Bohemian Waxwings selectively feeding on the stamens of Silver Maple

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Introduction

In the winter 2007-2008, Ontario experienced its largest winter finch irruption in the last ten years. Many boreal finches irrupted well south of their normal ranges, following the largest coniferous and deciduous tree seed crop failure in a decade across the boreal forests in much of Ontario and western Quebec. This event unfolded exactly as forecasted by Ron Pittaway in his *Winter Finch Forecast 2007-2008* (Pittaway 2007). At the same time, a massive crop failure of the native Mountain Ash (*Sorbus decora*), also occurred across much of northern Ontario. Mountain Ash berries normally provide an important winter food for Bohemian Waxwings (*Bombycilla garrulus*) across boreal regions of Canada, but the 2007 crop failure evidently precipitated another irruption of this species across eastern North America.

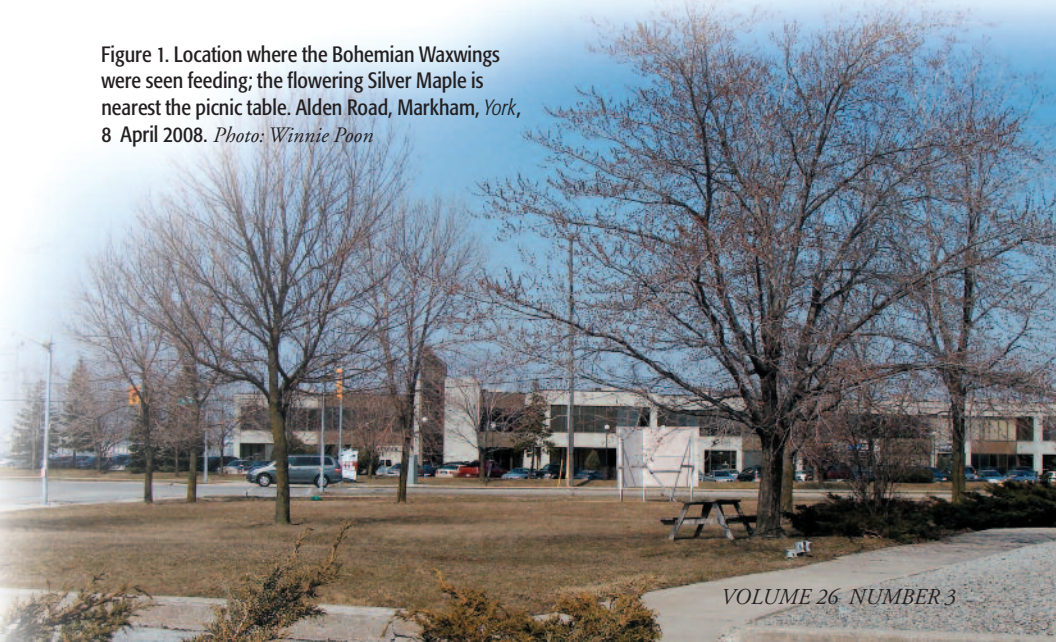

Figure 1. Location where the Bohemian Waxwings were seen feeding; the flowering Silver Maple is nearest the picnic table. Alden Road, Markham, *York*, 8 April 2008. *Photo: Winnie Poon*

This irruption turned out to be the largest ever recorded in the Greater Toronto Area (GTA) and adjacent southern Ontario (Poon 2008). It lasted from approximately mid-October 2007 to the third week of April 2008. It was very extensive in terms of bird numbers, geographic area covered and duration. Within the GTA, it surpassed the previous record of 1999-2000, and even the influx of 1958-1959, which Gunn (1959) described as "the largest of the century".

But the most notable feature of the 2007-2008 irruption was the returning wave of waxwings in spring, that resulted in an unprecedented number of April records for the GTA, especially within the City of Toronto. The number of records in the database of the Toronto Ornithological Club reached 48, whereas only eight previous years had April records, and then only 1 to 3 each. It is acknowledged that the database may be incomplete for some earlier years. It was during this returning wave that the apparently rarely seen feeding behaviour of Bohemian Waxwings eating the stamens of a Silver Maple tree (*Acer saccharinum*) was recorded.

Circumstances

On 3 April 2008, Siegmar Bodach posted to ONTBIRDS (the listserve of the Ontario Field Ornithologists) that a flock of about 35 Bohemian Waxwings and 9 Cedar Waxwings (*Bombycilla cedrorum*) had been seen near the intersection of Alden Road and Hood Road in Markham, York Regional Municipality. The waxwings were reported to be feeding on "fallen shoots", and also "newly opened shoots" on the trees. Intrigued by this report and being curious as to what the "shoots" would look like, Roy Smith and I arrived on site on 5 April for a closer look.

There were already six other birders enjoying the bird activities when we arrived at 1420 h. The location was the front lawn of a small industrial building on the southeast corner (Mactec Canada – 555 Alden Road) (Figure 1). Close to the front door of the building was a 7 – 8 m tall Silver Maple (*Acer saccharinum*) in full blossom. There were two other smaller maple trees about 10m north, but both had wilting blossoms. Around the northeast corner, at the back of the side yard, was a row of four very thin Highbush Cranberry (*Viburnum opulus*) bushes that were devoid of berries, except for some fallen ones on the lawn beneath. Most of the winter snow had melted, leaving about 5% of patchy snow cover on the lawns, and exposing the fallen fruits as noted. Lining the sides of the lawn were 6 small, bare ash trees. Also, across Alden Road were seven other similar maples in bloom.

We counted at least 38 Bohemian Waxwings, but no Cedar Waxwings. The majority were feeding actively on the one Silver Maple at the front door, but not on the other maples in the area. Sometimes a group would perch on one of the smaller bare ash trees, perceivably resting after a

good meal, while several times these birds flew down to a manhole cover nearby and drank from melt water that had collected there (Figure 2). At times, a few birds would split off and fly to the Highbush Cranberry bushes, dropping to the ground to eat the remaining fallen fruits.

All the birders were about 8-10m from the maple tree and waxwings which were pecking incessantly at what appeared to be clusters of tiny reddish buds on the branches. Using binoculars, I could see that the birds were not plucking off and consuming the buds, but instead were just dipping their bills into the buds. I examined closely a clump of these buds in my hand, and was surprised to find that from each tiny bud (flower) were many long and thin filaments (stamens) with richly laden yellow pollen pods at the tips (anthers) (Figure 3).

Each clump was a mass of newly opened maple flowers and I suspected that the birds might be after the pollen instead. I investigated further using my telescope, concentrating on one feeding waxwing. The bird appeared to be plucking off and eating only the stamens, leaving the small red petals intact on the flowers that it was feeding on. It required much concentration and time to see the bird swiftly plucking off the stamens, even with the help of a scope at close distance. At this point, I digiscoped many photographs of a feeding bird, including two series of continuous burst mode photos. Afterwards, by examining one of these series frame by frame, I was able to confirm that the bird was eating only the stamens (filaments and anthers), while the outer parts of the flowers remained untouched from the first frame to the last (Figure 4). These photos provide material evidence of the Bohemian Waxwing consuming stamens from a Silver Maple tree in spring.

Figure 2. Nine Bohemian Waxwings drinking from meltwater on manhole cover at Markham, *York*, 5 April 2008. *Photo: Winnie Poon*

Discussion

In winter, Bohemian Waxwings are primarily berry and fruit-eaters, utilizing a wide variety of fruits for their winter survival. In Ontario, some of these fruits are Mountain Ash, crab-apple (*Malus* sp.), buckthorn (*Rhamnus* sp.), juniper (*Juniperus* sp.), bittersweet (*Celastrus* sp.), dogwood (*Cornus* sp.), and Highbush Cranberry. When available, Bohemian Waxwings may also feed on protein-rich insects (Witmer 2002) and tree buds, including American Elm (*Ulmus americana*) and ash (*Fraxinus* sp.) (Pittaway 1990), as well as maple (*Acer* sp.) (Elder 2002).

Figure 4. Bohemian Waxwing feeding on the maple tree, note that the bird has three anthers in its bill and that most of the stamens have been nipped off the flowers directly in front of it. Markham, *York*, 5 April 2008.
Photo: Winnie Poon

Figure 3. Clusters of blooming Silver Maple flower. Each flower had at least 14 -15 stamens with extremely long filaments. The anthers were large and reddish-yellow in color when fresh. Markham, *York,* 8 April 2008. *Photo: Winnie Poon*

During spring, the waxwings may also feed on sap drips from maple and birch (*Betula* sp.) trees (Bent 1950). However, for North America, there seems to be no published record of Bohemian Waxwings selectively consuming flower stamens, despite the possibility that this may have been observed before. Bent (1950) quoted Swarth (1922) that Bohemian Waxwings "...were seen feeding on insects and also on berries and other vegetable matter". Although this quote may be suggestive, there is no specific mention of this species consuming

flower parts in Bent's account. Witmer (2002) also quoted from Bent (1950) that the Bohemian Waxwing "often feeds on flowers of trees and shrubs in spring". It is possible that Witmer drew the above quote from Bent's account of the Cedar Waxwing, since it is commonly accepted that the two North American species of waxwings share similar dietary and feeding habits. Undoubtedly, Bohemian Waxwings have often been seen eating the same foods as Cedar Waxwings, and it seems logical to assume that the results of certain studies of Cedar Waxwings can be extrapolated to Bohemian Waxwings as well.

Bent's account of the Cedar Waxwing contains a number of statements with regard to flower consumption; including the following:

- "The only other vegetable food of importance in the diet of the Cedarbird is flowers"
- "At New Orleans...about Feb.1, when it arrives to feed on the fruit of hackberry and Japan privet, and the flowers of the elm. It later feeds on the blossoms of the pecan..."
- There are several records of cedarbirds eating the petals of apple blossoms.

As for Cedar Waxwing specifically consuming flower stamens, one early report (Barrows 1912), states that "During spring and early summer the Cedarbird appears to be very fond of blossoms, and especially of the stamens, of many trees, particularly fruit trees. We have seen it frequently eating the stamens of apple, pear, cherry, oak, maple and ash, and it doubtless eats stamens of many other varieties". But for Bohemian Waxwing, Barrows only noted that "...this bird feeds mainly on the same berries, seeds and fruits as the Cedar-bird...".

More recent studies on the Cedar Waxwing found that flowers, including stamens, comprised only 4% of the annual diet, but in May, when fruits are scarce, they could amount to 44% of the diet (Witmer 1996). Flower petals may provide sugars, while pollen on stamens provides protein. Consumption of plant species that do not have showy petals or nectar rewards (*Acer*, oaks — *Quercus*, and poplars — *Populus*) indicated that the waxwings were partly motivated to consume pollen. Witmer also observed that Cedar Waxwings ate the staminate catkins of Eastern Cottonwoods (*Populus deltoides*) in combination with Highbush Cranberry in spring, this observation subsequently led to his conclusion that this diet-mixing behaviour was a strategic choice for the waxwings at that time of year.

The inter-relationships between the fruiting ecology of Highbush Cranberry, and the food requirements of Cedar Waxwings, were carefully unravelled by Witmer (1994, 1996, 1998, 2001). Starting with field observations, he noted that Highbush Cranberries tended to be ignored by most bird species during the late fall and early winter, and only eaten by Cedar Waxwings in late winter and spring, when alternative fruit resources

Figure 5. Dessicated *V. opulus* fruits can persist until late spring. *Toronto*, 22 May 2004. *Photo: Winnie Poon*

would be at minimum levels. Other species virtually ignored it. One might assume that these Highbush Cranberry fruits are generally unpalatable to birds, or perhaps contain insufficient energy or protein to be 'worth eating', but Witmer found that the aged fruit in late winter did contain enough simple sugars to meet the birds' energy needs, albeit deficient in nitrogen content. When Witmer presented samples of early winter fruits (preserved by freezing), and late winter ones to caged Cedar Waxwings, he found that his experimental birds preferred the early winter fruit over the aged fruit. By the natural process of ageing and dessication, late winter or aged fruits (Figure 5) contain higher concentrations of secondary compounds that help preserve them against microbial and fungal

attack. Among the four classes of secondary compounds: alkaloids, cyanogenic glucosides, terpenes, and phenolics, the latter two especially will produce strong organic acids if metabolized. Thus, the physiological challenge in consuming Highbush Cranberries is that they contain a phenolic compound (chlorogenic acid) that renders the fruits extremely acidic (ph 2.8 – 3.0). In addition, the osmotic load of simple sugars in dessicated persistent fruits likely creates a need for supplemental water as well (Studier *et al.* 1988), and waxwings often need to drink water or eat snow to meet the demand for water.

Witmer observed that Cedar Waxwings often ate the staminate catkins in early spring. But during most of the year, they are one of the most obligate frugivores found in North America, and can easily survive for long periods on sugary fruits alone. So why would they need supplemental protein at this time? Witmer guessed, correctly as it turned out, that the waxwings required the protein content from the pollen in these catkins to balance their bodily ph during the early spring period, when insect food is in short supply. To counteract the acidity in metabolizing Highbush Cranberry fruits, nitrogen (amino acids) is required in the physiological mechanism for acid buffering, producing bicarbonate and ammonium in the process. Eventually, bicarbonate is respired off as carbon dioxide, and ammonium is excreted in the urine. He supported this hypothesis by a series of experiments using caged Cedar Waxwings tested with various combinations of aged Highbush Cranberry fruits and the staminate catkins of *P. deltoides*. The results showed that the birds preferred and sought out a mixed diet of both types. He went on to establish experimentally that Cedar Waxwings fed on catkins alone did not obtain sufficient energy to maintain their body mass. Similarly, birds fed on aged *V. opulus* fruits alone did not thrive and started to lose body mass; in fact, results suggested that secondary compounds in the fruit exacerbated nitrogen losses in the birds. Evidently, waxwings need supplementary nitrogen (from pollen) in order to cope with the aged fruit. Furthermore, Cedar Waxwings seem to be more efficient at digesting the protein contained in *P. deltoides* pollen, with a relative value of 89% quoted, versus a value of <50% for protein digestion obtained in most studies of other birds (Witmer 2001). It is beyond the scope of this paper to discuss the scientific evidence in great detail here, but readers can refer to Witmer (1994, 1996, 1998, 2001, 2002) and other sources quoted therein.

Witmer concluded that "...The association of waxwings and *V. opulus* appears to be a result of the distinctive dietary habits of waxwings and the extreme persistence of these fruits". He went on to note that "The nutritional key that enables waxwings to feed on these energy-rich, but unpalatable, fruits is the sudden appearance of a complimentary

protein source with the springtime emergence of staminate flowers." (Witmer 2001).

As a result, the fruits of Highbush Cranberry survive, mostly uneaten, until early spring, when they become available to wandering flocks of waxwings, and the plant achieves potential long-distance dispersal of its seeds.

Conclusion

In view of the above information, it became clear that the feeding behaviour of the Bohemian Waxwings observed on 5 April 2008 was exactly analogous to the mutualistic relationship between Highbush Cranberry (*V. opulus*) and Cedar Waxwings proposed by Witmer. It seems that Bohemian Waxwings are almost certainly subjected to the same physiological stresses and requirements as Cedar Waxwings when consuming *V. opulus* fruits in spring. The rare opportunity to observe this feeding behaviour of Bohemian Waxwing was probably enabled by four factors. Firstly, the 2007-2008 irruption lasted longer than in most previous years, allowing the waxwings to linger well into April. Secondly, because they stayed later than 'normal', the presence of some birds coincided with the flowering of Silver Maple trees. Thirdly, site conditions provided three key components — available Highbush Cranberries, freshly emerged stamens, and water from the melting snow, in close proximity. Lastly, the recent development of digiscoping as a useful tool in birding made it easier to obtain good photographs.

There must be a relatively narrow window of opportunity in April and early May in northeast North America, when newly opening flowers of various tree species provide the supplemental protein that wandering flocks of waxwings require in order to process the persistent dessicated, but well preserved and chemically laden fruits of *V. opulus*. Presumably, other frugivores such as American Robin (*Turdus migratorius*) are unable to handle this and so seldom eat these fruits. Witmer may not have had an opportunity to study Bohemian Waxwings under the same circumstances, but the observation recorded in Markham on 5 April 2008 suggests that given the right conditions, their feeding behaviour may be exactly analogous. Cedar Waxwings are great wanderers, and Bohemian Waxwings even more so during their irregular irruptions. Hence, from the plant's perspective, to be descended upon by a flock of Bohemian Waxwings would be the equivalent of hitting the seed dispersal jackpot!

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