QUANTIFYING ANTHROPOGENIC CHANGE IN RELATION TO INSECT DIVERSITY IN THE APPALACHIAN MOUNTAINS AND OVIPOSITION PREFERENCE IN *DROSOPHILA SUZUKII*

A Thesis
by
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Abstract

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Anthropogenic changes such as urbanization and globalization have caused increased light pollution and invasive species. Light pollution has been found to decrease insect diversity, however, there is very little research done regarding light pollution and the rich insect community of the Southern Appalachian Mountains. A particular invasive species that has become a major crop pest is *Drosophila suzukii*. Many of the crops targeted by *Drosophila suzukii* can be found in the Southern Appalachian Mountains. We collected insects from two sites with different levels of light pollution and compared the orders found in both sites. We found that there was a higher level of order diversity in the area with high light pollution than in the area with low light pollution. We also assessed oviposition preference on six diets in eight inbred lines of locally collected *D. suzukii* and found a high preference for cherry, tomato, and blueberry.

Acknowledgments

I would like to thank the university and the Office of Student Research for their support. Thank you to Dr. Scott Chialvo and my committee members. I would also like to thank NSF for helping fund this project by providing an NSF grant DEB-1727869 to Clare Scott Chialvo and Laura K. Reed (University of Alabama).

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Chapter 1: Introduction

Anthropogenic (i.e., human-driven) change has caused a wide variety of negative effects on many ecosystems (Lewis & Maslin, 2015). Examples of anthropogenic change are deforestation, urbanization, globalization, and changing the composition of the Earth's atmosphere via greenhouse gases (Lewis & Maslin, 2015). Urbanization and globalization has resulted in the introduction of invasive species and the decline of native biodiversity in some regions (McCarthy et al., 2001).

Urbanization refers to the transition of rural areas into urban areas, which are classified by dense human populations (specifically 1,000 or more people per square mile), and by the amount of constructed material in the area (30% or more) (United States Environmental Protection Agency, 2023). The amount of urban areas has increased dramatically since 1970 and is continuing to increase with the continuation of population growth (Seto et al., 2011). Currently, more than 4.3 billion people around the world and 87% of the United States population live in urban areas (Ritchie & Roser, 2018). It is assumed that rapid urban growth will occur in underdeveloped countries, while developed countries will continue to have urban growth until large cities become supercities (Seto et al., 2011). While urbanization causes many issues for ecosystems such as habitat fragmentation, deforestation, and climate change, it also has a huge impact on biodiversity (Seto et al., 2011). The threat to biodiversity isn't just with the loss of habitat for many organisms, but also with the introduction of light pollution. With large cities housing an equally large population of humans, the result is often an enormous amount of artificial light at night (ALAN). Major sources of artificial light include street lights, billboard advertisements, architectural lights, domestic lights, and lights put in place for security measures (Gaston et al., 2015). ALAN can then take on different forms such as skyglow, light trespass,

glare, and over-illumination (Chepesiuk, 2009). Skyglow is when light is scattered due to molecules in the atmosphere and reflected upwards creating a halo around well-lit cities (Gaston et al., 2015). Skyglow itself can be seen from kilometers away from urban cities, especially when the weather is overcast (Kyba et al., 2015). Light trespass is when unwanted artificial light spills onto an adjacent property. Glare is created by intense horizontal light and often impairs vision. Over-illumination is when more light is used than needed, like keeping the light on in empty buildings (Chepesiuk, 2009). Most light that is used at night is on a different spectrum than sunlight, moonlight, or starlight, primarily using parts of the blue portion of the spectrum which creates a "whiter" type of light such as LEDs (Chepesiuk, 2009). Unlike other anthropogenic changes like climate change, changes from light pollution are unprecedented because they do not have any natural analogs to compare them to (Gaston et al., 2015).

In the past decade it has been observed that invertebrates, such as insects, are highly attracted to broad-spectrum artificial light that uses short wavelengths, such as white model LEDs (Davies et al., 2013; Davies & Smyth, 2018; Macgregor et al., 2015). It is now common to see swarms of insects around such artificial lighting (Janzen & Hallwachs, 2019). Multiple groups have observed rapid insect declines in multiple areas around the world (Farnworth et al., 2018; Hallmann et al., 2017; Janzen & Hallwachs, 2019; Owens & Lewis., 2018; Powney et al., 2019; van Langevalde et al., 2018; van Strien et al., 2019). A group of German scientists found that the biomass of flying insects in two agricultural areas decreased by more than 75% over the span of 27 years (Hallmann et al., 2017). In the Netherlands, it was found that there was a decrease in the population and diversity of moths in the span of 1985 to 2015, with the most affected species being light-sensitive or nocturnal (van Langevalde et al., 2018). Another study conducted by van Strien et al. (2019) looked at the diversity and abundance of Netherlands

butterflies from 1890 to 2017. They found that in the span of 127 years, there has been a significant decrease in Netherland butterflies, the decrease in the butterfly population has been estimated to be around 84% (van Strien et al., 2019). They also found that some of the previously documented butterfly species are now considered to be locally extinct from the Netherlands (van Strien et al., 2019). Van Strien (2019) also argues that the decrease in Netherlands butterfly diversity and abundance could be higher than what was estimated. In the UK there has been evidence of a decline in non-commercial pollinators such as wild bees and hoverflies (Powney et al., 2019). Some scientists have linked the decline of insect biodiversity to light pollution by observing some species avoiding places with light pollution (Farnworth et al., 2018), while other species circle the lights until they succumb to exhaustion or predation (Owens & Lewis., 2018).

The decline of insect biomass and diversity has generated quite a bit of alarm and has been given multiple names such as the insect apocalypse (Cardoso & Leather, 2019; Goulson, 2019; Jarvis, 2018; Montgomery et al., 2020), insect armageddon (Dornelas & Daskalova, 2020; Reynolds & Hoffmann, 2019; Roy, 2022) and ecological armageddon (Leather, 2017). The decline of insect diversity is a particular concern in the Southern Appalachian Mountains because the region is known as a diversity hotspot, and contains a wide range of insects and approximately 2500 plant species (Haskell, 2000; Highlands Biological Station, n.d.; Peine, 2001; Tripp & Lendemer, 2012; Simon et al., 2005;). While the Southern Appalachian Mountains are monitored and managed by a variety of environmental institutions (Peine, 2001), urbanization is still an issue. The Southern region of the US is one of the most rapidly urbanizing areas of the nation (Dudley et al., 2020; O'Driscoll et al., 2010). This means urbanization and deforestation are likely to impact the Southern Appalachian Mountains as the population grows. Light pollution in the Southern Appalachian Mountains is also expected to increase given that

light pollution has doubled in high-biodiversity areas globally since 1992 and is likely to continue to rise (Koen et al., 2018; Kyba et al., 2015). Light pollution may contribute to decreasing diversity in insect populations, however, literature that quantifies the effects light pollution has on the diversity of insect populations in the Southern Appalachians is very sparse and no measures have been taken yet.

Globalization is another form of anthropogenic change that has led to unexpected ecosystem and ecological impacts. Globalization refers to the growing interdependence of the world's economies, cultures, and people, allowing for an increase in travel and the trade of goods and services (Kolb, 2021). The increase in trade and travel has led to the introduction of invasive species in different habitats, with many invasive species introduced accidentally by traveling humans, modes of transportation, or with materials that are shipped globally (Allendorf & Lundquist, 2003). Invasive species can impact ecosystems by decreasing the native biodiversity (Mainka & Howard, 2010) and impact regions economically due to the cost of damage and mitigation, with estimates of roughly 137 billion dollars annually for the US alone (Pimental & Sparks, 2000). Not all introduced populations of known invasive species become invasive. Invasive success is often dependent on a variety of genetic, demographic, and ecological factors (Allendorf & Lundquist, 2003). However, mitigating well-established invasive species can be rigorous, costly, and oftentimes unsuccessful (Pimental & Sparks, 2000; Simberloff, 2013).

The introduction of *Drosophila suzukii* Matsumura (Diptera: Drosophilidae) into the US is an example of an organism accidentally introduced via globalization (Adrion et al., 2014). This fruit fly is known as cherry *Drosophila* in Japan and as spotted wing *Drosophila* (SWD) in North America (Walsh et al., 2011). This species is a native of Asia, with the first reports of it being from Japan (Kanzawa, 1939). *Drosophila suzukii* has expanded its range drastically in the last

decade (Adrion et al., 2014; Bolda et al., 2010; Ørsted & Ørsted, 2019; Rota-Stabelli et al., 2013). *Drosophila suzukii* was first documented in Japan in 1916, and by 1930-1931 the fruit fly was found in Korea and China as well (Kanzawa, 1939; Walsh et al., 2011). The fly was detected in Hawaii in 1980 (Kaneshiro, 1983), as well as in Myanmar, India, Italy, Thailand, Spain, and Russia (Toda, 1987). *Drosophila suzukii* was found in the United States of America in 2009, with the first reports being in California (Bolda et al., 2010), the fly has now been spotted in all states around the East and West Coast (Ørsted & Ørsted, 2019; Rota-Stabelli et al., 2013). As of 2018, *Drosophila suzukii* has been found in 52 countries worldwide (Ørsted & Ørsted, 2019).

Drosophila suzukii is thought to be a successful invader for multiple reasons. The unique serrated ovipositor possessed by the females allows them to lay eggs in a variety of ripe thin-skinned fruit (Bellamy et al., 2013). SWD is opportunistic (Walsh et al., 2011) and has a very broad host range, it has been seen infesting fruits such as blackberries, cherries, raspberries, blueberries, strawberries, peaches, plums, pluots, nectarines, grapes (juice, wine, and table varieties), figs and kiwis (Bellamy et al., 2013; Rota-Stabelli et al., 2013; Walsh et al., 2011). They have also been found infesting damaged fruit such as cranberries, tomatoes, mandarins, apples, pears, apricots, loquats, and persimmons (Bellamy et al., 2013; Kanzawa, 1939). In the absence of fruit, they can feed on oak tree sap and lay eggs in some species of flowers (Walsh et al., 2011). These flies propagate quickly with a single female laying an average of 384 eggs in her lifespan, 7-16 eggs per day (Kanzawa, 1939; Walsh et al., 2011). They also develop to adulthood rather quickly. Specifically, the eggs can hatch up to 72 hours after being laid, with the fastest time being after 2 hours (Kanzawa, 1939). The lifecycle can be completed in 21-25 days in temperatures of 59°F, and in 9-11 days when temperatures are of optimal conditions such as 77°F (Kanzawa, 1939).

Drosophila suzukii may impact the native biodiversity, agriculture, and economics of invaded areas. As an invasive species, it is thought that *D. suzukii* may threaten biodiversity by competing with native *Drosophila* species and preying on wild fruiting plants (Adrion et al., 2014; Walsh et al., 2011). Some ecological effects could be from trying to manage the pest with increased pesticides and traps that are not specific to only *D. suzukii* (Cloonan et al., 2018; Walsh et al., 2011). Initial invasions have a large impact on agriculture and can result in up to 80% loss in yield (Rota-Stabelli et al., 2013). Yield losses go down after farmers put control measures in place, averaging 20% a year (DiGiacomo et al., 2019). In 2017, affected raspberry farmers in Minnesota were thought to have lost 2.36 million dollars because of *D. suzukii* damages (DiGiacomo et al., 2019). Costs of production often rise after *D. suzukii* invasion because of monitoring, management, increased pesticide use, and secondary selection (Rota-Stabelli et al., 2013), costs are often larger for fruit farms that are small or have grown a variety of fruit (Knapp et al., 2021). The economic impacts of *D. suzukii* are thought to be large, but the full magnitude is still largely unknown (Knapp et al., 2021). Studies that focus on the impacts of *D. suzukii* in the Southern Appalachians are lacking with the exception of the research done by Elsensohn & Burrack (2023). Elsensohn and Burrack (2023) found not only the presence of *D. suzukii* in wild blackberries of undisturbed areas, but that there were higher rates of oviposition in the wild blackberries than in the cultivated populations of blackberries.

In this project, investigating the consequences of anthropogenic changes in the Southern Appalachians, we first set up an exploratory study to research the possible effects of light pollution on nocturnal insect communities. Our goal was to identify the captured organisms to family (or species if possible) and compare the diversity between a site that has very little light pollution to one that has a high amount of light pollution. We also conducted a study exploring

the consequences of an anthropogenically introduced novel species to the region, *D. suzukii*. We implemented host preference assays for eight different genetic lines of *D. suzukii* and quantified their oviposition rates among six different fruits known to be farmed in the Southern Appalachian Mountains. We asked whether there was a preference for one host species over the other and if the preference differed based on genetic factors.

Chapter 2: Methods

Effects of Light Pollution on Nocturnal Insect Communities

Insect Collection

Insects were collected at night from two sites in the high country of NC that varied in their degree of light pollution. The collection sites consisted of the roof of the Rankin Science building at Appalachian State University in Boone, NC (heavy light pollution, 36.21411581 Latitude, -81.68115533 Longitude) and a private property in Matney, NC (limited light pollution, 36.11’35 Latitude, -81.49’41 Longitude). At the collection site in Matney, we collected from the front of the property and from the back of the property. Insects were collected using one BioQuip universal black light trap and a portable battery situated at each site. Collections were performed during August and September of 2022, once nightly temperatures reached <50°F collections ceased. Collections at both sites were done within a few days of each other, excluding the collections that ran on August 25th, and September 20th. The only site that was used for collection on these dates was the site located on the roof of the Rankin Science building in Boone, NC. For each collection day, the traps were turned on at dusk and remained on until the battery ran out, the traps were cleaned out the following morning. Temperature, moon phase, precipitation, and wind speed were recorded for collection days using Google weather reports (see Appendix A). Specimens collected from the bucket traps were killed with potassium cyanide found in the trap, then put into a freezer until they were pinned. Fragile specimens such as Lepidoptera were put in a humid chamber consisting of damp paper towels for 24 hours and then pinned to a spreading board with steel or black enamel pins for characteristic visibility. Pine-sol was added to the paper towels to prevent mold growth. Small Lepidoptera that could not be pinned were stored in glassine envelopes. Large to moderate-sized Coleoptera, Hemiptera, and

Hymenoptera were pinned through the thorax with standard sized black enamel pins. Trichoptera specimens were pinned through the thorax with size 0 steel pins. Smaller specimens were glued using Elmer's multi-purpose extra strong formula glue to triangular cutouts of Canson mix media paper, the paper was then pinned through using black enamel pins. Pinned specimens and specimens inside glassine envelopes were then stored in cardboard containing foam bottoms and moth ball packets. Soft-bodied specimens such as Ephemeroptera were preserved in vials of 70% ethanol.

Insect Identification

Specimens collected were all identified to order using identification guides. Specimens that were identified to species or families were done so using a variety of books and online sources including, but not limited to, the 7th edition of Borror and Delong's Introduction to the Study of Insects, and BugGuide.Net (complete list of sources used can be found in Appendix B). Specimens from the orders Lepidoptera, Hemiptera, Hymenoptera, Coleoptera and Diptera were mainly identified to family using the 7th edition of Borror and Delong's Introduction to the study of Insects. Most Trichoptera, Ephemeroptera and Pscodea specimens could only be identified to order and might be identified further at a later date (a complete list of specimen data can be found in Appendix C). A couple of the specimens were destroyed by the presence of carpet beetles in a few of the collection boxes and could not be identified to family, but were able to be identified to order (one Diptera and one Trichoptera); these specimen were included in the order analysis, but not in the family analysis. The destroyed specimens that were identified to family prior to the presence of carpet beetles were included in the data analysis and specimen spreadsheet found in Appendix C.

Data Analysis for the Light Pollution Experiment

Insect data from the dates 8/31/2022, 9/1/2022, 9/12/2022, 9/15/2022 were compared by site. Comparisons primarily focused on the abundance of specimens found in each site, the amount of orders found in each site, and the amount of families found in each site. The Insect data from 8/25/2022 and 9/20/2022 consisted of only insects from the collection site in Boone, thus the collection data from these dates were not compared to the data from Matney. However, the collection data from 8/25/2022 and 9/20/2022 is still included, separate from the site comparison analysis.

D. suzukii Preferences Among Commercial Fruit Species

Fly Maintenance

The flies used were descended from wild *Drosophila suzukii* that were caught in Matney, North Carolina. The flies were then inbred in the lab until several unique genotypes were made, these unique genotypes are also mentioned as isofemale lines. The fly lines were kept in vials that contained one tablespoon of Carolina Biological 424 *Drosophila* media, six ml of water, a block of peeled button mushroom, and a cotton roll. The flies are transported into new vials when food in the old vials runs out or when new adults emerge. Eight inbred lines of *Drosophila suzukii* were used for each repetition to determine whether different genotypes had different preferences. The inbred lines were titled: line 105, line 102, line 100, line 93, line 85, line 70, line 53, and line 40.

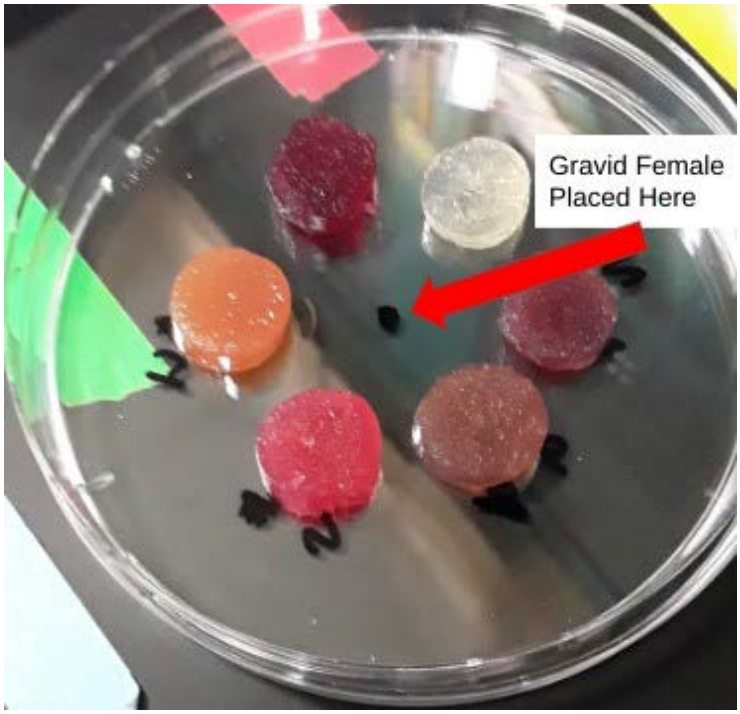
Oviposition Preference Experiments

We quantified oviposition preference across six different fruits (blueberry, cranberry, tomato, concord grape, apple, and black cherry). The oviposition media consisted of fruit juice (100 mL), water (100 mL), tegosept (200 mg) (an antifungal agent dissolved in ethanol), and

agar (4 g). Each media was cut into circles with a diameter of 1.5 cm and width of 0.5 cm and were arranged at an equal distance on a petri dish (see Figure 1). The placement of the gels was randomized and unique for each repetition. Eight inbred lines of *Drosophila suzukii* were used for each repetition to determine whether different genotypes had different preferences. The inbred lines were titled: line 105, line 102, line 100, line 93, line 85, line 70, line 53, and line 40. For each line, a single, gravid female was placed in a petri dish with the gels and incubated for 32 hours, after which the fly was removed. The media disks were then examined under a microscope and the number of eggs laid in each of the media was recorded for each. A repetition was considered successful if the female laid 3 or more eggs.

Figure 1

Setup of the Oviposition Experiment



Data Analysis for the Oviposition Experiment

I used JMP statistical software Pro (version 16; SAS Institute) for all analyses unless otherwise stated. I used a standard least squares to test for differences in mean oviposition rate (number of eggs laid) among fruit host media and isogenic lines of *D. suzukii.* Host fruit media, isogenic line, and their interactions were fixed effects in the model. The unit of analysis was the mean number of eggs laid in each media by each replicate of the different fly lines (complete oviposition data can be found in Appendix D). A *post hoc* Tukey test was used for all pairwise means comparisons.

Chapter 3: Results

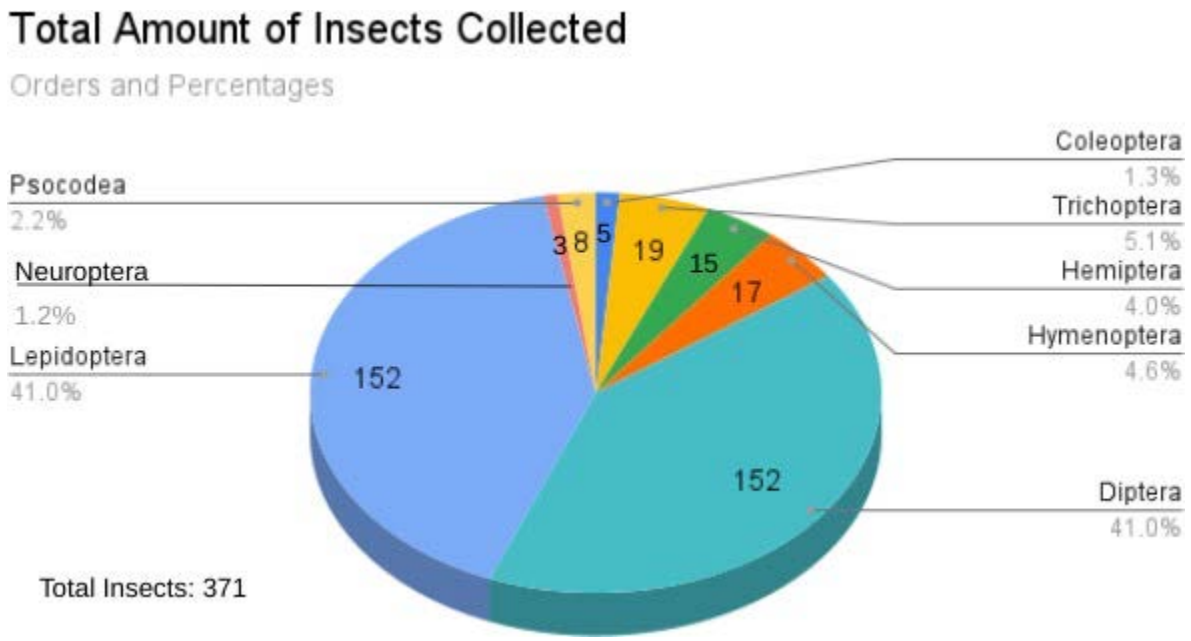
Effects of Light Pollution on Nocturnal Insect Communities

The Results From the Light Pollution Experiment

Comparison of Matney and Boone Collections. In both sites, a total of 371 specimens were collected and identified to orders, specifically 152 Diptera, 152 Lepidoptera, 17 Hymenoptera, 19 Trichoptera, 15 Hemiptera, five Coleoptera, eight Psocodea, and three Neuroptera. In total eight different orders were collected (amount and percentage can be seen in Figure 2, total amounts for all orders and sites can be seen in Figure 3).

Figure 2

Total Amount of Insects Collected During the Weeks of 8/28/2022 and 9/11/2022



During the week of 8/28/22 (which includes the Boone collection of 8/31/2022 and the Matney collection of 9/1/2022), the blacklight trap caught four Coleoptera, four Trichoptera, four Hemiptera, seven Hymenoptera, 63 Diptera, 10 Lepidoptera, three neuroptera, and three

Psocodea at the site in Boone. In Matney, the blacklight trap caught one Coleoptera, 13 Trichoptera, three Hemiptera, three Hymenoptera, 39 Diptera, and 100 Lepidoptera were caught at the site in Matney (see Figure 4b). During the week of 9/11/2022 (which includes the Boone collection of 9/12/2022 and the Matney collection of 9/15/2022) the blacklight trap caught one Trichoptera, eight Hemiptera, seven Hymenoptera, 44 Diptera, 14 Lepidoptera, and five Psocodea at the site in Boone. In Matney, the blacklight trap caught one Trichoptera, six Diptera, and 27 Lepidoptera were caught at the site in Matney (see Figure 4c). Overall, we collected more orders (eight out of eight) and a larger total of insects in the Boone site than in the Matney site. More insects from the orders Coleoptera, Trichoptera, Hemiptera, Hymenoptera, Diptera, Neuroptera, and Psocodea were collected from the Boone site. As for families, the site in Boone had procured: two Coleoptera families, 19 Diptera families, two Hemiptera families, eight Hymenoptera families, and seven Lepidoptera families in total (see Table 1). In the Matney site, we only collected six of the eight orders (Coleoptera, Trichoptera, Hemiptera, Hymenoptera, Diptera, and Lepidoptera) with a lack of individuals from the orders Neuroptera and Psocodea. However, we collected more Lepidopterans and Trichoptera in the Matney site than in the Boone site. As for families, the site in Matney had procured: one Coleoptera family, 14 Diptera families, one Hemiptera family, three Hymenoptera families, and 13 Lepidoptera families (see Table 2). Individuals from the order Ephemeroptera were not found at either site during these collection weeks.

Figure 3

Bar Graph Showing the Mean Number of Insects Collected From Each Order at Each Site

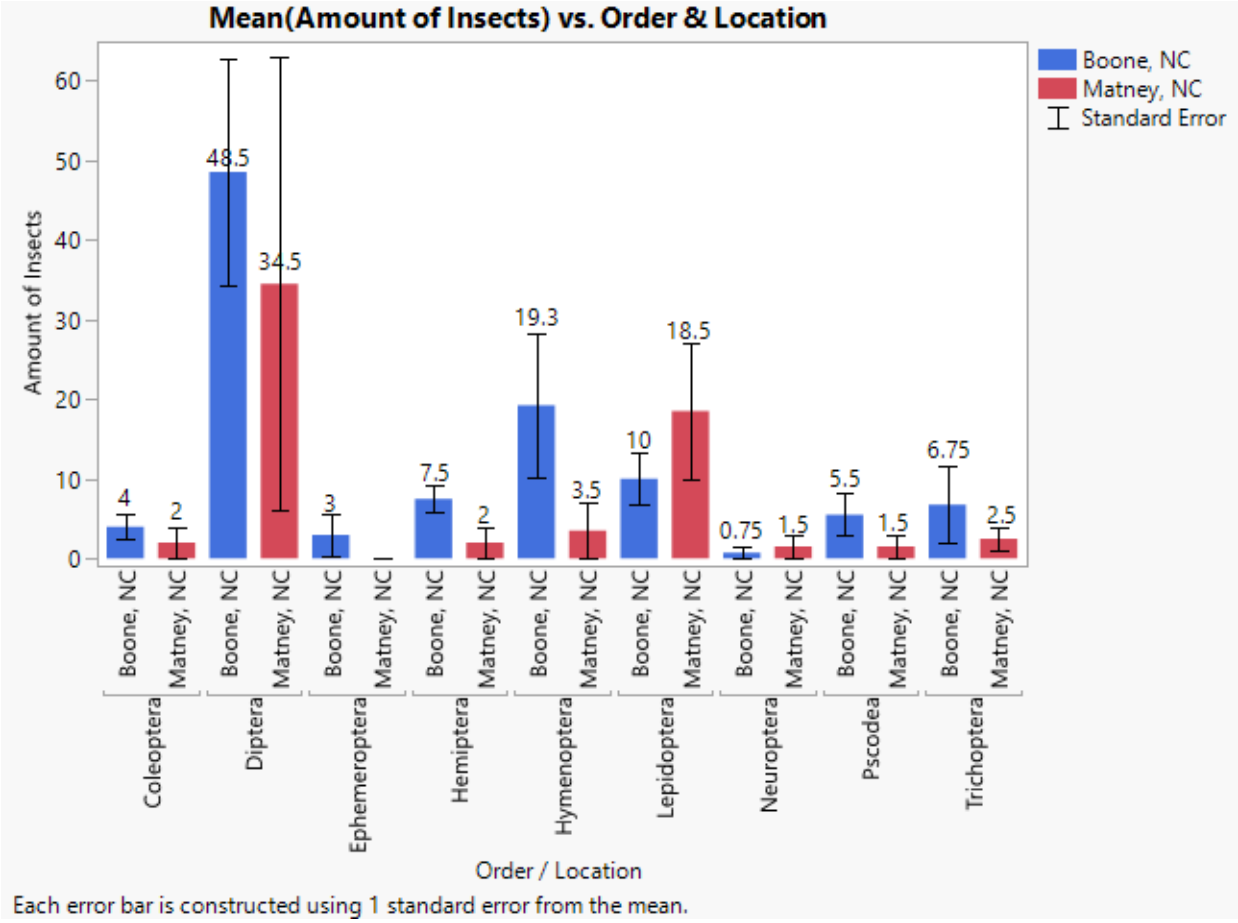
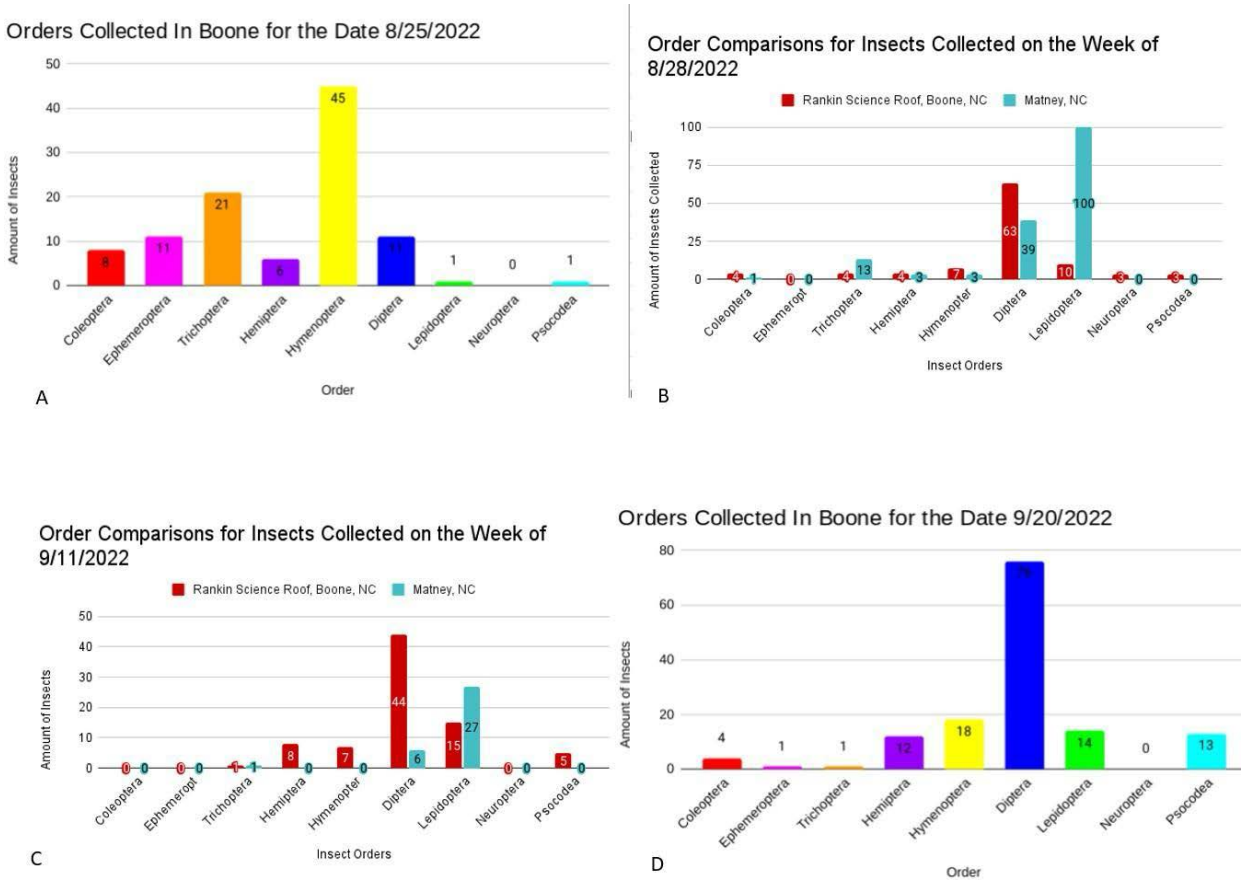


Figure 4

Amount of Insects per Order for Each Collection Date



Note: A: Showcases the amount of insects collected for each order in the Boone site during 8/25/2022. B: Showcases the amount of insects collected for each order in the Boone and Matney sites during the week of 8/28/2022. C: Showcases the amount of insects collected for each order in the Boone and Matney sites during the week of 9/11/2022. D: Showcases the amount of insects collected for each order in the Boone site during 9/20/202

Table 1

Families Collected in the Boone Samples During 8/31/2022 and 9/12/2022

Families in the Boone Samples, Dates 8/31/2022 and 9/12/2022								
Order: Diptera	**#**	**Order: Coleoptera**	**#**	**Order: Hemiptera**	**#**	**Order: Hymenoptera**	**#**	**Order: Lepidoptera**	**#**
Phoridae	75	Coccinellidae	1	Aphididae	10	Formicidae	1	Notodontidae	2
Ceratopogonidae	3	Derodontidae	3	Cicadellidae	2	Figitidae	2	Noctuidae	8
Drosophilidae	1					Braconidae	6	Tortricidae	3
Lonchopteridae	3					Ceraphronidae	1	Carposinidae	1
Cecidomyiidae	3					Diapriidae	1	Pyralidae	7
Sphaeroceridae	3					Sclerogibbidae	1	Crambidae	3
Blephariceridae	1					Cynipidae	1	Heliodinidae	1
Chironomidae	1					Heloridae	1		
Culicidae	1								
Ptychopteridae	1								
Platypezidae	1								
Scenopinidae	2								
Empididae	3								
Dolichopodidae	1								
Heleomyzidae	3								
Simuliidae	1								
Piophilidae	2								
Tephritidae	1								
Thamaleidae	1								

Table 2

Families Collected in the Matney Samples During 9/1/2022 and 9/15/2022

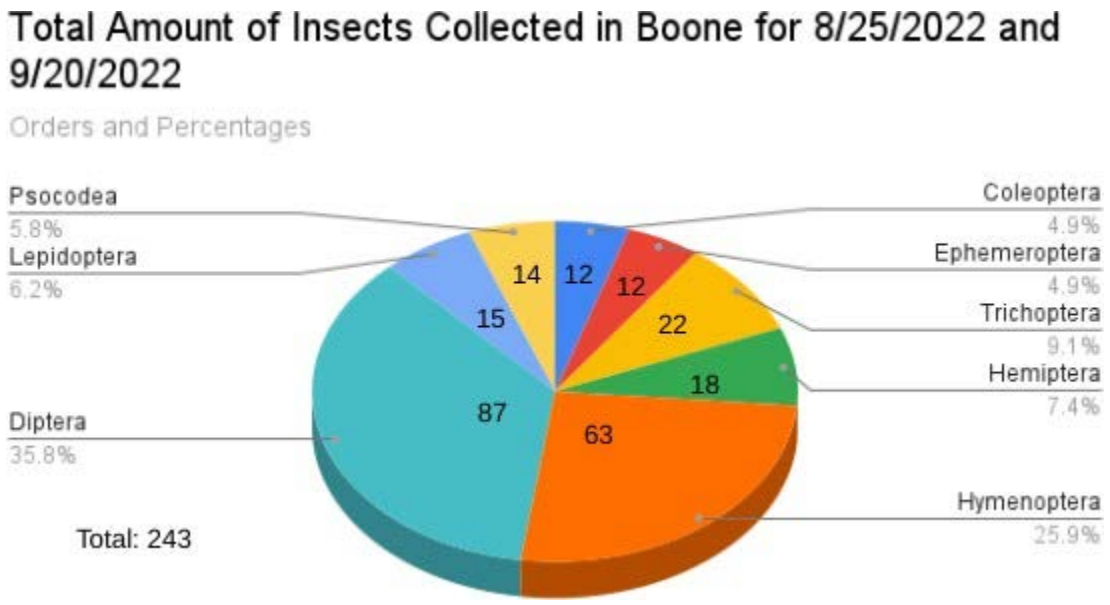
Families in Matney Samples, Dates 9/1/2022 and 9/15/2022								
Order: Diptera	**#**	**Order: Coleoptera**	**#**	**Order: Hemiptera**	**#**	**Order: Hymenoptera**	**#**	**Order: Lepidoptera**	**#**
Cecidomyiidae	6	Scarabaeidae	1	Cicadellidae	3	Formicidae	1	Noctuidae	62
Lonchopteridae	3					Ichneumonidae	1	Geometridae	8
Empididae	1					Figitidae	1	Erebidae	3
Tipulidae	3							Crambidae	6
Platypezidae	2							Tortricidae	14
Phoridae	8							Notodontidae	2
Anisopodidae	1							Pyralidae	24
Ceratopogonidae	8							Elachistidae	1
Chironomidae	2							Yponomeutidae	2
Scenopinidae	1							Gelechiidae	1
Psychodidae	2							Carposinidae	1
Dolichopodidae	2							Tineidae	1
Tanyderidae	5								
Asilidae	1								

Results of the Incomparable Dates From the Boone Collections. On the collection dates of 8/25/2022 and 9/20/2022, the Boone site at Appalachian State University was the only site that was used (as seen from Figure 4a and 4d). Since the collections were only done at one site, the specimens from said collections can not be fully compared to what was found at the Matney site. However, the collections done at the Boone site during 8/25/2022 and 9/20/2022 resulted in some unique orders that were not found during the other collection days (as seen in Figure 5 and Table 3).

During the Boone only dates a total of 243 specimens were collected and identified to order. Of those 243 individuals, 87 were Diptera, 15 were Lepidoptera, 63 were Hymenoptera, 22 were Trichoptera, 18 were Hemiptera, 12 were Coleoptera, 14 were Psocodea, and 12 were Ephemeroptera (see Figure 5). Overall eight orders were found. There were no individuals from the Neuroptera order.

Figure 5

Total Amount of Insects Collected in Boone During the Weeks of 8/25/2022 and 9/20/2022



As for families, during 8/25/2022 and 9/20/2022 the Boone site had procured: seven Coleoptera families, 17 Diptera families, five Hemiptera families, six Hymenoptera families, and five Lepidoptera families in total.

Table 3

Families Found in Boone During Incomparable Collection Days

Families Found in Boone During 8/25/2022 and 9/20/2022									
Order: Diptera	**#**	**Order: Coleoptera**	**#**	**Order: Hemiptera**	**#**	**Order: Hymenoptera**	**#**	**Order: Lepidoptera**	**#**
Chloropidae	1	Coccinellidae	3	Pentatomidae	1	Formicidae	46	Noctuidae	7
Scathophagidae	1	Scarabaeidae	1	Reduviidae	2	Ichneumonidae	1	Pyralidae	2
Tipulidae	1	Elateridae	1	Cicadellidae	7	Figitidae	6	Crambidae	2
Cecidomyiidae	5	Laemophloeidae	1	Aphididae	7	Braconidae	8	Heliodinidae	1
Simuliidae	5	Chrysomelidae	1	Cercopidae	1	Tenthredinidae	1	Tortricidae	3
Empididae	4	Derodontidae	1			Megaspilidae	1		
Sciaridae	2	Leiodidae	4						
Phoridae	46								
Lonchopteridae	3								
Dolichopodidae	2								
Platypezidae	2								
Ceratopogonidae	8								
Chironomidae	2								
Mycetophilidae	1								
Culicidae	1								
Fanniidae	2								
Sphaeroceridae	1								

D. suzukii Preferences Among Commercial Fruit Species

The Results of the Oviposition Experiment

An unexpected issue occurred as the oviposition experiment was being conducted. The populations started to decline meaning that the number of successful repetitions differed among the inbred lines. Due to the declining populations "rest periods" had to be given for some of the isofemale lines. Line 105 had 52 successful repetitions, line 102 had 50, line 100 had 42 as did line 93, line 85 had 20, line 70 had 30, line 53 had 23, and line 40 had 38 (The lines and the amount of repetitions can be found in Table 4). Populations of lines 85, 70, 53, and 40 were declining and thus had less successful repetitions.

Table 4

Amount of Repetitions for Every IsoFemale Line Used

Line	Amount of Repetitions
105	52
102	50
100	42
93	42
85	20
70	30
53	23
40	38

Preferences for Media Among the Lines. The average number of eggs laid differed based on the media used and the inbred line used (see Figure 6). According to the parallel plot, line 105 laid more eggs on blueberry media than on other fruit media, line 102 laid more eggs on blueberry media than on other fruit media, line 100 laid more eggs on cherry media than on other fruit media, line 93 laid more eggs on tomato media than on other fruit media, line 85 laid more eggs on blueberry media than on other fruit media, line 70 laid more eggs on blueberry media than on other fruit media, line 53 laid more eggs on tomato media than on other fruit media, and line 40 laid more eggs on blueberry media than on other fruit media. The cranberry media had the lowest amount of eggs laid for line 85, line 100, line 105, and line 53. The apple media had the lowest amount of eggs for line 93 and line 40. The cranberry and apple media tied for the lowest amount of eggs laid for line 102. The cranberry and concord grape media tied for the lowest amount of eggs in line 70. This implies that there is a higher preference for blueberry, cherry, and tomato media (negative control) and a lower preference for cranberry, apple, and

concord grape media. However, *post hoc* Tukey-test (see Table 8) revealed that not all of the means are significantly different.

Figure 6

Parallel Plot Showcasing the Mean Number of Eggs Laid on the Media by Each Line

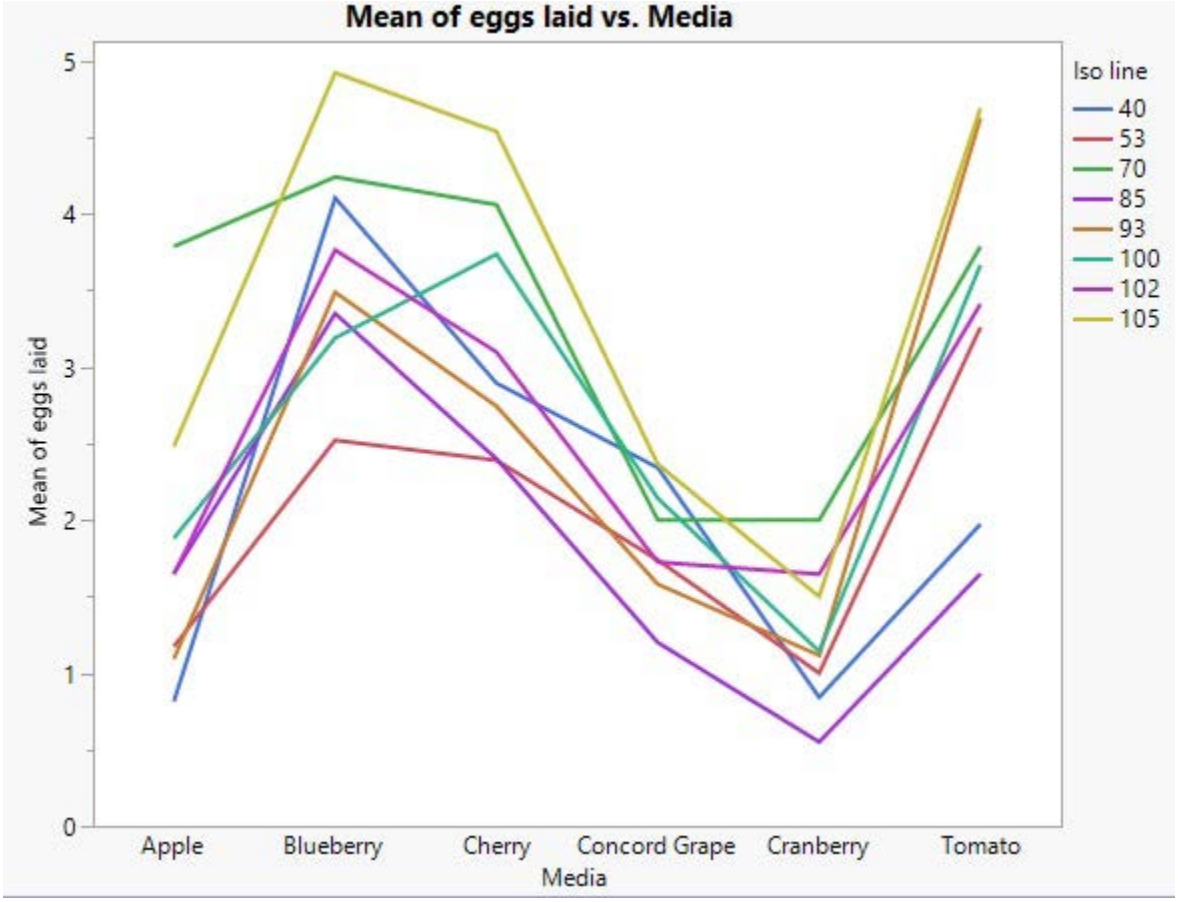


Table 5

Standard Least Squares Testing for Differences in the Mean Number of Eggs Laid Among Host Fruit Media and D. suzukii Isogenic Lines.

Phenotype	Source	Sum of Squares	DF	Mean Square	f	p
Eggs Laid	Media	1414	5	282.8	24.95	<.001***
	Iso Female Line	481	7	68.8	6.07	<.001***
	Media x Iso Female Line	416	35	11.9	1.05	0.390

*P<0.05, **P<.01, ***P<.001

The standard least squares test analyzing the number of eggs laid for each media and each inbred female line revealed that some of the factors have a significant impact on the number of eggs laid (See Table 5). For the relationship between the number of eggs laid and the media used, the p-value is less than .001, meaning that media does have an effect on the number of eggs laid (or that the difference in the number of eggs laid on each media is significant). The p-value for the isofemale line is also less than .001 meaning that the amount of eggs laid does depend on the isofemale line. However, the effect of fruit media in relation to isofemale line did not have a significant p-value, this means that while genotype does account for variation in media use and eggs laid, there is not a significant link between media and genotype.

Table 6

Post-Hoc Tukey Tests for Pairwise Comparisons of the Mean Number of Eggs Laid on Each Media for Each IsoFemale Line

	Line															
	105		102		100		93		85		70		53		40	
Media	**Mean**	**95% CI**	**Mean**	**95% CI**	**Mean**	**95% CI**	**Mean**	**95% CI**	**Mean**	**95% CI**	**Mean**	**95% CI**	**Mean**	**95% CI**	**Mean**	**95% CI**
Apple	2.48077^{BC}	[1.4365, 3.5251]	1.64706^{B}	[0.6682, 2.6259]	1.88095^{AB}	[0.8654, 2.8965]	1.09302^{C}	[0.1404, 2.0457]	1.65^{AB}	[0.449, 2.8514]	3.78788^{A}	[2.4487, 5.1271]	1.17391^{A}	[-0.091, 2.4388]	0.81579^{C}	[4.34e-5, 1.6315]
Blueberry	4.92308^{A}	[3.8788, 5.9674]	3.76471^{A}	[2.7858, 4.7436]	3.19048^{AB}	[2.1749, 4.2060]	3.48837^{AB}	[2.5357, 4.4410]	3.35^{A}	[2.149, 4.5514]	4.24242^{A}	[2.9032, 5.5816]	2.52174^{A}	[1.257, 3.7866]	4.10526^{A}	[3.2895,4.9210]
Cherry	4.53846^{AB}	[3.4942, 5.5828]	3.09804^{AB}	[2.1192, 4.0769]	3.7381^{A}	[2.7226, 4.7536]	2.74419^{ABC}	[1.7915, 3.6968]	2.4^{AB}	[1.199, 3.6014]	4.06061^{A}	[2.7214, 5.3998]	2.3913^{A}	[1.126, 3.6562]	2.89474^{AB}	[2.0790, 3.7105]
Cranberry	1.5^{C}	[0.4557, 2.5443]	1.64706^{B}	[0.6682, 2.6259]	1.14286^{B}	[0.1273, 2.1584]	1.11628^{C}	[0.1636, 2.0689]	0.55^{B}	[-0.651, 1.7514]	2^{A}	[0.6608, 3.3392]	1^{A}	[-0.265, 2.2649]	0.84211^{C}	[0.0264, 1.6579]
Concord Grape	2.36538^{C}	[1.3211, 3.4097]	1.72549^{B}	[0.7466, 2.7043]	2.14286^{AB}	[1.1273, 3.1584]	1.5814^{BC}	[0.6287, 2.5340]	1.2^{AB}	[-0.0014, 2.4014]	2^{A}	[0.6608, 3.3392]	1.73913^{A}	[0.474, 3.0040]	2.34211^{BC}	[1.5264, 3.1579]
Tomato	4.69231^{A}	[3.6480, 5.7366]	3.41176^{AB}	[2.4329, 4.3906]	3.66667^{A}	[2.6511, 4.6822]	4.62791^{A}	[3.6753, 5.5806]	1.65^{AB}	[0.449, 2.8514]	3.78788^{A}	[2.4487, 5.1271]	3.26087^{A}	[1.996, 4.5258]	1.97368^{Bc}	[1.1579, 2.7894]

*Means not sharing any letters are significantly different in a Tukey-test at P< 0.05

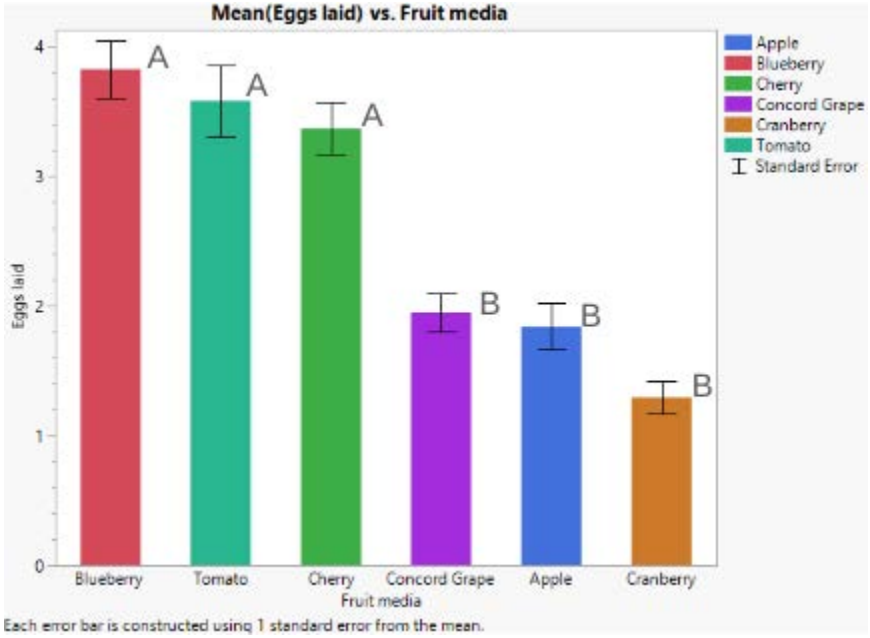
A *post hoc* Tukey-test was used to further compare the number of eggs laid for each media against each inbred line to show if there is a significant difference between the different media and where that difference may be (see Table 6). For isofemale line 105, there was a significant preference for blueberry and tomato media over apple, concord grape, and cranberry media ($P < 0.05$). Cherry media was preferred over concord grape and cranberry media ($P < 0.05$) but no significant preference was seen with apple media. For isofemale line 102, there was a preference for blueberry media over concord grape, apple, and cranberry media ($P < 0.05$). For isofemale line 100, cherry and tomato media were preferred over cranberry media ($P < 0.01$). For isofemale line 93, tomato media was preferred over cranberry, concord grape, and apple media ($P <0.001$). Blueberry media was preferred over cranberry and apple media ($P < 0.01$), but no significant preference was found over cherry or concord grape media. In isofemale line 85, blueberry media was preferred over cranberry media ($P < 0.05$), but no other preference was found. In isofemale line 40, blueberry media was preferred over concord grape, tomato, apple, and, cranberry media ($P < 0.05$). Cherry media was preferred over cranberry and apple media ($P < 0.01$), but no preference was found over concord grape and tomato media. The means for isofemale lines 70 and 53 were not significantly different, so no preferences were found among these lines.

Relationship Between Eggs Laid and Media. To see if the amount of eggs laid depended on the media, the data showcasing the amount of eggs laid on each media during each repetition was analyzed using a *post-hoc* Tukey test (see figure 7 and table 7). The amount of eggs laid on blueberry, cherry, and tomato was significantly more than the amount of eggs laid on concord grape, apple, and cranberry. There was no significant difference among blueberry,

cherry, and tomato. There was also no significant difference among concord grape, apple, and cranberry.

Figure 7

Bar Graph Comparing the Mean Number of Eggs Laid on Each Fruit Media



Note: Bars not sharing letters were significantly different in a *post-hoc* Tukey test

Table 7

Post-hoc Tukey Tests for Pairwise Comparisons of the Mean Number of Eggs Laid for Each Media

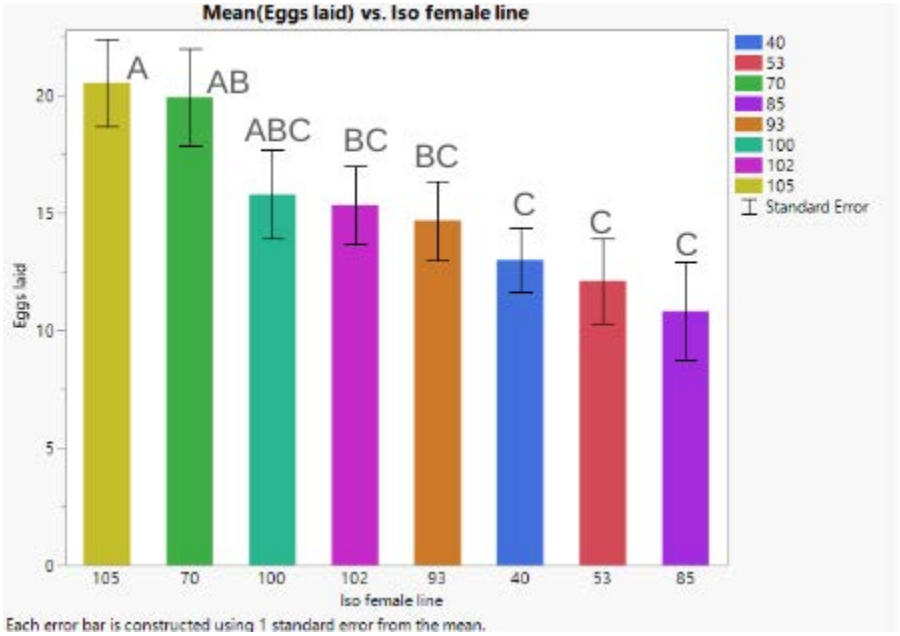
Media	Mean	Std Error
Apple	1.8161731[B]	0.20444965
Blueberry	3.6982572[A]	0.20444965
Cherry	3.2331787[A]	0.20444965
Concord Grape	1.8870454[B]	0.20444965
Cranberry	1.2247875[B]	0.20444965
Tomato	3.3838848[A]	0.20444965

*Means not sharing any letters are significantly different in a Tukey-test at P < 0.05

Relationship Between Eggs Laid and Isofemale Line. To see if the amount of eggs laid depended on the line, and therefore, may have a genetic link, the data showcasing the amount of eggs laid by each line during each repetition was analyzed. Line 105 laid significant more eggs in comparison to line 102, line 100, line 85, line 53, and line 40 (see Figure 8 and Table 9). Line 70 laid more eggs than line 85, line 53 and line 40. There was not a significant difference of eggs laid among the other lines (Table 8).

Figure 8

Bar Graph Comparing the Mean Number of Eggs Laid for Each IsoFemale Line



Note: Bars not sharing letters were significantly different in a *post-hoc* Tukey test

Table 8

Post-hoc Tukey Tests for Pairwise Comparisons of the Mean Number of Eggs Laid for Each IsoFemale Line

Iso Line	Mean	Std Error
105	20^{A}	0.19060844
102	15.2941^{Bc}	0.19246807
100	15.7619^{ABc}	0.21208949
93	14.6512^{Bc}	0.20960882
85	10.8^{c}	0.30734687
70	19.8788^{AB}	0.23926921
53	12.087^{c}	0.28660243
40	12.9737^{c}	0.22297285

*Means not sharing any letters are significantly different in a Tukey-test at $P < 0.05$

Chapter 4: Discussion

Effects of Light Pollution on Nocturnal Insect Communities

The results from the light pollution experiment differ from what was expected. The site in Boone, NC, which was thought to have less insect diversity due to the heavy light pollution, produced more orders than the less light-polluted sight in Matney, NC during both of the weeks sampled. Some orders were only found at the Boone site such as Neuroptera and Pscodea which were not found at the Matney site for either of the collection weeks. The addition of Neuroptera and Pscodea orders is not really a major surprise. The Neuroptera that were found were from the family Coniopterygidae, also known as dusty wings. While there seems to be a consensus that this group is photosensitive and is most attracted to blue or UV light, there is very little research documenting how this family is affected by light pollution (Stelzl & Devetak, 1999; van Wielink & Spijkers, 2013). Individuals from Pscodea have also been known to be photosensitive and equally attracted to blue and UV light (Mendez et al., 2022). The Matney site had more individual specimens, primarily Lepidoptera, than the Boone site during the week of 8/28/2022. The Matney site had 159 specimens, while the Boone site had 98 specimens. During the week of 9/11/2022, the Boone site collected more orders than the Matney site, with Hymenoptera, Hemiptera, and Pscodea found only at the Boone site. Neither site found any Coleoptera or Neuroptera during the collection week. The week of 9/11 was different than the previous week given that more individuals, primarily Diptera, were found in the Boone site than in the Matney site. With 80 individuals found in the Boone site and 34 found in the Matney site. Regardless of the decline, the Matney site still boasted more Lepidoptera than the Boone site. The overall decline in individuals could be due to the Matney site being at a higher elevation and thus lower temperature.

Overall, the Boone site found more families than the Matney site, primarily those from Diptera, Coleoptera, Hemiptera, and Hymenoptera. Some families were only found in the Boone site, with a majority of the unique families from the Diptera order such as Drosophilidae, Sphaeroceridae, Blephariceridae, Culicidae, Ptychopteridae, Heleomyzidae, Simulidae, Piophilidae, Tephritidae, and Thamaleidae. Other families that were unique to the Boone site include: Coccinellidae (Order: Coleoptera), Derodontidae (Order: Coleoptera), Aphidae (Order: Hemiptera), Braconidae (Order: Hymenoptera), Ceraphronidae (Order: Hymenoptera), Diapriidae (Order: Hymenoptera), Sclerogibbidae (Order: Hymenoptera), Cynipidae (Order: Hymenoptera), Heloridae (Order: Hymenoptera), and Heliodinidae (Order: Lepidoptera). Phoridae (Order: Diptera) included the largest amount of specimens collected at 75 individuals, families Aphidae (Order: Hemiptera) and Noctuidae (Order: Lepidoptera) had the second and third largest amount of specimens at 10 and 8 respectfully. The other families had seven or fewer individuals collected from each. While the Matney site had fewer families overall, it still boasted more Lepidoptera families than the Boone site. The Matney site also had families unique to it, with the majority of the families being from the order Lepidoptera such as Geometridae, Erebidae, Elachistidae, Limacodidae, Yponomeutidae, Gelechiidae, and Tineidae. Other families that were unique to the Matney site include Scarabaeidae (Order: Coleoptera), Asilidae (Order: Diptera), Tipulidae (Order: Diptera), Anisopodidae (Order: Diptera), Psychodidae (Order: Diptera), Tanyderidae (Order: Diptera), and Ichneumonidae (Order: Hymenoptera). Noctuidae (Order: Lepidoptera) included the largest amount of specimens collected at 62 individuals, and families Pyralidae (Order: Lepidoptera) and Torticidae (Order: Lepidoptera) had the second and third largest amount of specimens at 24 and 14 respectively. The difference in the site surroundings could be attributed to the unexpected results. The site chosen in Boone (the roof of

the science building) was close to a few bodies of water such as an artificial pond and a small stream. The site chosen in Matney (the yard in a private residence) was close to one body of water, a small creek, and has a higher elevation. The proximity to a body of water could be a cause given that some of the orders that were found more in the Boone site were Trichoptera and Ephemeroptera (which were only found in the Boone site), both orders being aquatic emergent orders. Light pollution has been seen to affect aquatic ecosystems as well by sometimes decreasing the chances of survival for aquatic predators and increasing the chances of survival for aquatic emergent insects (Meyer & Sullivan, 2013). While the Boone site attracted more orders and families it is important to point out that the Matney site seemed to have a more even amount of individuals across the families collected. The Boone site was also shown to attract more Diptera while the Matney site was shown to primarily attract more Lepidoptera. Both Diptera and Lepidoptera are thought to be highly susceptible to light pollution (Justice & Justice, 2016), explaining the high numbers collected. Insect communities are responding to ALAN regardless of whether there is a high or low amount of light pollution (Kehoe et al., 2022). Quantifying the specific effects of ALAN can be difficult given that there is a decent amount of photosensory mechanisms involved in how ALAN affects insects, and insects that have the same photoreceptors might not be affected by ALAN the same way (Alaasam et al., 2021). Our experiment primarily focuses on how ALAN affects the abundance and evenness of insect communities but other factors such as predation, photoreceptors, topography, as well as how the collected insects impact each other should be taken into account in order to get a full picture. For example, Parkinson et al., (2020) studied the effects of ALAN on emergent insects in a riparian area. They found that ALAN allowed the insect community to become dominated by a single family which resulted in an increase of spider predators, increasing the biomass of emergent

insect biomass as well as decreasing the species evenness. It has also been seen that other factors such as habitat fragmentation and tree cover can exacerbate or mitigate the effects light pollution has on insect communites (Camacho et al., 2021; Straka et al., 2021). The Choco golden scarab, *Chrysina argenteola*, was found to be scarcer in areas with reduced forest cover as well as more likely to congregate to lights, however, the beetle is less likely to be attracted to light in areas with less than 4km² of forest cover (Camach et al., 2021). Straka and other researchers (2021) found similar results while studying light pollution and macro-moths, they found that tree cover density increased species richness and abundance. They also found that mercury light decreased macro-moth species richness while urban structures decreased the abundance of macro-moths (Straka et al., 2021).

Given that the light pollution experiment was an exploratory experiment, definite conclusions can not be made. If the experiment is to be continued in the future, more traps and sites would be added as well as a more cohesive collection schedule. Different types of light traps would be included, such as sheet traps, to account for any sampling bias that could occur from using only bucket traps.

The results from our experiment may hint that the relationship between light pollution and insect diversity is more complicated than originally assumend, however, the experiment was still effective in giving insight into the effects of light pollution in the southeastern Appalachian Mountains as well documenting some of the insects that can be found in the area.

D. suzukii Preferences Among Commercial Fruit Species

The results from the oviposition experiment suggest that *Drosophila suzukii* has a preference for host plants such as tomato, cherry, and blueberry. Research has shown that *Drosophila suzukii* often prefers and targets blueberry and cherry plants as hosts for oviposition

(Diepenbrock et al., 2016; Kinjo et al., 2013; Lee et al., 2016). However, using tomato plants for oviposition hosts has only been documented in lab settings, not in field settings (Cini et al., 2012). This experiment did not go into further detail on what exactly makes a preferred fruit host for *Drosophila suzukii,* but other researchers have speculated that host preference comes from a combination of characteristics such as pH, total soluble solids, and flesh firmness (Lee et al., 2016). Gravid *Drosophila suzukii* females tend to prefer to lay eggs in fruits that have softer firmness (Diepenbrock et al., 2016). Firmness may have played a role in host preference during the experiment given that the blueberry, cherry, and tomato gels were semi-soft while the apple gel was quite firm and the cranberry gel was extremely soft. The results of the experiment showed that genotype does account for some media preferences, but there was not a specific link between genotype and specific media. The experiment also showed that the amount of eggs laid was dependent on the Iso female line for some of the lines, but not for all of the lines, this result could be due to not all of the lines reaching 50 repetitions. If the experiment was continued to where 50 repetitions were reached for all isofemale lines used, perhaps a link would be found or maybe all lines would show that genotype affects egg amount, however, it is unsure given that the lines that did reach 50 repetitions did not show a specific link between genotype and fruit preferred and some did not show a significant difference in the number of eggs laid.

Future research involving this experiment would include further analysis of the components of the media used, continued repetitions, and larval assays that show how fruit media can affect the development of *Drosophila suzukii* larvae. Experiments involving the effects firmness has on host preference would also be explored, to see if any of the preferences are changed once firmness differs. Preferences with other fruit medias such as blackberries, raspberries, and strawberries would be explored given that the aforementioned fruits are a

popular crop in the Southern Appalachian Mountains. We would also like to further investigate host preferences by preforming the experiment in the field with naturally occurring plants, to see how the presence of whole fruit with the skin intact affect host preferences.

This experiment has shown that endemic cranberries may not be at risk given that other locally occurring plants such as blueberries are shown to be more preferred. There may still be a concern with how *Drosophila suzukii* will affect fruit farmers in the Southern Appalachians given that many susceptible berry crops such as blackberries, blueberries, strawberries, and raspberries are found to farmed in the area.

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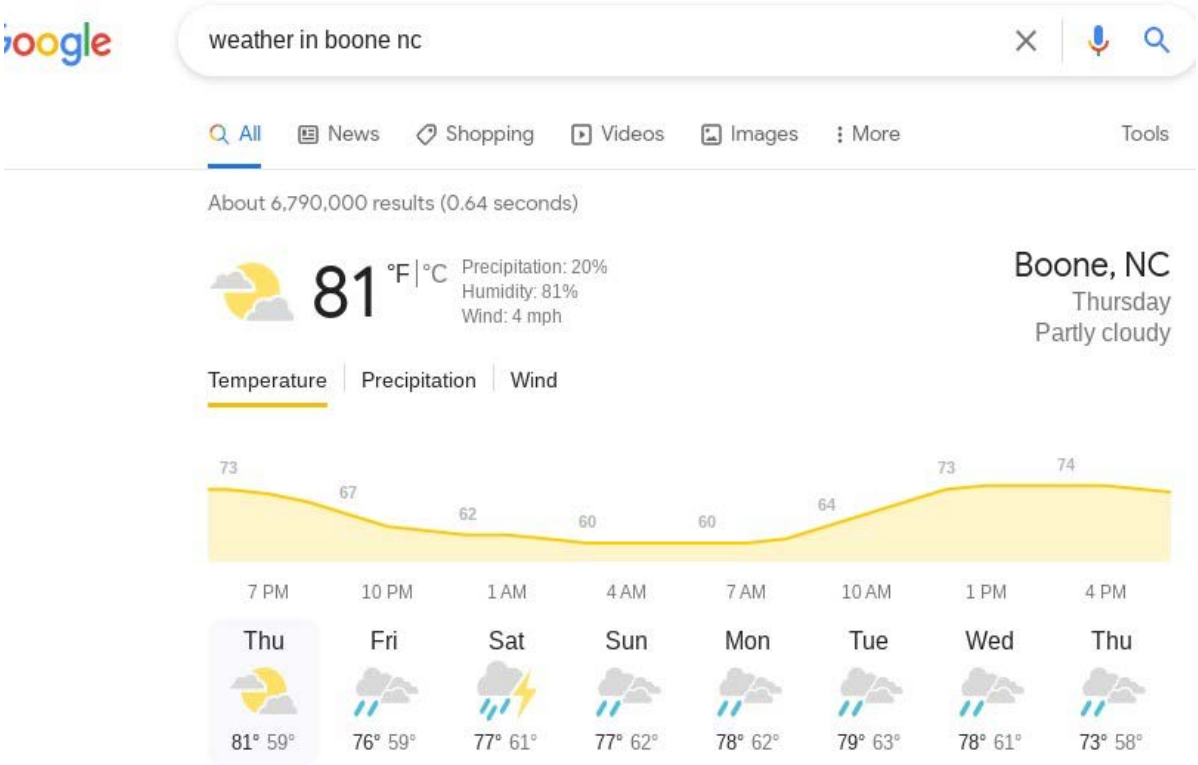
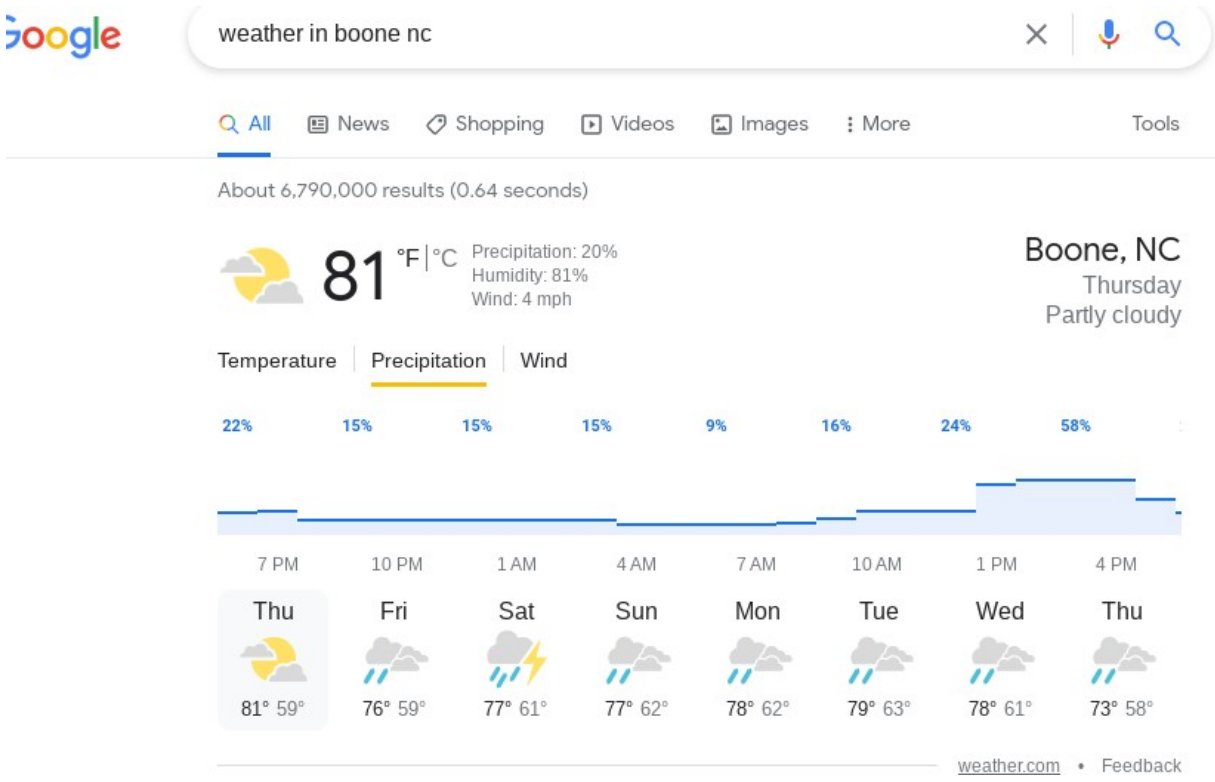
Appendix A

Google weather reports from the nights of insect collection, this includes temperature, moon phase, precipitation, and wind speed for both collection sites during collection days.

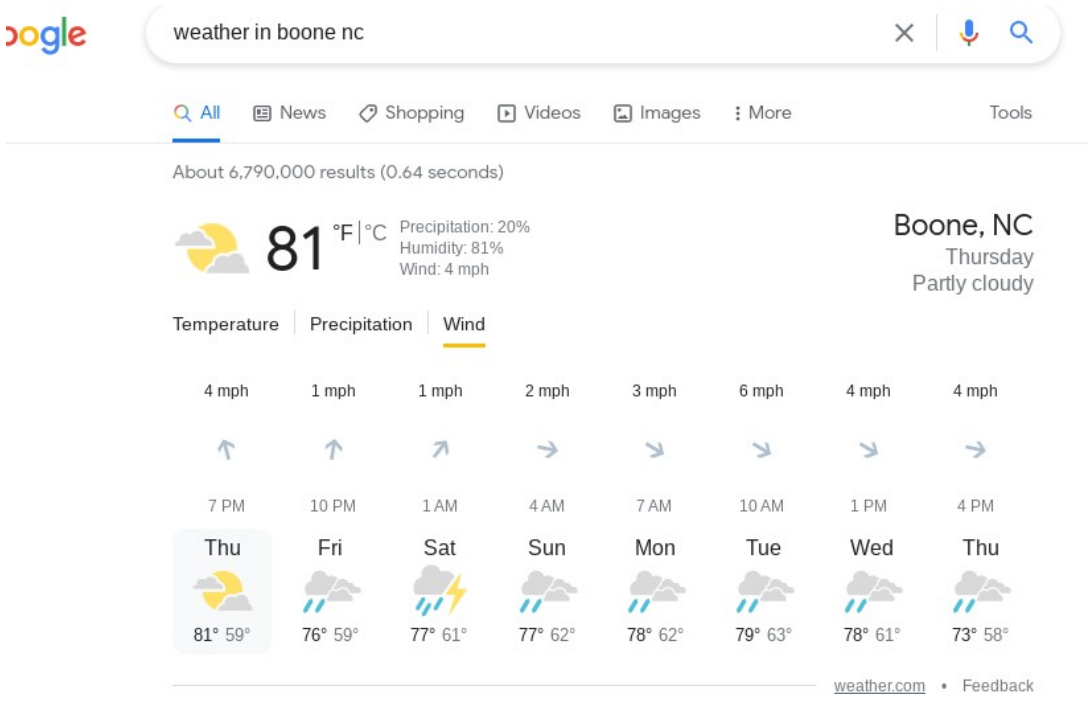
Date: Aug. 25, 2022, running 1 bucket trap on the Roof of Rankin. Start at dusk, Time: 8:14 pm
Ending on Aug 26 in the morning, Time:8:40 am
Moon phase: Waning Crescent
Weather report according to Google (Temp., precipitation, wind):
Temperature:



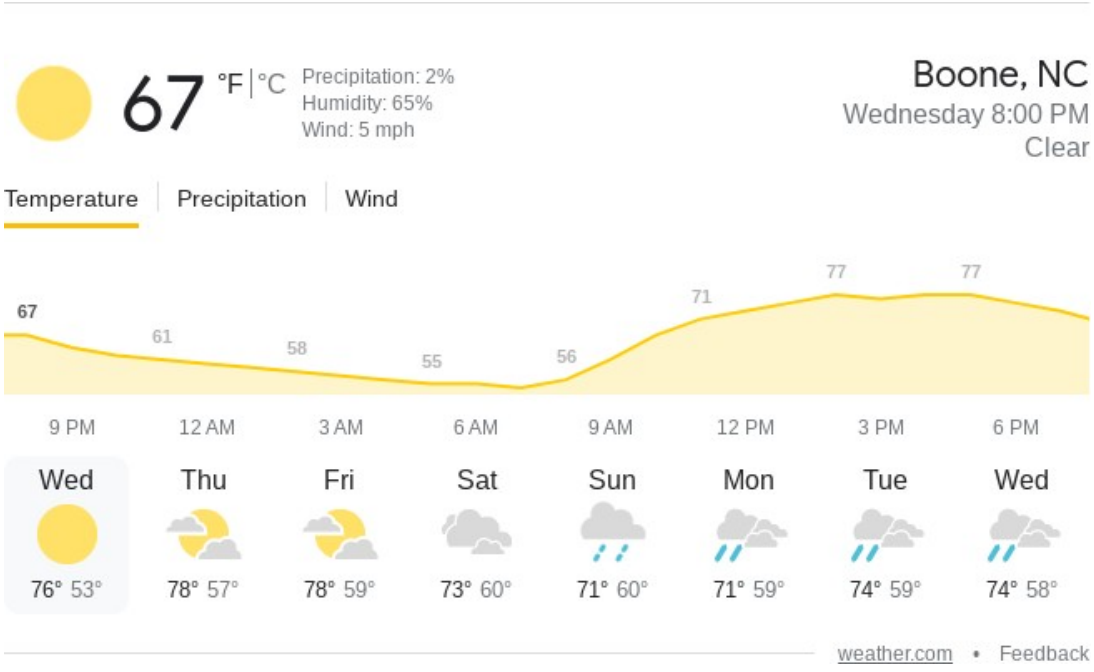
Precipitation:



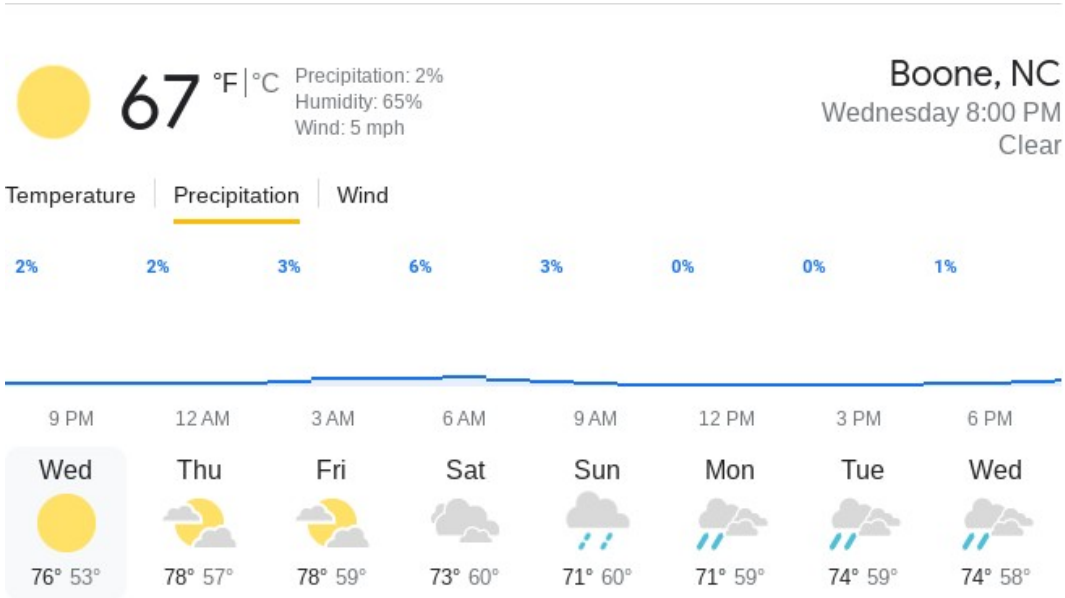
Wind:



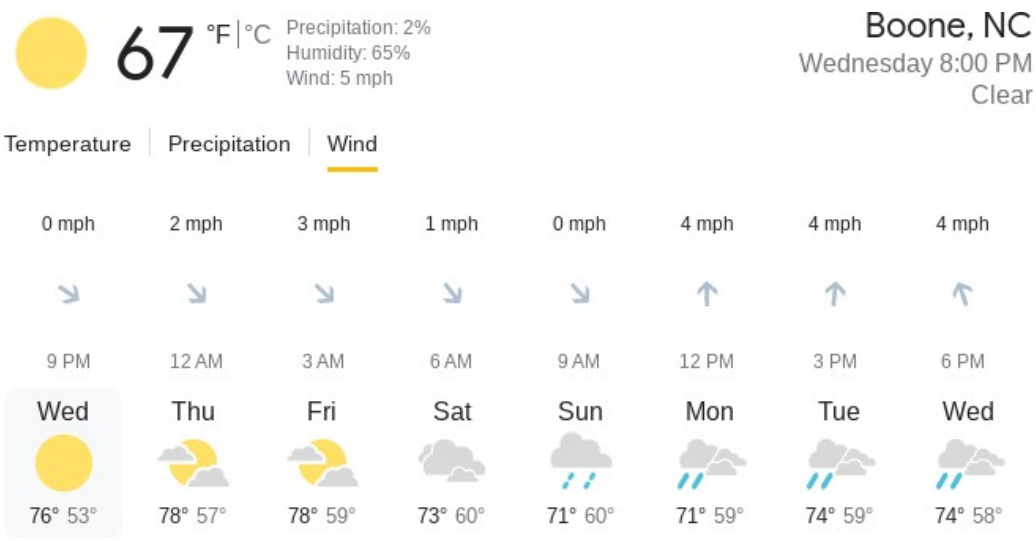
Date: Aug. 31, 2022, running 1 bucket trap on the Roof of Rankin. Start at dusk, Time: 8:19 pm
Ending on Sep 1st in the morning
Moon phase: Waxing Crescent
Weather report according to Google (Temp., precipitation, wind):
Temperature:



Precipitation:



Wind:

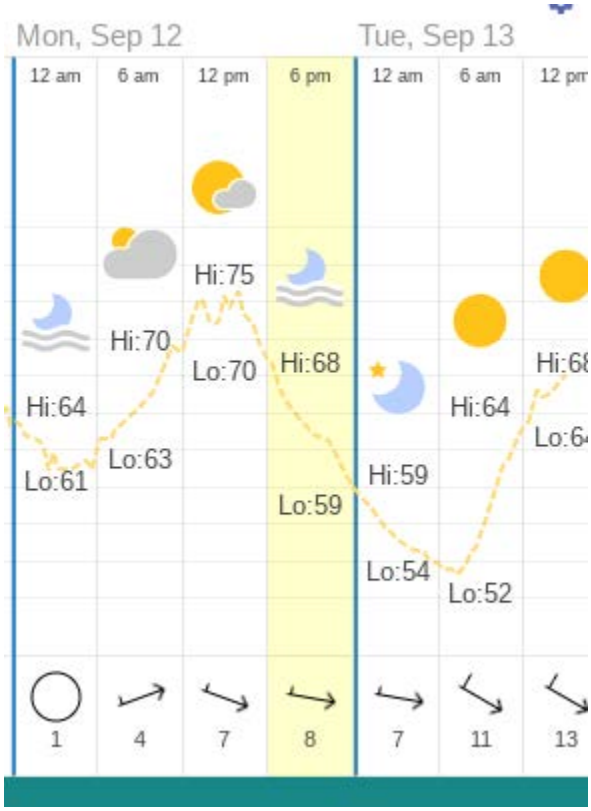

67 °F | °C
Precipitation: 2%
Humidity: 65%
Wind: 5 mph
Boone, NC
Wednesday 8:00 PM
Clear
Temperature
Precipitation
Wind
0 mph
2 mph
3 mph
1 mph
0 mph
4 mph
4 mph
4 mph
9 PM
12 AM
3 AM
6 AM
9 AM
12 PM
3 PM
6 PM
Wed
Thu
Fri
Sat
Sun
Mon
Tue
Wed
76° 53°
78° 57°
78° 59°
73° 60°
71° 60°
71° 59°
74° 59°
74° 58°

Date: Sep 1, 2022, 2 bucket traps were run in the private residence in Matney, NC.
Start at dusk, Time: 7:59 pm
Ended on Sep 2nd in the morning
Moon phase: Waxing Crescent
Weather report according to Google

September 01, 2022

	Atmospheric conditions and temperature °F	RealFeel °F	Atmospheric pressure inHg	Wind speed mph	Humidity
Night	+57°	+57°	26.8	NW 3.4	71%
Morning	+54°	+54°	26.8	NW 3.8	80%
Day	+75°	+75°	26.9	S 4.9	50%
Evening	+70°	+70°	26.9	S 2.2	67%

Date: Sep. 12, 2022, running 1 bucket trap on the roof of Rankin Science South, Boone, NC.
Start at dusk, Time: 7:59 pm
Ending on Sep 13th in the morning, Time: 10:30 am
Moon phase: Waning Gibbous
Weather report according to Google (Temp., precipitation, wind):



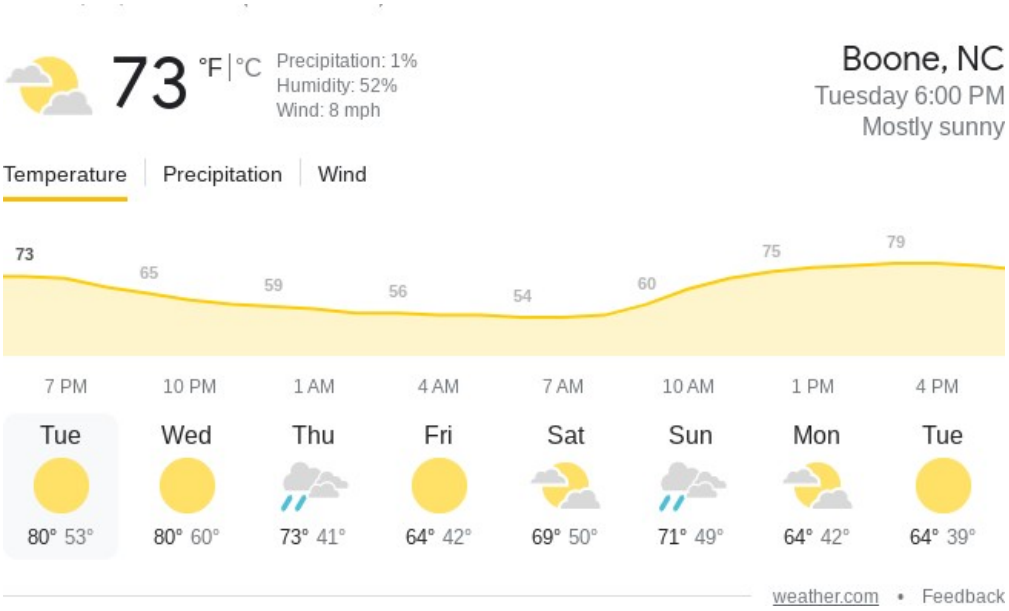
Date: Sep 15, 2022, running 1 bucket trap at the private residence in Matney, NC. (back house)
Start at dusk, Time: 7:30 pm
Ending on Sep 1st in the morning, Time: 8:00 am
Moon phase: Waning Gibbous
Weather report according to Google (Temp., precipitation, wind):

wunderground.com/history/daily/us/nc/banner-elk/KTRI/date/2022-9-15

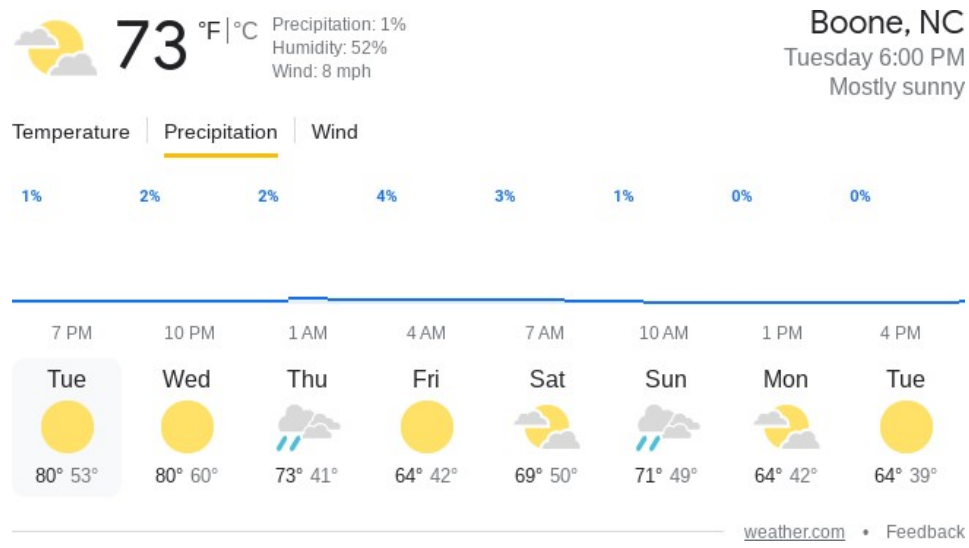
Summary

Temperature (°F)	Actual	Historic Avg.	Record
High Temp	82	81.1	91
Low Temp	50	56.8	40
Day Average Temp	61.48	69	-
Precipitation (in)	Actual	Historic Avg.	Record
Precipitation (past 24 hours from 04:53:00)	0.00	3.30	-
Dew Point (°F)	Actual	Historic Avg.	Record
Dew Point	53.94	-	-
High	61	-	-
Low	49	-	-
Average	53.94	-	-
Wind (mph)	Actual	Historic Avg.	Record
Max Wind Speed	5	-	-
Visibility	10	-	-

Date: Sep. 20, 2022, running 1 bucket trap on the roof of Rankin Science South, Boone, NC.
Start at dusk, Time: 7:30 pm
Ending on Sep 21st in the morning, Time: 10:30 am
Moon phase: Waning crescent
Weather report according to Google (Temp., precipitation, wind):
Temperature:



Precipitation:



Wind:


73 °F | °C
Precipitation: 1%
Humidity: 52%
Wind: 8 mph
Boone, NC
Tuesday 6:00 PM
Mostly sunny
Temperature
Precipitation
Wind
6 mph
1 mph
1 mph
1 mph
1 mph
3 mph
5 mph
5 mph
7 PM
10 PM
1 AM
4 AM
7 AM
10 AM
1 PM
4 PM
Tue
Wed
Thu
Fri
Sat
Sun
Mon
Tue
80° 53°
80° 60°
73° 41°
64° 42°
69° 50°
71° 49°
64° 42°
64° 39°
weather.com • Feedback

Appendix B

The following contains the citations for the field guides (hardcopy and online sources) used to identify the specimens collected.

Books used:

Borror, D. J., & White R. E. (1970). *Peterson Field Guide to Insects.* Houghton Mifflin Company.

Covell, C. V., Jr., (1984). *A Field Guide to Moths of Eastern North America.* Virginia Museum of Natural History.

Eaton, E. R. & Kaufman K. (2007). *Kaufman Field Guide to Insects of North America.* Houghton Mifflin Company.

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Triplehorn, C. A. & Johnson, N. F. (2005). *Borror and Delong's Introduction to the Study of Insects* (7th ed.). BROOKS/COLE CENGAGE learning.

Online sources:

Beaty, S. R., Walters, M. D., Holland, V. (2013). The Ephemeroptera of North Carolina: A Biologist's Handbook With Standard Taxonomic Effort Levels (version 4.11). North Carolina Department of Environment and Natural Resources Division of Water Quality Biological Assessment Division.

https://www.deq.nc.gov/water-quality/environmental-sciences/bau/benthos-reference/bau-taxonomy-ephemeroptera-21oct13-full-version/download

BugGuide. https://bugguide.net/node/view/15740. Ames, IA: Iowa State University [accessed April 25, 2023]

*Note: BugGuide.net was used multiple times, the following links are the pages that were most relevant to the research: https://bugguide.net/node/view/78/bgpage (This link is for the suborders of Ephemeroptera), https://bugguide.net/node/view/9531/bgimage?from=216 (This link is for the subfamily Noctuinae), https://bugguide.net/node/view/9524 (This link is for the family Tortricidae), https://bugguide.net/node/view/15085 (This link is for one of the species that was identified, *Nephelodes minians* the Bronzed Cutworm), https://bugguide.net/node/view/33325 (This link is for one of the species that was identified, *Apantesis phalerata* The Harnessed Tiger moth)

Choate, P. M. (1999). Dichotomous Keys to Some Families of Florida Coleoptera. (n.p.). https://entnemdept.ufl.edu/choate/beetles.pdf

Moth Photographers Group. 2022. http://mothphotographersgroup.msstate.edu. Accessed (2023, June 5th).

*Note: This website was used multiple times, the following links are the pages that were most relevant to the research: https://mothphotographersgroup.msstate.edu/pinned.php?plate=33&size=m&sort=h (This link is for the Noctuinae photos), https://mothphotographersgroup.msstate.edu/pinned.php?plate=8&sort=h (This link is for the photos of Tortricidae: Olethreutinae - Olethreutini),

https://mothphotographersgroup.msstate.edu/pinned.php?plate=66.0&page=3 (This link is for the photos of Noctuidae: Condicinae - Heliothinae - Eriopinae - Bryophilinae)

National Science Foundation. (n.d.). Atlas of Common Freshwater Macroinvertebrates of Eastern North America. https://www.macroinvertebrates.org/

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Polistes Foundation. (2023, July 8). Discover Life. https://www.discoverlife.org/

Sheppard, J. (2007). A Simple Key to the Adult Mayflies of Eastern US Streams: Those of Major Interest to Trout Fishers. Potomac-Patuxent Chapter Trout Unlimited. https://www.pptu.org/images/entomology/MayflyKEY.pdf

Appendix C

This Appendix contains a slightly simplified copy of the insect data via pictures and the full data set via link. Link to the complete data set:

https://docs.google.com/spreadsheets/d/1IaIkneX8uhS9Sw86_xeVttGDHFnNx5Uh5kccyPqusDQ/edit#gid=

Date_collected	Country	State	County	City	Locality detail	Class	Order	Family
8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Coleoptera	Coccinellidae
8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Coleoptera	Coccinellidae
8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Coleoptera	Coccinellidae
8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Coleoptera	Scarabaeidae
8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Coleoptera	Elateridae
8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Coleoptera	Laemophloeidae
8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Coleoptera	Chrysomelidae
8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Coleoptera	Derodontidae
8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Ephemeroptera	Heptageniidae
8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Ephemeroptera	Baetidae
8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Ephemeroptera	Baetidae
8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Ephemeroptera	Ephemeridae
8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Ephemeroptera	Caenidae
8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Ephemeroptera	Potamanthidae
8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Ephemeroptera	Baetidae
8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Ephemeroptera	Baetidae
8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Ephemeroptera	Baetidae
8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Ephemeroptera	Baetidae
8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Ephemeroptera	Baetidae
8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Trichoptera	-
8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Trichoptera	-
8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Trichoptera	-
8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Trichoptera	-
8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Trichoptera	-
8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Trichoptera	-
8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Trichoptera	-

1	Date_collected	Country	State	County	City	Locality detail	Class	Order	Family
28	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Trichoptera	-
29	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Trichoptera	-
30	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Trichoptera	-
31	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Trichoptera	-
32	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Trichoptera	-
33	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Trichoptera	-
34	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Trichoptera	-
35	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Trichoptera	-
36	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Trichoptera	-
37	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Trichoptera	-
38	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Trichoptera	-
39	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Trichoptera	-
40	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Trichoptera	-
41	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hemiptera	Pentatomidae
42	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hemiptera	Reduviidae
43	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hemiptera	Reduviidae
44	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Psocodea	-
45	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hemiptera	Cicadellidae
46	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hemiptera	Aphididae
47	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hemiptera	Aphididae
48	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
49	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
50	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
51	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
52	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
53	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae

1	Date_collected	Country	State	County	City	Locality detail	Class	Order	Family
54	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
55	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
56	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
57	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
58	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
59	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
60	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
61	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
62	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
63	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
64	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
65	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
66	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
67	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
68	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
69	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
70	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
71	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
72	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
73	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
74	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
75	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
76	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
77	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
78	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
79	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae

1	Date_collected	Country	State	County	City	Locality detail	Class	Order	Family
80	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
81	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
82	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
83	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
84	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
85	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
86	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
87	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
88	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
89	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
90	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
91	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
92	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
93	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Chloropidae
94	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Scathophagidae
95	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Tipulidae
96	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Cecidomyiidae, Iestremiinae
97	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Simuliidae
98	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Cecidomyiidae
99	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Empididae, Hybotinae
100	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Simuliidae
101	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Sciaridae
102	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Sciaridae
103	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Simuliidae
104	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Tortricidae
105	8/25/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Trichoptera	-

1	Date_collected	Country	State	County	City	Locality detail	Class	Order	Family
106	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Trichoptera	-
107	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Notodontidae
108	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Notodontidae
109	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Noctuidae
110	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Tortricidae
111	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Carposinidae
112	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Pyralidae
113	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Pyralidae
114	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Pyralidae
115	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Tortricidae
116	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Pyralidae
117	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Coleoptera	Coccinellidae
118	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Coleoptera	Derodontidae
119	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Coleoptera	Derodontidae
120	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Coleoptera	Derodontidae
121	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hemiptera	Aphididae
122	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hemiptera	Aphididae
123	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hemiptera	Aphididae
124	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hemiptera	Cicadellidae
125	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
126	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Figitidae
127	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Figitidae
128	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Braconidae
129	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Braconidae
130	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Braconidae
131	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae

1	Date_collected	Country	State	County	City	Locality detail	Class	Order	Family
132	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Ceratopogonidae
133	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
134	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Ceratopogonidae
135	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
136	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Drosophilidae
137	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
138	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
139	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
140	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
141	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
142	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Lonchopteridae
143	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
144	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
145	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
146	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
147	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
148	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
149	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
150	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Cecidomyiidae
151	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Sphaeroceridae
152	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
153	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
154	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
155	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
156	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
157	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae

1	Date_collected	Country	State	County	City	Locality detail	Class	Order	Family
158	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
159	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
160	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Sphaeroceridae
161	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
162	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
163	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Blephariceridae
164	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
165	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Chironomidae
166	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Culicidae
167	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
168	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
169	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
170	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Thamaleidae
171	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
172	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
173	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Ptychopteridae
174	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
175	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
176	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
177	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
178	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Cecidomyiidae
179	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
180	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
181	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
182	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
183	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae

1	Date_collected	Country	State	County	City	Locality detail	Class	Order	Family
184	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
185	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
186	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Platypezidae
187	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
188	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
189	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Cecidomyiidae
190	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
191	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
192	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
193	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Scenopinidae
194	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Neuroptera	Coniopterygidae
195	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Neuroptera	Coniopterygidae
196	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Neuroptera	Coniopterygidae
197	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Psocodea	-
198	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Trichoptera	-
199	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Trichoptera	-
200	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Psocodea	-
201	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Trichoptera	-
202	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Psocodea	-
203	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Trichoptera	-
204	8/31/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Ceraphronidae
205	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Trichoptera	-
206	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Trichoptera	Phryganeidae
207	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Trichoptera	Phryganeidae
208	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Trichoptera	-
209	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Trichoptera	-

1	Date_collected	Country	State	County	City	Locality detail	Class	Order	Family
210	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Trichoptera	-
211	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Trichoptera	-
212	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Trichoptera	-
213	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Trichoptera	-
214	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Noctuidae
215	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Noctuidae
216	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Noctuidae
217	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Noctuidae
218	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Noctuidae
219	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Noctuidae
220	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Noctuidae
221	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Noctuidae
222	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Noctuidae
223	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Noctuidae
224	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Noctuidae
225	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Noctuidae
226	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Noctuidae
227	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Noctuidae
228	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Noctuidae
229	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Noctuidae
230	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Noctuidae
231	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Noctuidae
232	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Noctuidae
233	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Noctuidae
234	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Noctuidae
235	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Geometridae

1	Date_collected	Country	State	County	City	Locality detail	Class	Order	Family
236	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Geometridae
237	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Geometridae
238	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Geometridae
239	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Geometridae
240	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Noctuidae
241	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Noctuidae
242	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Noctuidae
243	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Noctuidae
244	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Erebidae
245	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Erebidae
246	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Crambidae
247	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Crambidae
248	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Tortricidae
249	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Notodontidae
250	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Notodontidae
251	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Tortricidae
252	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Pyralidae
253	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Tortricidae
254	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Tortricidae
255	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Pyralidae
256	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Pyralidae
257	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Pyralidae
258	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Tortricidae
259	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Elachistidae
260	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Limacodidae
261	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Pyralidae

1	Date_collected	Country	State	County	City	Locality detail	Class	Order	Family
262	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Tortricidae
263	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Crambidae
264	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Tortricidae
265	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Yponomeutidae
266	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Lepidoptera	Pyralidae
267	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Trichoptera	-
268	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Diptera	Cecidomyiidae
269	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Diptera	Lonchopteridae
270	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Diptera	Empididae
271	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Diptera	Asilidae
272	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Diptera	Tipulidae
273	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Diptera	Platypezidae
274	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Diptera	Phoridae
275	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Diptera	Phoridae
276	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Diptera	Cecidomyiidae
277	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Diptera	-
278	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Diptera	Anisopodidae
279	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Diptera	Ceratopogonidae
280	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Diptera	Ceratopogonidae
281	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Diptera	Chironomidae
282	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Diptera	Cecidomyiidae
283	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Diptera	Phoridae
284	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Diptera	Cecidomyiidae
285	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Diptera	Platypezidae
286	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Diptera	Scenopinidae
287	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Diptera	Psychodidae

1	Date_collected	Country	State	County	City	Locality detail	Class	Order	Family
288	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Diptera	Phoridae
289	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Diptera	Cecidomyiidae
290	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Diptera	Chironomidae
291	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Diptera	Ceratopogonidae
292	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Diptera	Cecidomyiidae
293	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Diptera	Tipulidae
294	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Hemiptera	Cicadellidae
295	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Hemiptera	Cicadellidae
296	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Coleoptera	Scarabaeidae
297	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-front house-83 degrees east	Insecta	Hymenoptera	Formicidae
298	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Trichoptera	Phryganeidae
299	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Trichoptera	Phryganeidae
300	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Hymenoptera	Ichneumonidae
301	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Trichoptera	-
302	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
303	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
304	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
305	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
306	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
307	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
308	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
309	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
310	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
311	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Geometridae
312	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
313	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae

1	Date_collected	Country	State	County	City	Locality detail	Class	Order	Family
314	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
315	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
316	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
317	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Geometridae
318	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Geometridae
319	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Pyralidae
320	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
321	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Pyralidae
322	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Pyralidae
323	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Gelechiidae
324	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Carposinidae
325	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Pyralidae
326	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Tortricidae
327	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Pyralidae
328	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Tortricidae
329	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Pyralidae
330	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Pyralidae
331	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Tortricidae
332	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Tortricidae
333	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Tortricidae
334	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Tortricidae
335	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Pyralidae
336	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Tortricidae
337	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Erebidae
338	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Diptera	Phoridae
339	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Diptera	Ceratopogonidae

1	Date_collected	Country	State	County	City	Locality detail	Class	Order	Family
340	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Diptera	Ceratopogonidae
341	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Diptera	Dolichopodidae
342	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Diptera	Tanyderidae
343	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Diptera	Tanyderidae
344	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Diptera	Phoridae
345	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Diptera	Phoridae
346	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Diptera	Ceratopogonidae
347	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Diptera	Dolichopodidae
348	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Diptera	Tanyderidae
349	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Diptera	Phoridae
350	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Diptera	Tanyderidae
351	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Hymenoptera	Figitidae
352	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Hemiptera	Cicadellidae
353	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Pyralidae
354	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Pyralidae
355	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Pyralidae
356	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Pyralidae
357	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Pyralidae
358	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Pyralidae
359	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Pyralidae
360	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Pyralidae
361	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Yponomeutidae
362	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Limacodidae
363	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Pyralidae
364	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Trichoptera	-
365	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Noctuidae

1	Date_collected	Country	State	County	City	Locality detail	Class	Order	Family
340	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Diptera	Ceratopogonidae
341	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Diptera	Dolichopodidae
342	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Diptera	Tanyderidae
343	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Diptera	Tanyderidae
344	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Diptera	Phoridae
345	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Diptera	Phoridae
346	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Diptera	Ceratopogonidae
347	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Diptera	Dolichopodidae
348	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Diptera	Tanyderidae
349	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Diptera	Phoridae
350	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Diptera	Tanyderidae
351	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Hymenoptera	Figitidae
352	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Hemiptera	Cicadellidae
353	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Pyralidae
354	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Pyralidae
355	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Pyralidae
356	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Pyralidae
357	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Pyralidae
358	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Pyralidae
359	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Pyralidae
360	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Pyralidae
361	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Yponomeutidae
362	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Limacodidae
363	9/1/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Pyralidae
364	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Trichoptera	-
365	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Noctuidae

1	Date_collected	Country	State	County	City	Locality detail	Class	Order	Family
366	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Noctuidae
367	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Noctuidae
368	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Noctuidae
369	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Noctuidae
370	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Noctuidae
371	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Crambidae
372	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Crambidae
373	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Crambidae
374	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Pyralidae
375	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Pyralidae
376	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Pyralidae
377	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Tortricidae
378	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Noctuidae
379	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Empididae
380	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Empididae
381	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Lonchopteridae
382	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
383	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
384	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
385	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Scenopinidae
386	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
387	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
388	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Ceratopogonidae
389	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
390	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Dolichopodidae
391	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae

1	Date_collected	Country	State	County	City	Locality detail	Class	Order	Family
392	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Lonchopteridae
393	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
394	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Heleomyzidae
395	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Simuliidae
396	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
397	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Piophilidae
398	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
399	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
400	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Empididae
401	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
402	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
403	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
404	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Sphaeroceridae
405	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
406	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
407	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
408	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Piophilidae
409	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
410	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Heleomyzidae
411	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
412	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
413	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
414	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
415	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
416	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
417	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae

1	Date_collected	Country	State	County	City	Locality detail	Class	Order	Family
418	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
419	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Heleomyzidae
420	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
421	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Heliodinidae
422	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
423	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Tephritidae
424	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Diapriidae
425	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Braconidae
426	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Sclerogibbidae
427	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Braconidae
428	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Cynipidae
429	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Braconidae
430	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Heloridae
431	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hemiptera	Cicadellidae
432	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hemiptera	Aphididae
433	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hemiptera	Aphididae
434	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hemiptera	Aphididae
435	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hemiptera	Aphididae
436	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hemiptera	Aphididae
437	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hemiptera	Aphididae
438	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hemiptera	Aphididae
439	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Psocodea	-
440	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Psocodea	-
441	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Psocodea	-
442	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Psocodea	-
443	9/12/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Psocodea	-

1	Date_collected	Country	State	County	City	Locality detail	Class	Order	Family
444	9/15/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Trichoptera	Phryganeidae
445	9/15/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
446	9/15/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
447	9/15/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
448	9/15/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
449	9/15/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
450	9/15/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
451	9/15/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
452	9/15/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
453	9/15/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
454	9/15/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
455	9/15/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
456	9/15/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
457	9/15/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
458	9/15/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
459	9/15/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
460	9/15/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
461	9/15/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
462	9/15/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
463	9/15/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
464	9/15/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
465	9/15/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
466	9/15/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Noctuidae
467	9/15/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Crambidae
468	9/15/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Pyralidae
469	9/15/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Tineidae

1	Date_collected	Country	State	County	City	Locality detail	Class	Order	Family
470	9/15/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Crambidae
471	9/15/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Lepidoptera	Crambidae
472	9/15/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Diptera	Ceratopogonidae
473	9/15/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Diptera	Ceratopogonidae
474	9/15/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Diptera	Psychodidae
475	9/15/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Diptera	Lonchopteridae
476	9/15/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Diptera	Tipulidae
477	9/15/2022	USA	NC	Watauga	Matney	A Private Residence-back house-307 degrees NW	Insecta	Diptera	Tanyderidae
478	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Noctuidae
479	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Noctuidae
480	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Noctuidae
481	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Noctuidae
482	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Noctuidae
483	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Pyralidae
484	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Crambidae
485	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Pyralidae
486	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Noctuidae
487	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Crambidae
488	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Noctuidae
489	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Tortricidae
490	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Tortricidae
491	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Trichoptera	-
492	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Ephemeroptera	-
493	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Lepidoptera	Heliodinidae
494	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
495	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Lonchopteridae

1	Date_collected	Country	State	County	City	Locality detail	Class	Order	Family
496	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
497	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
498	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Dolichopodidae
499	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
500	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
501	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Dolichopodidae
502	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
503	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
504	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
505	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Simuliidae
506	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
507	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
508	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
509	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Platypezidae
510	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
511	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Lonchopteridae
512	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
513	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
514	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Platypezidae
515	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Empididae
516	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Ceratopogonidae
517	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
518	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Cecidomyiidae
519	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Ceratopogonidae
520	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Ceratopogonidae
521	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Lonchopteridae

1	Date_collected	Country	State	County	City	Locality detail	Class	Order	Family
522	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
523	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
524	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Ceratopogonidae
525	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
526	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Ceratopogonidae
527	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Ceratopogonidae
528	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Cecidomyiidae
529	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
530	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Chironomidae
531	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
532	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Chironomidae
533	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
534	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
535	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
536	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Cecidomyiidae
537	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
538	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
539	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
540	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
541	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Empididae
542	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
543	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
544	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Mycetophilidae
545	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
546	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
547	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Ceratopogonidae

1	Date_collected	Country	State	County	City	Locality detail	Class	Order	Family
548	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
549	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Simuliidae
550	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
551	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Culicidae
552	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
553	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Fanniidae
554	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Empididae
555	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
556	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
557	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
558	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
559	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
560	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
561	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
562	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Sphaeroceridae
563	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Fanniidae
564	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
565	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
566	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Ceratopogonidae
567	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
568	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
569	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Diptera	Phoridae
570	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Coleoptera	Leiodidae
571	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Coleoptera	Leiodidae
572	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Coleoptera	Leiodidae
573	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Coleoptera	Leiodidae

1	Date_collected	Country	State	County	City	Locality detail	Class	Order	Family
574	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Ichneumonidae
575	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Figitidae
576	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Braconidae
577	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Formicidae
578	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Figitidae
579	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Tenthredinidae
580	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Braconidae
581	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Braconidae
582	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Figitidae
583	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Braconidae
584	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Figitidae
585	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Figitidae
586	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Braconidae
587	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Figitidae
588	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Braconidae
589	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Braconidae
590	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Megaspilidae
591	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hymenoptera	Braconidae
592	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hemiptera	Cercopidae
593	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hemiptera	Cicadellidae
594	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hemiptera	Cicadellidae
595	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hemiptera	Cicadellidae
596	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hemiptera	Cicadellidae
597	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hemiptera	Cicadellidae
598	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hemiptera	Cicadellidae
599	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hemiptera	Aphididae

1	Date_collected	Country	State	County	City	Locality detail	Class	Order	Family
600	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hemiptera	Aphididae
601	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hemiptera	Aphididae
602	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hemiptera	Aphididae
603	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Hemiptera	Aphididae
604	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Psocodea	-
605	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Psocodea	-
606	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Psocodea	-
607	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Psocodea	-
608	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Psocodea	-
609	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Psocodea	-
610	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Psocodea	-
611	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Psocodea	-
612	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Psocodea	-
613	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Psocodea	-
614	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Psocodea	-
615	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Psocodea	-
616	9/20/2022	USA	NC	Watauga	Boone	Rankin Science South, Appalachian State University	Insecta	Psocodea	-

Appendix D

This appendix contains the link to the complete data that was used for the oviposition experiment analysis. This appendix also contains pictures of the means of eggs laid in each fruit media,

Link:https://docs.google.com/spreadsheets/d/193VDlMgqRXdqSZJPfxj0kEDkzpE9eJPfIHYD-4Mrxdk/edit#gid=0

1	Iso line	Media	Mean of eggs laid
2	105	Apple	2.480769231
3	105	Concord Grape	2.365384615
4	105	Blueberry	4.923076923
5	105	Tomato	4.692307692
6	105	Cranberry	1.5
7	105	Cherry	4.538461538
8	102	Apple	1.647058824
9	102	Concord Grape	1.725490196
10	102	Blueberry	3.764705882
11	102	Tomato	3.411764706
12	102	Cranberry	1.647058824
13	102	Cherry	3.098039216
14	100	Apple	1.880952381
15	100	Concord Grape	2.142857143
16	100	Blueberry	3.19047619
17	100	Tomato	3.666666667
18	100	Cranberry	1.142857143
19	100	Cherry	3.738095238

1	Iso line	Media	Mean of eggs laid
20	93	Apple	1.093023256
21	93	Concord Grape	1.581395349
22	93	Blueberry	3.488372093
23	93	Tomato	4.627906977
24	93	Cranberry	1.11627907
25	93	Cherry	2.744186047
26	85	Apple	1.65
27	85	Concord Grape	1.2
28	85	Blueberry	3.35
29	85	Tomato	1.65
30	85	Cranberry	0.55
31	85	Cherry	2.4
32	70	Apple	3.787878788
33	70	Concord Grape	2
34	70	Blueberry	4.242424242
35	70	Tomato	3.787878788
36	70	Cranberry	2
37	70	Cherry	4.060606061

1	Iso line	Media	Mean of eggs laid
38	53	Apple	1.173913043
39	53	Concord Grape	1.739130435
40	53	Blueberry	2.52173913
41	53	Tomato	3.260869565
42	53	Cranberry	1
43	53	Cherry	2.391304348
44	40	Apple	0.8157894737
45	40	Concord Grape	2.342105263
46	40	Blueberry	4.105263158
47	40	Tomato	1.973684211
48	40	Cranberry	0.8421052632
49	40	Cherry	2.894736842

Vita

Jazlyn Pointer was born in Chapel Hill, North Carolina to Sherry M. Duncan and John D. Pointer. She completed her bachelor's degree in Biology with a concentration in Zoology at the University of North Carolina at Pembroke in 2020. Jazlyn then enrolled in the master's program at Appalachian State University in spring 2021 to get her master's in biology with a concentration in ecological, environmental, and evolutionary biology. Her career goal for the future is to work in conservation.