EFFECT OF ANTHER STIMULATION ON DELAYED STIGMATIC DEFLECTION OF PASSIFLORA VITIFOLIA

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Abstract (T.G.)

The flowers of Passiflora vitifolia exhibit delayed stigmatic deflection. To maximize fitness through outcrossing, the stigmatic surfaces should be available after the flower's own pollen has been taken and after the pollinators have visited many flowers. We found that stimulating the anthers on the flowers was not a triggering mechanism for stigmatic deflection, nor did it have an effect on the rate at which stigmatic surfaces deflected. We cannot draw any specific conclusions as to other influences on stigmatic deflection triggering or rate, which were beyond the scope of this study.

Introduction (T.G.)

P. vitifolia has hermaphroditic flowers which are primarily pollinated by traplining hummingbirds, hymenopterans and lepidopterans. Each flower is open for one day. When the flower first opens, the stigmatic surfaces are erect and only the anthers are available to the pollinators. After some time the styles bend and stigmatic surfaces also become available to pollinators. The flowers are self-incompatable, yet stigmatic deflection still may increase the plant's overall fitness. Male fitness may be increased as pollen is not wasted on the same flower's stigma. Female fitness may be increased as the stigmatic surfaces are made available to pollinators only after the pollinators have had the opportunity to visit many other plants and bring back pollen of other conspecific individuals (Janzen, 1983). To maximize fitness, the stigmatic surfaces should be made available to traplining pollinators only after the flower's own pollen has been taken and after the pollinators have visited many flowers. One might predict, then, that the styles may be triggered to begin deflection after the anthers are first stimulated by a visitor. By such a triggering mechanism, the flower would have its stigmatic surfaces available at the optimal time to enhance fitness. We tested the legitimacy of such a triggering device. Our hypothesis stated that stimulating the anthers would trigger stigmatic deflection in a flower of P. vitifolia.

Methods (T.G.)

We located a patch of P. vitifolia plants near the Pavo Trail at Sirena, Corcovado National Park, Costa Rica. Two hours before sunrise we tagged and enclosed in mosquito netting 20 flowers that were ready to open. This prevented pollinators from stimulating the anthers. We noted the time when each flower opened, which we defined as when the tips of the petals were below the level of the anthers. Upon opening, we simulated a visit by a trapline pollinator on 10 of the 20 flowers by probing into the nectar base with thin scissors five times, and rubbing pollen off all 5 anthers with a cotton swab. The other 10 flowers were not touched. Stimulated and non-stimulated flowers were randomly distributed amongst one another. We noted the time when the stigmatic surfaces were fully deflected for each flower, which we defined as when the stigma were within 1mm of the anthers. The stigmatic surfaces of one of the flowers were unusually small and they did not deflect during our observation period. This flower's data were discarded.

Results (G.Y.)

Delayed stigmatic deflection did not occur significantly sooner in stimulated flowers as compared to untouched controls ($U_m = 54.5$, $n_1 = 10$, $n_2 = 9$, $p > 0.10$). Table 1 contains the raw data. Stimulated flowers exhibited an average delayed stigmatic deflection time of 56.0 minutes. Untouched controls exhibited an average delayed stigmatic deflection time of 58.2 minutes. Because stigmatic deflection did occur in untouched controls, we conclude that stimulation of anthers and probing of the flower base is not the specific trigger which initiates stigmatic deflection.

Discussion (G.Y.)

Our results indicate that the first pollinator visit of the day as simulated in this study, did not trigger stigmatic deflection to begin, nor did it increase rate of stigmatic deflection. Casual observation suggested that stigmatic deflection may have been triggered by the opening of the flower, and that the delay may have been due to an inherently slow rate of stigmatic deflection. We did not identify the specific environmental and/or genetic factors which influence the rate of stigmatic deflection.

However, we did hear a hummingbird near the test sites about 15 minutes before flowers began to open, and observed it to feed on nearby Passiflora vitifolia early in our testing period. The presence of a pollinator at a Passiflora before the stigma had been available indicated that delayed stigmatic deflection could still provide the flower with potential fitness benefits, even though visits by pollinators were not a trigger. Because the

stigma was not available upon the first pollinator visit, it is less likely that the pollinator would transfer pollen from the anther to the stigma of the same flower. Preventing this waste of pollen could potentially increase the flowers' male fitness. Furthermore, because the stigma were not available until after traplining pollinators had potentially visited many distant flowers, it is likely that a more diverse collection of pollen would be deposited on the stigma when it finally became available. This could potentially increase female fitness of the flower.

Although we discount their significance, two potential sources of error may have biased our results. First, the mosquito nets did not entirely prevent hymenopteran access to test flowers. We observed a bee under a net on 2 occasions; on one of these occasions, the bee contacted the anthers of a test flower in the stimulated treatment. Thus, the potential exists that other bees may have agitated anthers on control flowers, although we believe we probably would have seen them. Second, we did not control for nectar robbery in test flowers and 7 of 19 test flowers did show signs of nectar robbery. It is possible that nectar robbery had some effect on stigmatic deflection.

Table 1: Times of stigmatic deflection for untouched controls and (stimulated) Passiflora pollinator-simulated flowers at Corcovado National Park.

Trial	Control(min)	Stimulated(min)
1	41	45
2	59	84
3	42	42
4	60	37
5	60	49
6	55	49
7	62	80
8	72	60
9	64	58
10	67	?