

**OBSERVATIONS ON BLACK-HORNED TREE CRICKET,
OECANTHUS NIGRICORNIS WALKER, FLORAL TISSUE
HERBIVORY AND POLLEN TRANSFER OF NEW ENGLAND
ASTER, *SYMPHYOTRICHUM NOVAE-ANGLIAE* (L.)
G.L.NESOM**

H. A. CRAY

School of Environment, Resources and Sustainability, University of Waterloo,
200 University Avenue West, Waterloo, ON, Canada, N2L 3G1
email, heatheracray@gmail.com

Scientific Note

J. ent. Soc. Ont. 149: 21–26

Despite being a relatively common species in northeastern North America and the object of interest for over a century (Fulton 1915; Coome 2016), surprisingly little is known about the natural feeding habits of the black-horned tree cricket, *Oecanthus nigricornis* Walker (Orthoptera: Gryllidae). This note adds to the natural history knowledge of *O. nigricornis* by presenting evidence of observed feeding behaviour and pollen transfer by a wild individual in southern Ontario, Canada.

Species of *Oecanthus* Serville as a group are described in field guides as feeding on plant parts, some insects, and other materials such as fungi and pollen (Swan and Papp 1972), but very limited species-level information is available about the feeding habits of *Oecanthus* in the wild. Captive *O. nigricornis* have been fed on young potted wheat shoots, raspberry foliage, commercial Tetra Growth Food®TM (Bell 1979), apple slices and ‘cricket chow’ (Brown and Kuns 2000; Bussière *et al.* 2005; Brown 2008). Experiments with feeding cages containing Gryllidae (including but not limited to *O. nigricornis*) demonstrated a varied diet: plant lice (Sternorrhyncha, Hemiptera); exposed apple branch cambium; the pulp of peaches and plums; scale insects (Hemiptera: Coccoidea); and anthers, outer stalk tissue, and other floral parts of *Daucus carota* Linnaeus (Apiaceae) (Fulton 1915).

There are only two entries in the primary literature reporting the diet of *O. nigricornis* outside of captivity. In the first, it is unclear whether the *O. nigricornis* specimens examined were wild-collected or partially or wholly raised in feeding cages. In this New York-based, USA, study, the crops of an unknown number of *O. nigricornis* specimens were dissected, and in most specimens a large part of the diet was found to consist of plant tissue (leaf hairs and vascular tissue) as well as mycelia and spores of various fungi, although the crops of some specimens contained a few insect remains (Fulton 1915). An observation from Illinois, USA, reports *O. nigricornis* feeding on the floral tissue of *Agalinis auriculata* (Michaux) S.F. Blake (Orobanchaceae), including the petals, ovaries, pistils, and stamens (Mulaney *et al.* 2006). There are apparently no published Canadian natural history observations dealing with the diet or feeding behaviour of *O. nigricornis*.

Published September 2018

During the course of vegetation fieldwork on 14 September 2017 at 1:14 pm, a female of *O. nigricornis* was observed feeding on the floral tissue of New England aster, *Symphotrichum novae-angliae* Linnaeus (Asteraceae) in a recently-restored tallgrass prairie at the Glenorchy Conservation Area, Oakville, Ontario. Although there is an established history of tallgrass prairie in the area, the site was in agriculture for the decades prior to 2010 when restoration activities were initiated. The vegetation surrounding the observed behaviour is characterized by early-restoration tallgrass prairie forbs and graminoids (*Symphotrichum* spp. Ness [Asteraceae], *Solidago* spp. Linnaeus [Asteraceae], *Rudbeckia* sp. Linnaeus [Asteraceae], *Monarda* sp. Linnaeus [Lamiaceae], *Elymus* spp. Linnaeus [Poaceae], *Andropogon* sp. Linnaeus [Poaceae], *Sorghastrum* sp. Nash [Poaceae]) and ruderal weeds (e.g. *Cirsium* spp. Miller [Asteraceae], *Trifolium* spp. Linnaeus [Fabaceae], *Dipsacus* sp. Linnaeus [Caprifoliaceae], *Daucus* sp. Linnaeus [Apiaceae], *Taraxacum* sp. F.H. Wigg [Asteraceae], *Panicum* sp. Linnaeus [Poaceae]).

The individual was observed and photographed engaging in feeding behaviour for ten minutes, during which time it travelled between two different flower heads. The open (tall), perfect disc florets were targeted on both flower heads, with the individual of *O. nigricornis* moving from one open disc floret to the next within a flower head and concentrating feeding on these structures (Fig. 1). This preference for the open, perfect florets is particularly obvious when looking at the flower head before, during, and after herbivory (Fig. 2). Once the individual of *O. nigricornis* had fed on the desired floral tissue, the rest was discarded (Fig. 3). Pollen transfer to the head, antennae, palps, and legs occurred during feeding, remained after grooming (Fig. 4), and persisted during and after the move to another flower head.

Symphotrichum novae-angliae (Asteraceae) is an obligate outbreeder, being largely incapable of self-pollination (Chmielewski and Semple 2003) and thus unlikely to benefit from pollen transfer by *O. nigricornis* unless an individual moves between non-clonal plants. Although not impossible, the large number of flowers available simultaneously on *Symphotrichum novae-angliae* (Asteraceae) means that a single plant will have numerous floral tissue resources for any individual *O. nigricornis*. For this reason, pollination services

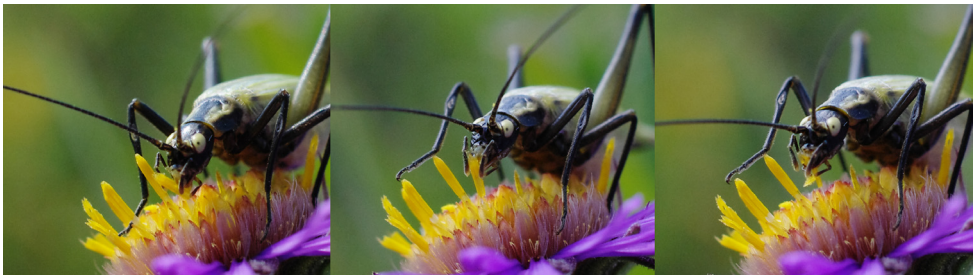


FIGURE 1. Three images demonstrating *O. nigricornis* feeding behaviour on *S. novae-angliae* florets; the images show the *O. nigricornis* individual manipulating a floret with its palps; note the stub of a previously-grazed floret under its head, evident in all three images (flower #1).

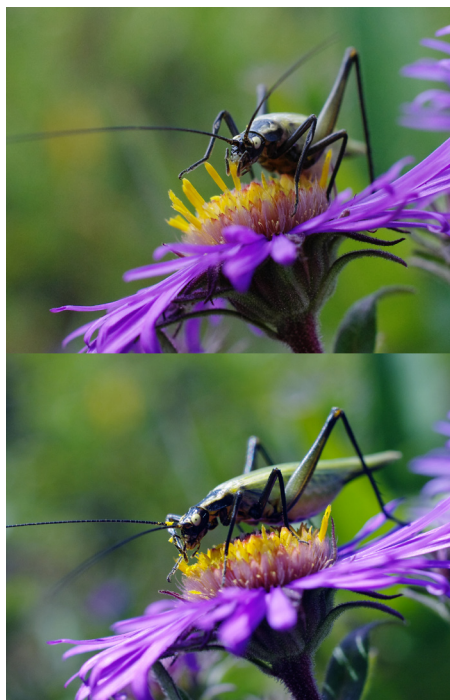


FIGURE 2. Two images demonstrating *O. nigricornis* feeding behaviour on *S. novae-angliae* (Asteraceae) florets. Top: the *O. nigricornis* individual beginning to feed on a flower head. Bottom: after a few minutes of *O. nigricornis* floral tissue herbivory, all but one open, perfect floret has been grazed (flower #1).

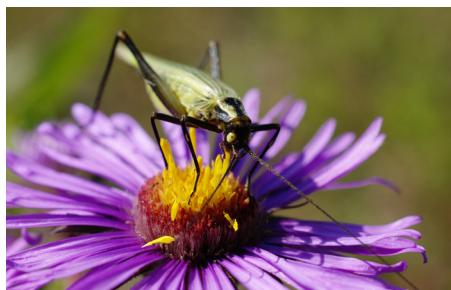


FIGURE 3. The *O. nigricornis* individual grazing on open florets of a *S. novae-angliae* (Asteraceae) flower head; note the discarded floral tissue in the foreground of the image (flower #2).



FIGURE 4. The *O. nigricornis* individual grooming its antennae on the edge of a *S. novae-angliae* (Asteraceae) flower head; note the pollen remaining on head, antennae, and legs of the insect (flower #1).

are unlikely to be significant unless the floral tissue represents a main food source for the cricket. While the consumption of the open, perfect floret tissue could also limit the potential for cross-pollination, observed herbivory on these structures was not complete (one floret on the first head was left untouched).

Aside from the few direct observations of feeding behaviour in the primary literature, *O. nigricornis* has documented associations with other plant genera and species, and it is possible that floral tissue feeding may occur in these cases as well. Adult *O. nigricornis* individuals have been observed in August and September on the branches or flowers of tall forbs, including *Solidago* spp. (Asteraceae), *Erigeron* sp. Linnaeus (Asteraceae), *Eupatorium* sp. Linnaeus (Asteraceae), and *Helianthus* sp. Linnaeus (Asteraceae), as well

as on trees and bushes (e.g. *Rubus* spp. Linnaeus [Rosaceae]) (Bruner 1895; Walker 1904; Blatchley 1920; Walker 1963; Vickery and Kevan 1986). While floral tissue herbivory has not been documented in these cases, *O. nigricornis* oviposit in the stems of some of these same species, including *Solidago* spp. (Asteraceae), *Helianthus* sp. (Asteraceae), and *Ambrosia* spp. Linnaeus (Asteraceae) (Bruner 1895; Blatchley 1920; Fulton 1926; Vickery and Kevan 1986). As Bruner (1895) highlights, oviposition into annual forb species, or perennial species whose above-ground stalks and stems die off, means that nymphs, which emerge in June or July (Vickery and Kevan 1986) may not emerge in direct contact with living plant tissue. Further, as many of these forb species flower into August and September, the floral tissue of these plant species are unlikely to be an important food source for *O. nigricornis* nymphs, and more likely to be used by adults which appear through August and September (Vickery and Kevan 1986).

In addition to the associations reported in the primary literature, adult *O. nigricornis* have been photographed on the floral tissue of 10 genera of plants in Canada and the USA, most from the family Asteraceae (Table 1). Out of 123 total *O. nigricornis* individuals posted to the iNaturalist and BugGuide websites (<https://www.inaturalist.org/> and <https://bugguide.net/node/view/15740>, respectively) from Canada and the USA, 16 were photographed on active (pistils and/or stamens present), non-senescent floral tissue (Table 1). Although the resolution, zoom, and angle of photos on these websites do not allow for positive confirmation of floral herbivory, floral herbivory was deemed likely in three cases; two on *Helianthus* spp. (Asteraceae) flowers and one on *Symphyotrichum lanceolatum* (Willdenow) G.L. Nesom (Asteraceae). No other examples of floral tissue herbivory on *S. novae-angliae* (Asteraceae) have been recorded on either BugGuide or iNaturalist. Aside from these cases, for both the historical and photograph-based observations, it is important to note that, while floral tissue herbivory may be the reason for *O. nigricornis* presence, the individuals recorded may be using the plants in question for oviposition, calling, resting, or hunting, and further investigation will be necessary to determine the exact nature of these associations.

As *O. nigricornis* has now been confirmed to consume the floral parts of three plant species in different families; *Daucus carota* (Apiaceae) (Fulton 1915), *Agalinis auriculata* (Orobanchaceae) (Mulvaney *et al.* 2006), and *Symphyotrichum novae-angliae* (Asteraceae) (this work), in New York, Illinois, and Ontario, respectively, we can reasonably expect that floral tissue herbivory by *O. nigricornis* may extend to other members of these plant families. Observations from BugGuide and iNaturalist also support this supposition. It is also likely that other plant families, including those that the species used for oviposition, may also be consumed. In such cases the conditions for successful pollination may be met. Future investigation may reveal the specific trade-offs between potential incidental pollination by *O. nigricornis* and loss of floral tissue.

Acknowledgements

I would like to thank to Nigel Finney at Conservation Halton and Dr. Stephen Murphy at the University of Waterloo for facilitating my work in the Glenorchy Conservation Area. I would also like to thank journal editor Chris MacQuarrie, copyeditor Thomas

Onuferko, and two anonymous reviewers for their valuable comments and suggestions. This work was supported in part by the Natural Science and Engineering Research Council of Canada through the Vanier Canada Graduate Scholarship program.

TABLE 1: *Oecanthus nigricornis* individuals photographed on floral tissue, reviewed from all observations made in Canada and the USA; photos sourced from the BugGuide (BG) and iNaturalist (iNat) websites. For each observation, the year of observation; genus and family of the plant; province/state; website source; photo number (from the source); contributor ID; and whether or not floral herbivory was evident in the photo is noted.

Year	Flower genus/ species	Province/ State	Source	Photo #	Contributor ID	Floral herbivory evident in photo?
2015	<i>Tanacetum</i> L. (Asteraceae)	NB	BG	1139177	Brian Stone	Possible
2013	<i>Solidago</i> L. (Asteraceae)	PA	BG	846603	Kenneth Frank	Possible
2013	<i>Solidago</i> (Asteraceae)	OH	BG	837784	William Hull	Possible
2012	<i>Setaria</i> P. Beauv. (Poaceae)	NJ	BG	703647	Yurika Alexander	No
2012	<i>Ammophila</i> Host (Poaceae)	NB	BG	691179	Stuart Tingley	Possible
2010	<i>Verbesina</i> L. (Asteraceae)	WV	BG	471798	Stephen Cresswell	Possible
2007	<i>Solidago</i> (Asteraceae)	ON	BG	152052	imarsman	Possible
2006	<i>Eutrochium</i> Raf. (Asteraceae)	MA	BG	77558	Bill Claff	Possible
2017	<i>Solidago</i> (Asteraceae)	ON	iNat	8379218	alysonkarson	Possible
2017	<i>Solidago</i> (Asteraceae)	NY	iNat	9476228	jasondombroskie	No
2017	<i>Helianthus</i> L. (Asteraceae)	IL	iNat	11852805	psweet	Likely; pollen visible on mandibles, front legs, antennae
2017	<i>Symphyotrichum</i> <i>lanceolatum</i> (Willd.) G.L. Nesom (Asteraceae)	NY	iNat	8153233	arianawalczyk	Likely
2017	<i>Solidago</i> (Asteraceae)	NY	iNat	7864242	edgarallenhoopoe	No
2016	<i>Heliopsis</i> Pers. (Asteraceae)	WI	iNat	4105212	zachary25	Possible
2015	<i>Ageratina</i> Spach (Asteraceae)	OH	iNat	1918983	rcurtis	No
2014	<i>Helianthus</i> (Asteraceae)	OH	iNat	880144	acryptozoo	Likely; pollen visible on mandibles, front legs, antennae

References

- Bell, P. D. 1979. Rearing the black horned tree cricket, *Oecanthus nigricornis* (Orthoptera: Gryllidae). *The Canadian Entomologist*, **111**: 709–712. doi: 10.4039/Ent111709-6.
- Blatchley, W. S. 1920. *Orthoptera of Northeastern America, with Especial Reference to the Faunas of Indiana and Florida*. The Nature Publishing Company, Indianapolis, Indiana, United States of America. doi: 10.5962/bhl.title.1700.
- Brown, W. D. 2008. Size-biased mating in both sexes of the black-horned tree cricket, *Oecanthus nigricornis* Walker (Orthoptera: Gryllidae: Oecanthinae). *Journal of Insect Behavior*, **21**: 130–142. doi: 10.1007/s10905-007-9112-1.
- Brown, W. D., and Kuns, M. M. 2000. Female choice and the consistency of courtship feeding in black-horned tree crickets *Oecanthus nigricornis* Walker (Orthoptera: Gryllidae: Oecanthinae). *Ethology*, **106**: 543–557. doi: 10.1046/j.1439-0310.2000.00569.x.
- Bruner, L. 1895. Insect enemies of the grape vine. *Nebraska State Horticultural Report*: 68–162.
- Bussière, L. F., Basit, H. A., and Gwynne, D. T. 2005. Preferred males are not always good providers: female choice and male investment in tree crickets. *Behavioral Ecology*, **16**: 223–231. doi: 10.1093/beheco/arh156.
- Chmielewski, J. G., and Semple J. C. 2003. The biology of Canadian weeds. 125. *Symphyotrichum ericoides* (L.) Nesom (*Aster ericoides* L.) and *S. novae-angliae* (L.) Nesom (*A. novae-angliae* L.). *Canadian Journal of Plant Science*, **83**: 1017–1037. doi: 10.4141/P01-179.
- Coome, L. A. 2016. Nutritionally deprived black-horned tree cricket (*Oecanthus nigricornis*) consumes own spermatophore after failed mating. *Archives of Sexual Behavior*, **45**: 1023–1025. doi: 10.1007/s10508-016-0760-0.
- Fulton, B. B. 1915. The tree crickets of New York: life history and bionomics. *New York Agricultural Experiment Station Technical Bulletin*, **42**: 3–47.
- Fulton, B. B. 1926. Geographic variations in the *nigricornis* group of *Oecanthus* (Orthoptera). *Iowa State College Journal of Science*, **1**: 43–62.
- Mulvaney, C. R., Molano-Flores, B., and Whitman, D. W. 2006. Is insect herbivory contributing to the threatened status of *Agalinis auriculata* (Orobanchaceae) in Illinois? *The Journal of the Torrey Botanical Society*, **133**: 560–565. doi: 10.3159/1095-5674(2006)133[560:IIHCTT]2.0.CO;2.
- Swan, L. A., and Papp, C. S. 1972. *The Common Insects of North America*. Harper and Row, New York, New York, United States of America.
- Vickery, V. R. and Kevan, D. K. McE. 1986. The grasshoppers, crickets, and related insects of Canada and adjacent regions: Ulonata: Dermaptera, Cheleutoptera, Notoptera, Dictuoptera, Grylloptera, and Orthoptera. *Insects and Arachnids of Canada Handbook Series*, **14**: 268–269.
- Walker, E. M. 1904. The Crickets of Ontario. *Canadian Entomologist*, **36**: 249–255. doi: 10.4039/Ent36249-9.
- Walker, T. J. 1963. The taxonomy and calling songs of the United States tree crickets (Orthoptera: Gryllidae: Oecanthinae). II. The *nigricornis* group of the genus *Oecanthus*. *Annals of the Entomological Society of America*, **56**: 772–789. doi: 10.1093/aesa/55.3.303.