ASPECTS OF FLORAL BIOLOGY OF BUZZ POLLINATED *SENNA CANA* (LEGUMINOSAE: CAESALPINIOIDEAE) IN A RUPESTRIAN FIELD IN MUCUGÊ, BA.

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INTRODUCTION

Senna (K.Bahuin) Miller is a large and widespread genus of Caesalpinioideae (Leguminosae) characterized by a distinctive floral morphology. In the subtribe Cassiinae (Irwin & Barneby 1982), the yellow and nectarless flowers of *Senna* show poricidal anther dehiscence and offer pollen as a reward to their pollinators. Successful pollination can only come about through actively pollen-collecting female bees, termed buzz-pollination. The zygomorphic flowers of *Senna* are characterized by heteranthery and enantiostyly (Gottsberger & Silberbauer-Gottsberger 1988). Enantiostyly is a form of floral asymmetric in which the style is deflected away from the main axis of the flower either to the left or right side. This stylar polymorphism has evolved independently in at least a dozen flowering plant families and is often associated with other floral traits including dimorphic anthers, vibrational pollen collection by bees and lack of nectarines. The presence of this pollination syndrome in unrelated groups suggests functional convergence in which the position of the pollinator is important for pollen dispersal and male reproductive success (Barret *et al* 2000). In *Cassia*, a related genus, some authors have interpreted this floral dimorphism as a device for promoting cross-pollination or for promoting pollination between left and right-styled morphs (Laporta 2005).

In the present study we provide information on floral biology and enantiostyly distribution within individuals and in the population. We also investigated the composition and behavior of *Senna cana* flowers visitors.

MATERIALS AND METHODS

Rupestrian fields are associated with mountains in tropical areas of Brazil, usually at altitudes above 900m, overlying quartzites or sandstone, with elevated rainfall and cloudiness, among rocky outcrops, damp sands and high altitude bogs (Harley & Giulietti 2004). The study was conducted along Tiburtino trial at Parque Municipal de Mucugê, BA, Brazil. The study area comprises open fields and portions of rocky outcrops with vegetation mainly composed by herbs, shrubs and treelets. *Senna cana* is a shrub or treelet (2-6m) that occurs between 400 to 1000 m elevation on rocky outcrops. The flowering season occurs on March and April but can be extending for months. At the study area, *S. cana* is abundant, but with a clumped distribution. We bagged 20 flower buds of different individuals, prior to anthesis, with voile bags in order to: 1) define anthesis time, 2) test stigma receptivity with hydrogen peroxide (Zeisler 1938) and 3) test pollen viability for each stamen morph (Dafni 1992). To evaluate the distribution of right and left-styled flower morphs within *S. cana* individuals we utilized paired t-test and $^{-2}$test for flowers morphs available in the population, by counting all perfect flowers from three branches randomly selected in eighteen individuals. We recorded the composition, frequency and behavior of floral visitors through 20 hours of observation on May 14th and 15th, 2007. We conducted observations for two days in three clumps of *S. cana*, between 8AM and 5PM, in order to define the highest pick of activity, bee's behavior in each flower and number of flowers visited. Within each plant, we observed visitor's movement to recognize if they discriminated among floral types or alternatively or randomly moved between them, as well as among long and medium stamens.

RESULTS AND DISCUSSION

The flowers are perfect, without nectar, odorless and pollen is the main reward. The yellow coloration of corolla and anthers are the primary attraction display. Androecium: the anthers dehisce by apical slits which open or close according to

ambient humidity. The androecium has three abaxial curved stamens with long filaments and large anthers. The two lateral stamens of this group of three are inclined each one to the right and to the left of the midline of the flower. The third stamen is centric and its filament is shorter than the others, reaching half of the height of them. A group of four stamens with short filaments and large anthers is positioned in the center of the flower directed with the apertures towards an approaching floral visitor. The three most adaxially positioned stamens are reduced to pollenless staminodes. Gynoecium: the unique and whole carpel is deflected and the stigma is terminal, minute and dry. The pistil is projected to the right or to the left of the middle line of the flower and is curved upwards. Our observations are supported by Gottsberger & Silberbauer-Gottsberger (1988) descriptions for *Senna* flowers. Right and left handed flowers are also borne in the same raceme in different nodes but a regular pattern in their sequence in the inflorescence could not be discerned. At the individual plant, there is no significant difference between flower morphs (Paried t-test = 0.82; d.f. = 17; p = 0.42). Considering all 590 flowers counted in the population, the enantiomorphs approached 1:1 ratio (χ^2 =1.14; d.f. =1; p=0.28). Anthesis occurs around 7AM. The stigma is receptive in the bud at pre-anthesis. Pollen grains for all stamens morphs are viable being necessary germination tests to better understand morphs differences.

We observed bees vibrating the medium stamens during their visits and receive the pollen on the ventral side of their bodies and on their mouthparts. The vibrations are transmitted by the bee's body to the long stamens promoting the pollen ejection and deposition on the back or on the sides of them. This behavior gives the idea of distinct stamens morphs function, feeding and pollinating. Pollen is deposited on the bee's body just at the place where the stigma may touch or approximates closely during vibrations, although direct contact of the stigma and the bee body could not be observed. In fact, it seems that bees do not discriminate between floral morphs. We collected seven bees' species visiting *Senna cana* flowers: *Centris fuscata* (1), *Centris* sp.(1), *Bombus brevivillus* (4), *Bombus morio* (1), *Xylocopa cearensis* (1), *Xylocopa* sp. (1) and *Euglossa* sp (1) and another unidentified himenopterans including ants and wasps. We recorded that the morning (8AM to 12AM) was the day period with more visits (76.7%) and also with more flowers visited (86.8%). At afternoon the visitation decreased with only 4.4% of the visits (2.6% of flowers visited) between 12AM to 2PM, 8.8% of the visits (10.8% of flowers visited) 3PM to 5PM, without visits between 2PM and 3PM. Our results corroborate to the potential of large bees of different genera as the main pollinators of *Senna* as observed byGottsberger and Silberbauer-Gottsberger (1988). Bees foraging behavior is essential for cross-pollination in this system, however the role of equal distribution of enantiomorphs within individuals and in the population to pollination effectiveness still unexplored. (This work is part of the III Field course of pollination ecology promoted by 'Rede Baiana de Polinizadores' fulfilled at 'Parque Municipal de Mucugê/Projeto Sempre Viva').

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