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PREDATION OF HILLTOPPING HORSE-FLIES (TABANIDAE) BY BIRDS IN BRAZIL

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Predação de moscas (Tabanidae) em agregações de topo de morro por aves no Brasil.

Key words: Insect aggregation, insect predation, hilltop, lek, Tabanidae.

Hilltops and other elevated landmarks are often used as mate encounter sites by insect species from Diptera, Lepidoptera and Hymenoptera orders (Höglund & Alatalo 1995, Shields 1967). In such places, hilltopping males establish temporary high density aggregations and wait for vacant females in order to try to copulate (Alcock 1987, Höglund & Alatalo 1995).

This reproductive strategy, which in some species conforms to the traditional definition of a "lek" (Alcock 1987), is expected to occur in insect species that are either rare (Scott 1968) or widely dispersed (Thornhill & Alcock 1983), since it increases the probability of encountering mates. Some authors also suggest that hilltops might act as convergence points in the landscape (e.g., Parker 1978) or orientation guides for dispersing females (Alcock 1987).

However, in spite of the benefits that result from this strategy (Höglund & Alatalo 1995), aggregating can also increase the probability of being found by a predator, through an increase in visual (e.g., Balmford & Turyaho 1992), acoustic (e.g., Sakaluck & Belwood 1984, Sick 2001) and/or quimic (e.g., Hendrichs *et al.* 1994) stimuli.

Considering that birds figure among the main insect consumers and use mainly visual stimuli to search for their prey (Sick 2001), it is feasible to predict that some species would attempt to feed on hilltop insect aggregations. However, such predation events were not found in the literature. The aims of this work were to present data on predation of aggregating insects by birds and to discuss ecological aspects of this kind of interaction.

METHODS

The study was conducted at Intervales State Park, Ribeirão Grande, SP, southeast Brazil (24°20'S, 48°15'W). Average annual temperature is 18°C and precipitation is 2600 mm. The park vegetation cover is primary and secondary semi-deciduous rain forests. The study site was a hilltop locally known as Mirante Velho, approximately 1000 m high. The insect aggregations were observed in a clearing of approximately 90 m^2, partially covered by fern shrubs up to 50 cm tall and surrounded by shrubs and dense rain forest vegetation on the slopes.

The surveys were conducted in 3 days in January 2002, from 10:00 h to 15:30 h, with one 8x32 binoculars. The number of individuals and the species of birds visiting the clearing as well as the number of feeding bouts and the foraging behavior of birds were registered during the observations.

RESULTS

Horse-flies (Diptera – Tabanidae) and butterflies (Lepidoptera – Papillionidae) were observed setting aggregations at the clearing. According to Daniels (1989), Tabanidae family has approximately 3000 species, most of which characterized by the utilization of lekking as a reproductive strategy.

During the first and second days of surveys the horse-flies set aggregations of several hundreds of individuals at the clearing, fighting over perches and mates between 11:00 h and 14:40 h, and were predated by birds. Only a few individuals of horse-flies were seen at the clearing in the third day, and no predation was observed.

The bird species observed foraging at the clearing were Swainson's Flycatcher (*Myiarchus swainsoni*), White-collared Swift (*Streptoprocne zonaris*), Blue-and-white Swallow (*Pygochelidon cyanoleuca*), Shear-tailed Grey-Tyrant (*Muscipipra vetula*), and Cliff Flycatcher (*Hirundinea ferruginea*).

The foraging strategy of swifts and swallows consisted in flying uninterruptedly and capturing aerial insects, usually in a straight hovering with no maneuvers ("screening", according to Fitzpatrick 1980). White-collared Swifts flew solitary or in groups of two or three individuals around and above Mirante Velho and other hills on the surrounding, spending from 5 to 40 s nearby each hill. Despite the habit of flying at high altitudes, this species usually flies close to ground level on hilltops (Sick 2001). White-collared Swifts screened between 1 and 3 m above ground level at Mirante Velho's Hill, capturing hilltopping flies at the clearing.

Blue-and-white Swallow flew above Mirante Velho's Hill in circular flights, about 30 m above the hilltop. Occasionally, some individuals screened near ground level and captured flies at the clearing.

Two Shear-tailed Grey-Tyrants approached the hilltop vocalizing uninterruptedly and landed on small trees around the clearing. They searched for insects from these perches and sometimes from the small shrubs within the clearing, spending 50 min foraging at the horse-flies aggregation. Shear-tailed Grey-Tyrants used three different foraging strategies, according to Fitzpatrick (1980): perch to ground sallying, sally gleaning and aerial hawking. They captured flies from the ground and up to 4 m above ground level. A third individual arrived at the clearing, but it was promptly chased by one of the former individuals and left the hilltop just after the persecution.

An adult and an immature of the Swainson's Flycatcher spent 22 min at the clearing. The adult bird captured horse-flies on the ground or on the surface of small shrubs through short flights, sally gleaning from saplings at the border of the clearing. It ate the prey just after capturing it or returned to the perch and fed the immature with the captured fly.

One Cliff Flycatcher spent 35 min nearby the clearing, perched on an energy line that crosses the area. It captured flies sally gleaning over small trees around the clearing. During observations, the birds did not drive the flies away from the clearing and predation did not result in displacement of the insect aggregation.

DISCUSSION

The birds that fed on hilltopping flies are mainly common visitors of hilltops, with the

exception of the Swainson's Flycatcher. White-collared Swifts and Blue-and-white Swallows usually hover above these formations, Shear-tailed Grey-Tyrants inhabit high altitudes in the Atlantic forest and Cliff Flycatchers usually nest and forage on cliffs and mountain ridges.

Other studies report bird predation in different cases of insect aggregations. Eisenmann (1961) and Gussoni & Campos (2003) registered 16 and 26 species of birds, respectively, feeding on aggregations of flying winged termites (Isoptera). Falcons (Sick 2001) and parakeets (Sazima 1989) were also observed feeding on this kind of aggregation. Ant-following birds, mainly from the Formicaridae family, forage close to massive movements of *Eciton* and *Labidus* ants through the forest ground, feeding on the ants and on the great number of insects that flee from them (Sick 2001). Despite the unpredictable characteristic of such aggregations, the locally abundant insects and the activity of foraging birds in these events make them conspicuous enough to attract other animals from the surroundings (Sick 2001).

Hilltopping aggregations are usually not as conspicuous as winged termite aggregations or massive ant movements, but Otte (1974) stresses that insects aggregations provide an important visual stimulus to insectivorous birds, and Burk (1982) points out that predation may be the main mortality factor of sexually active male insects that perform conspicuous courtship displays. Furthermore, hilltopping aggregations are, at certain degree, predictable events, since they take place in specific microhabitats and periods of the day. Thus, we might expect that some birds could learn these informations and use the hilltops as convergence points or orientation guides with certain regularity to search for hilltopping insects and to forage on this locally abundant resources. The predation events observed at Mirante Velho drive the attention to this issue but do not provide evidences to support this hypothesis. Predictability can be an important factor responsible for bringing insect predators to the courtship arenas. But to better understand these interactions, some questions should be addressed to future studies: 1. How often do birds forage on insect hilltop aggregations? 2. Are there bird species that search for these aggregations? 3. If so, is there a response from the insects? Long term studies and more surveys will be necessary to approach these questions in a proper way.

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REFERENCES

Alcock, J. 1987. Leks and hilltopping in insects. J. Nat. Hist. 21: 319–328.

Balmford, A., & M. Turyaho. 1992. Predation risk and lek-breeding in Uganda kob. Anim. Behav. 44: 117–127.

Burk, T. 1982. Evolutionary significance of predation on sexually signalling males. Flor. Entomol. 65: 90–104.

Daniels, G. 1989. Family Tabanidae. Pp. 277–294 *in* Evenhuis, N. L. (ed.). Catalog of the Diptera of the Australasian and Oceanian regions. Bishop Museum Special Publication 86, Bishop Museum Press, Honolulu, Hawaian Islands.

Eisenmann, E. 1961. Favorite foods of Neotropical birds: flying termites and *Cecropia* catkins. Auk 78: 636.

Fitzpatrick, J. W. 1980. Foraging behavior of Neotropical tyrant flycatchers. Condor 82: 43–57.

Gussoni, C. O. A., & R. P. Campos. 2003. Registro de uma grande concentração de aves se alimentando de "aleluias" (Isoptera). Lundiana

4(1): 71.
Hamilton, W. D. 1971. Geometry for the selfish herd. J. Theor. Biol. 31: 95–311.
Hendrichs, J., B. I. Katsoyannos, V. Wornoayporn, & M. A. Hendrichs. 1994. Odour-mediated foraging by yellowjacket wasps (Hymenoptera: Vespidae): predation on leks of pheromone-calling Mediterranean fruit fly males (Diptera: Tephritidae). Oecologia 99: 88–94.
Höglund, J., & R. V. Alatalo. 1995. Leks. Princeton Univ. Press, Princeton, New Jersey.
Otte, D. 1974. Effects and functions on the evolution of signaling systems. Ann. Rev. Ecol. Syst. 5: 385–417.
Parker, G. A. 1978. Evolution of competitive mate searching. Ann. Rev. Entomol. 23: 173–196.
Sakaluk, S. K., & J. J. Belwood. 1984. Gecko phonotaxis to cricket calling song: a case of satellite predation. Anim. Behav. 36: 1846–1848.
Sazima, I. 1989. Peach fronted parakeet feeding on winged termites. Wilson Bull. 101: 656–657.
Scott, J. A. 1968. Hilltopping as a mating mechanism to aid the survival of low density species. J. Res. Lepid. 7: 191–204.
Shields, O. 1967. Hilltopping. J. Res. Lepid. 6: 69–178.
Sick, H. 2001. Ornitologia Brasileira. Editora Nova Fronteira, Rio de Janeiro, Brasil.
Thornhill, R., & J. Alcock. 1983. The evolution of insect mating systems. Harvard Univ. Press, Cambridge, UK.

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