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RESEARCH ARTICLE

Painted Redstarts (*Myioborus Pictus*) Attack Larger Prey when Using Flush-Pursue Strategy

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Abstract:

Introduction:

Prey escape reaction in insects is an antipredatory adaptation that is mediated by prey neural escape circuits with specific sensory properties.

Methods:

Certain insectivorous birds, flush-pursuers, exploit this visual sensitivity by employing conspicuous pivoting movements of spread tail and wings to flush the prey into the air where it is available for chase in aerial pursuits. Although it is known that this strategy increases the number of insects attacked, no information has been published on the size distribution of arthropods attacked using flush-pursue strategy *vs*. traditional gleaning and pecking off substrate strategy.

Results:

Based on one season of observational data of foraging redstarts (*Myioborus pictus*) we show that prey items that were flushed and chased were on average larger than prey pecked off of substrates.

Conclusion:

This may be one of the benefits from flush-pursue foraging – a strategy that is probably costly in terms of energy demands.

Keywords: *Myioborus pictus*, Predator-prey interactions, Flush-pursuers, Sensory exploitation, Foraging, "Rare enemy", Prey size.

1. INTRODUCTION

Some species of insectivorous birds, the flush-pursuers (*sensu)* [1], use conspicuous pivoting movements of spread tail and wings to exploit prey antipredatory escape reactions [2, 3]. These birds make a cryptic prey item conspicuous by flushing it into the air where it can be captured following an aerial pursuit, and by using this foraging method they increase the number of prey items delivered to their nestlings [4 - 14].

The painted redstart (*Myioborus pictus*) is one of such flush-pursuing species and it uses the conspicuous wing and tail displays during foraging [8, 15 - 17]. When *Myioborus* redstarts use their displays, prey-pursuit flights are more frequent then they are during non-display-foraging [8] and they are able to feed their nestlings more frequently [8, 10, 18, 19]. Although it is known that this strategy increases the number of insects attacked, no information has been

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published on the size distribution of arthropods attacked using flush-pursue strategy *vs.* traditional gleaning and pecking off substrate strategy. We ask here whether prey items that were flushed and chased differ in size from those that were pecked off of substrates. The answer will expand our knowledge about predator-prey interactions in the systems with flush-pursue predators.

2. METHODS

The research was conducted in the Cave Creek Canyon, Chiricahua Mountains, near the Southwestern Research Station, Portal, AZ (latitude: 31.866; longitude: 109.238; UTM zone 12). During the breeding season of 1997 (May - June) foraging redstarts were followed to describe food-size distributions for birds during aerial chasing or pecking off the prey. During field work concerning breeding phenology, singing and territorial behavior we opportunistically collected foraging observations of birds across the whole study area. Although many birds were not individually banded, foraging observations were sparsely distributed in space and time and we assumed that they were independent from each other and probably from 24 different birds. The observations were conducted along the Cave Creek with its tributaries and along the East Turkey Creek, altogether comprising the total length of about 17 km. Redstart breeding territories and nests were located along these creeks (Fig. **1**) (nest locations from 1997). When a foraging bird was spotted the observer attempted to watch it closely through binoculars while audio-recording the observations for later translation. Only occasionally, it was possible to determine the size of the prey captured by a foraging bird. In total, we collected such information for 32 prey items (average 1.3 per bird) captured during aerial chases after flushed prey and for 52 prey items (average 2.2 per bird) captured by picking off the substrate (trunks, branches and leaves). Because the determination of size is not always possible the foraging sequences in which it was achieved several times for one bird were interspersed in time and across different trees. Therefore we regarded them as independent events. We coded prey size captured by birds in five size ranks: 1. prey smaller than 2mm; 2. prey larger than 2 mm and smaller than or equal to half of redstart bill length; 3. prey larger than half but smaller than or equal to one bill length; 4. prey larger than one bill length and smaller than or equal to 1.5 bill lengths; 5. prey larger than 1.5 bill lengths. Using a Mann-Whitney U test, we tested the null hypothesis that median prey size rank does not differ between the two hunting techniques: pecking off the substrate and chasing prey in air. Using G-test, we also compared distributions of the prey sizes between these two hunting techniques. We used sequential-Bonferroni correction of significance levels for these two tests (k=2; Rice, 1989). The taxonomic category of the prey was difficult to ascertain in most cases.

3. RESULTS

The size rank of prey chased in air (mean, [median, (minimum-maximum)]; 2.6 [3] (1-5), n=32) was larger (Mann Whitney test; Z_1=2.68, P=0.008) than the size rank of prey pecked off the substrate (1.8) [1] (1-5),(n=52), and the two prey size distributions differed between each other (Fig. **1**); (G_4 = 25.71), (P=0.00008). Most prey pecked off substrates consisted of small unrecognizable insects. Among 10 insects pecked that were recognizable there were 6 caterpillars, 3 spiders, and 1 cicada nymph. Among 8 insects chased that were recognizable there were 3 flies, 2 cicadas, 1 moth and 2 Hemipterans. Caterpillars were the largest prey items pecked off the substrate. The details of the diet of redstart's nestlings during breeding season are going to be reported separately, but these taxonomic groups of prey are commonly brought to nestlings.

4. DISCUSSION

In addition to previous analyses on foraging Painted redstarts and Slate-throated redstarts [8, 10, 19], that indicated benefit from flush-pursuing owing to the larger number of attacks on prey, here we focused on the size of prey estimated in the field conditions. The recorded size distribution of prey suggested that Painted redstarts may additionally benefit because the flush-pursue strategy results in on average larger prey than the prey pecked off the substrates. Jablonski and Strausfeld [16, 17] and Jablonski *et al.* [18] have shown that models of redstarts approaching a variety of potential prey at the present study site may evoke escape responses in a variety of medium- and large-sized prey such as flies, leafhoppers or moths. In another flush-pursuing species, the American Redstart (*Setophaga ruticilla*), Robinson & Holmes [11] and Keast *et al.* [9] also suggested that the majority of prey pursued in flight was medium or large size, while the prey pecked off the substrate by warblers often contained small and energetically unrewarding insects (in addition to some large caterpillars during specific time of year). Similarly, flush-pursue strategy of tail-flicking in the Hooded Warbler (*Setophaga citrina*) results in different types of prey brought to the nestlings [20]. Hence, it seems that regardless of whether flush-pursuers use tail-flicking or spread-tail pivoting the birds capture more and different, possibly more energy-rewarding, insects. It is possible that temperature may affect this difference in prey

size between flush-pursuing and gleaning because it is possible that insects may flush more easily in higher temperatures. Future studies should address this issue.

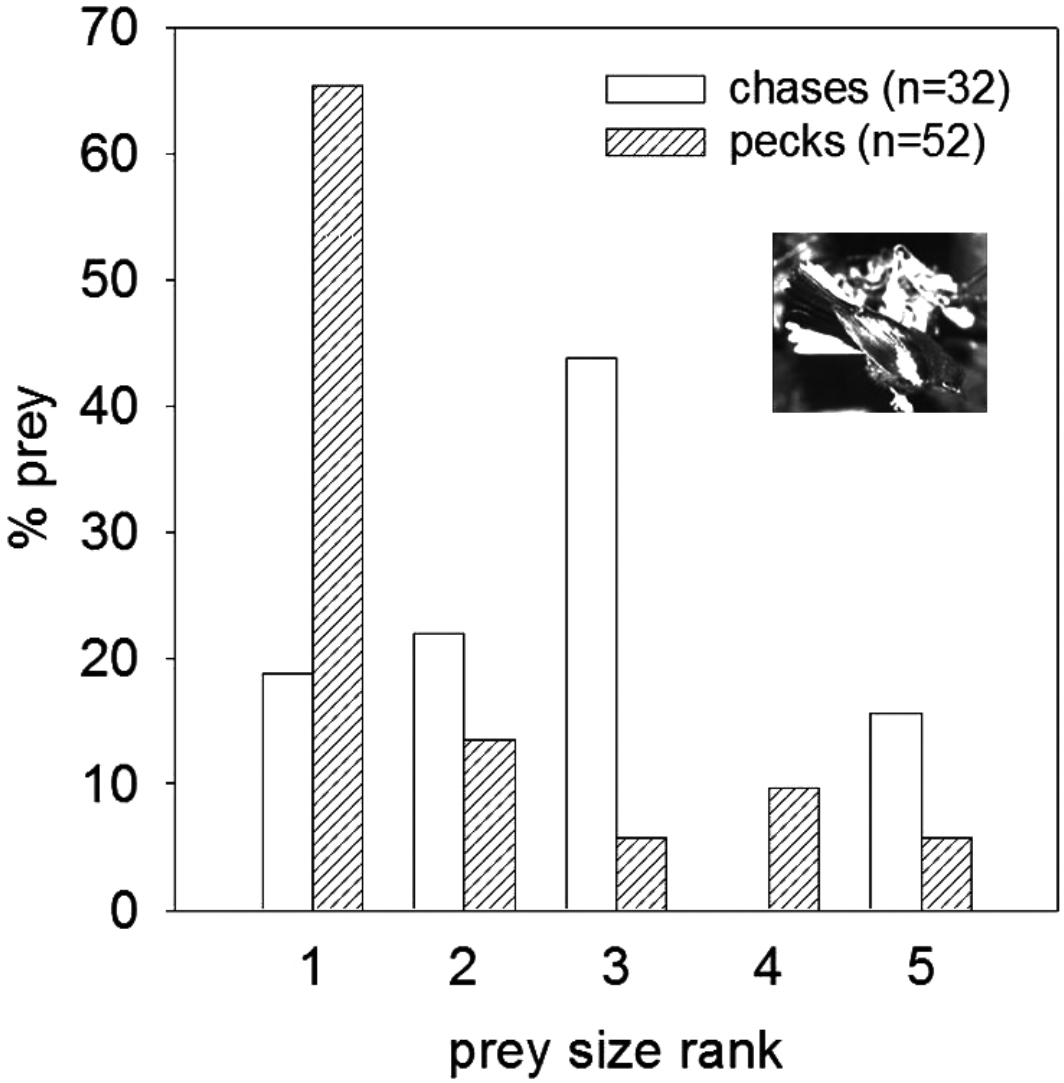

Fig. (1). Comparison of size distributions of prey caught by pecking off substrates and by chasing flying prey. Ranks: 1 – prey smaller than 2 mm; 2 – prey larger than 2 mm and smaller than or equal to half of redstart bill length; 3 - prey larger than half and smaller than or equal to one bill length; 4 – prey larger than one bill length and smaller than or equal to 1.5 bill lengths; 5 – prey larger than 1.5 bill lengths. The inset shows a foraging Painted redstart in a display pose (photo by P. G. Jablonski).

CONCLUSION

In summary, this is the first report based on direct observations of foraging birds that documents how flush-pursue foraging method may not only increase the number of insects available for pursuit, but that those insects are of medium and large size, providing energetic benefits that may possibly help to offset the costs of aerial chases by flush-pursuers.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

HUMAN AND ANIMAL RIGHTS

No human or animal were used in this study that on bases of this research.

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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