology of *S. pickeringii* will be useful in the management of this species; however, knowledge of its pollination requirements is a necessary component in the development of a reestablishment program for this species.

During summers 1999 and 2000, two insects visiting the flowers of *S. pickeringii* were observed, collected and identified as *Heterostylum croceum* Painter and *H. robustum* (Osten Stacken) (Diptera: Bombyliidae). Both sexes of each species were collected. Although somewhat numerous in the Mason County *S. pickeringii* population, both were state records, previously unreported in Illinois (Webb, 2001). In addition, another species, *Neorhyncocephalus volaticus* (Diptera: Nemestrinidae), was collected around the plants. This species also was a state record. Clearly, these insect-plant interactions are unique in Illinois.

S. pickeringii has the typical funnel-shaped flowers characteristic of Convolvulaceae. Its flowers are white and have an average corolla diameter of 1.9 cm. Eighteen genera of insects were collected visiting its flowers during summer 2001. The six most frequent insect visitors (from most to least frequent visits) were *Apis mellifera*, *H. croceum*, *Agapostemon splendens*, *Dialictus sp.*, *Perdita sp.*, and *Toxomerus marginatus*. The purpose of this study was to determine if these six genera of insect visitors were involved in the pollination of *S. pickeringii* by comparing pollen collected from insects to that of *S. pickeringii*. It is the overall goal of this research to increase the understanding of species interactions in sand prairies of Illinois to improve management of these precious areas.

METHODOLOGY

In summer 2001, *S. pickeringii* flowers were collected and preserved in FAA (formaldehyde, acetic acid, alcohol). Pollen was collected from anthers of preserved flowers and from bodies of the six most frequent insect visitors. Pollen was observed at 100 and 400X under a compound, light microscope and photographed at 400X magnification. Light Microscopy (LM) was used as it is an inexpensive method and pollen grains can easily be moved around while viewing. Key characteristics used in pollen comparisons were shape, color, and diameter. Diameters of 15 pollen grains collected from *S. pickeringii* and the bodies of the six insect visitors were measured using a compound microscope and micrometer. Average diameters of pollen grains were calculated.

RESULTS

Pollen was predominately found on the head and leg regions of collected insects. As observed under a compound microscope (100 and 400X), pollen of *S. pickeringii* is white or yellow-tinted and spheroidal. Likewise, pollen collected from insects also was white or yellow-tinted and spherical (Figure 1). The average diameter of *S. pickeringii* was not significantly different to pollen collected from *H. croceum*, *A. splendens*, *Perdita sp.*, and *A. mellifera*; however, it was significantly larger than that of *Dialictus sp.* and *T. marginatus* (Table 1).

DISCUSSION

It appears that pollen collected from insect bodies match pollen collected from anthers of *S. pickeringii* flowers, as both are spheroidal and white or yellow-tinted in color. Although the average diameter of *S. pickeringii* pollen was significantly larger than that of pollen collected from *Dialictus sp.* and *T. marginatus*, all of the collected pollen grains are classified as "large", being in or near the range of 50 to 100 μm , which is typical of Convolvulaceae (Erdtman, 1969; Kothari et al., 1997). Pollen also may vary in size according to its stage of maturity (Erdtman, 1969). Using Scanning Electron Microscopy (SEM) may be more useful than LM in comparing pollen grains as the resolution and magnification of SEM is greater than that of LM. SEM would allow for more descriptive analyses of pollen grains.

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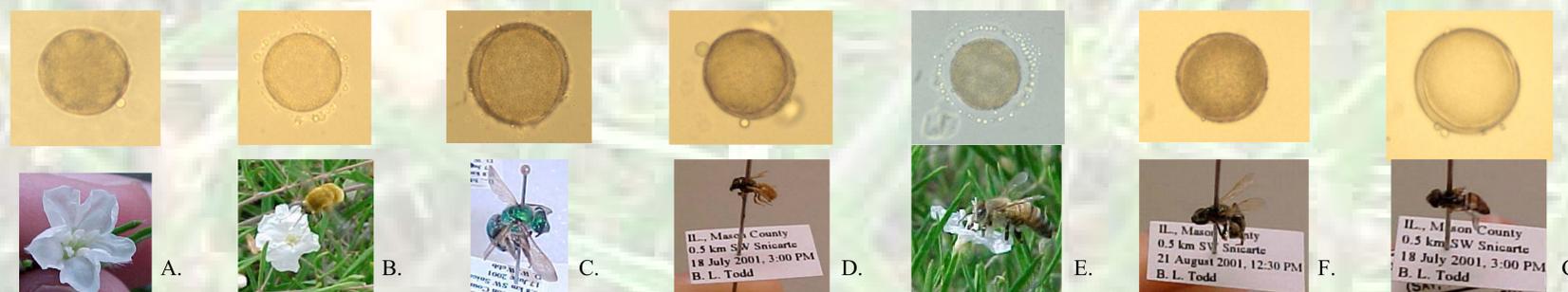


Figure 1. A. *Stylisma pickeringii*; B. *Heterostylum croceum*; C. *Agapostemon splendens*; D. *Perdita sp.*; E. *Apis mellifera*; F. *Dialictus sp.*; G. *Toxomerus marginatus*. All pollen grains magnified 400X.

Table 1. Average diameter (μm) of pollen collected from *Stylisma pickeringii* and various insects that visited its flowers. ²Mean separations based on Duncan's multiple range test at 5%, n=15. Means followed by different letters are significantly different.

Pollen source	Average diameter (μm)
<i>Stylisma pickeringii</i>	53.7 ± 6.5 a ²
<i>Heterostylum croceum</i>	53.7 ± 8.6 a
<i>Agapostemon splendens</i>	51.4 ± 2.0 ab
<i>Perdita sp.</i>	50.9 ± 3.3 ab
<i>Apis mellifera</i>	50.0 ± 2.8 ab
<i>Dialictus sp.</i>	49.6 ± 3.9 b
<i>Toxomerus marginatus</i>	49.5 ± 3.3 b