2020 ENTOMOLOGY GAMES: PRELIMINARY ROUND

1. *Daptolestes feminategus*, a new species described in Robinson et al. (2020), was named in honor of Marvel Comics assassin Natasha Romanoff a.k.a. Black Widow. The name is especially apt because this species belongs to **what family of Diptera** whose members are often known as assassin flies or robber flies?

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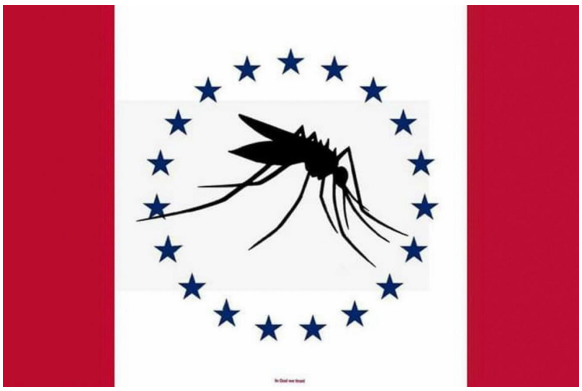
2. DBI is a biotic index developed by Uyizeye (2020) for monitoring freshwater ecosystems in Rwanda using populations of **what palaeopterous insect order as biological indicators?** Rwandan members of this order include the violet dropwing (*Trithemis annulata*) and dwarf percher (*Diplacodes pumila*), which are also locally known as "Flying Flowers of the River."

3. The compound ethyl butylacetylaminopropionate was recently discovered to have antimicrobial and antiviral properties (Iyigundogdu et al. 2019), but since it is most commonly used for protection against mosquitoes and biting flies, it is better known as IR3535. **What does "IR" stand for in the name of this compound?**

4. Name any one of the three entomologists that are **currently in the ESA 'presidential line of succession'** (i.e., the entomologists scheduled to begin their terms as ESA President at the end of 2020, 2021, and 2022).

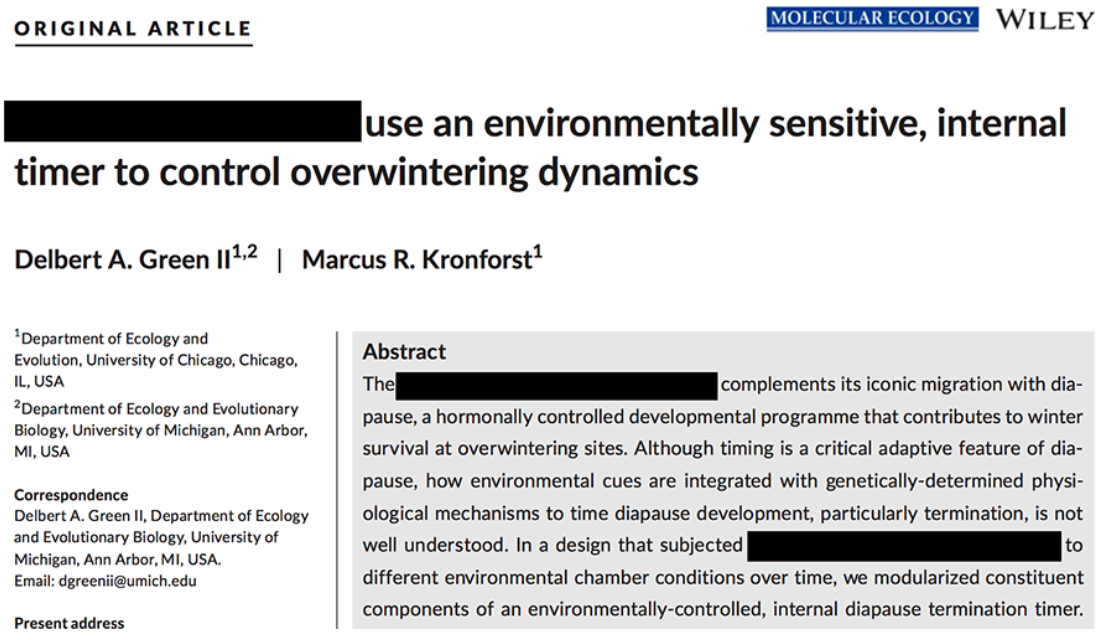
5. After a controversial flag featuring a Confederate battle emblem was removed, this mosquito-centric image was one of the options considered for **what state's** new flag design?



[Image is in the public domain, taken from its state's Department of Archives and History]

6. Chasen et al. (2015) performed field trials to determine yield loss of alfalfa crops due to infestation of the leafhopper *Empoasca fabae*. They then used their results, in conjunction with current crop market values and control costs, to directly calculate **what value** for *E. fabae* in alfalfa?

7. **What well-known North American insect** is the subject of the partially redacted article pictured here?



ORIGINAL ARTICLE

MOLECULAR ECOLOGY WILEY

[redacted] use an environmentally sensitive, internal timer to control overwintering dynamics

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Abstract

The [redacted] complements its iconic migration with diapause, a hormonally controlled developmental programme that contributes to winter survival at overwintering sites. Although timing is a critical adaptive feature of diapause, how environmental cues are integrated with genetically-determined physiological mechanisms to time diapause development, particularly termination, is not well understood. In a design that subjected [redacted] to different environmental chamber conditions over time, we modularized constituent components of an environmentally-controlled, internal diapause termination timer.

8. Hoy & Herzog's (2012) book on biological control in the context of IPM contains an introductory summary of the history of integrated control in the US. In this summary, a paragraph about the classic Stern et al. (1959) IPM paper is immediately followed by a paragraph about **what bestselling book,** released roughly three years later?

9. Fadamiro et al. (2005) demonstrated that newly emerged *Pseudactaeon tricuspis* adults lack sufficient nutrient reserves to survive more than a few days. Consequently, these parasitoid flies should be fed sugar and/or nectar in order to make them more effective as biological control agents of **what invasive species?**

10. *Aedes aegypti* mosquitoes and other blood-feeding arthropods produce the enzyme apyrase, which degrades ADP and impedes blood coagulation. According to Smartt et al. (1995), the apyrase gene is expressed specifically in **what glands** of adult female *Aedes aegypti*?

11. The louse *Lepidophthirus macrorhini* has been shown to survive under high hydrostatic pressure and is one of the few insects adapted to extreme marine conditions (Leonardi et al. 2020). This particular specimen's host was **what type of amphibious mammal**, which can expose its parasites to high-pressure environments by diving as deep as 2,000 m below the surface?

12. Recent ecological niche modeling (Wakie et al. 2020) indicates that **what invasive fulgorid** has significant potential to establish new populations in the western United States, especially in the regions of California and Washington that have an abundance of trees of heaven (*Ailanthus altissima*)?

13. **What prefix** precedes 'azaquin' and 'pyroximate' in the names of two pesticides used by Lopez & Liburd (2020) for effective management of tetranychid mites? This prefix also has an unrelated definition as a type of wetlands habitat.

14. The *Hel*-ID diagnostic test kit, developed at Agdia Inc. in the late 1990s (Bryan et al. 2000), was used to identify two native insect pests of cotton that both belong to what family?

15. A study on disease transmission among social insects (which has particular resonance in 2020) suggests that they rely more on behavioral mechanisms (i.e., hygienic behaviors) rather than natural immune response in order to reduce the risk of transmission (López-Uribe et al. 2016). This hypothesis was tested by measuring **what type of immune response**, which is a common defense against pathogens that are too large to be phagocytosed?

16. A relatively new, behaviorally-based management method called IPM-CPR (Integrated Pest Management - Crop Perimeter Restructuring) has been tested for efficacy against four key pest species in apple orchards (Akotsen-Mensah et al. 2020) and peach orchards (Blaauw et al. 2014). These four pests belong to two different insect orders. **Name either one of these orders.**

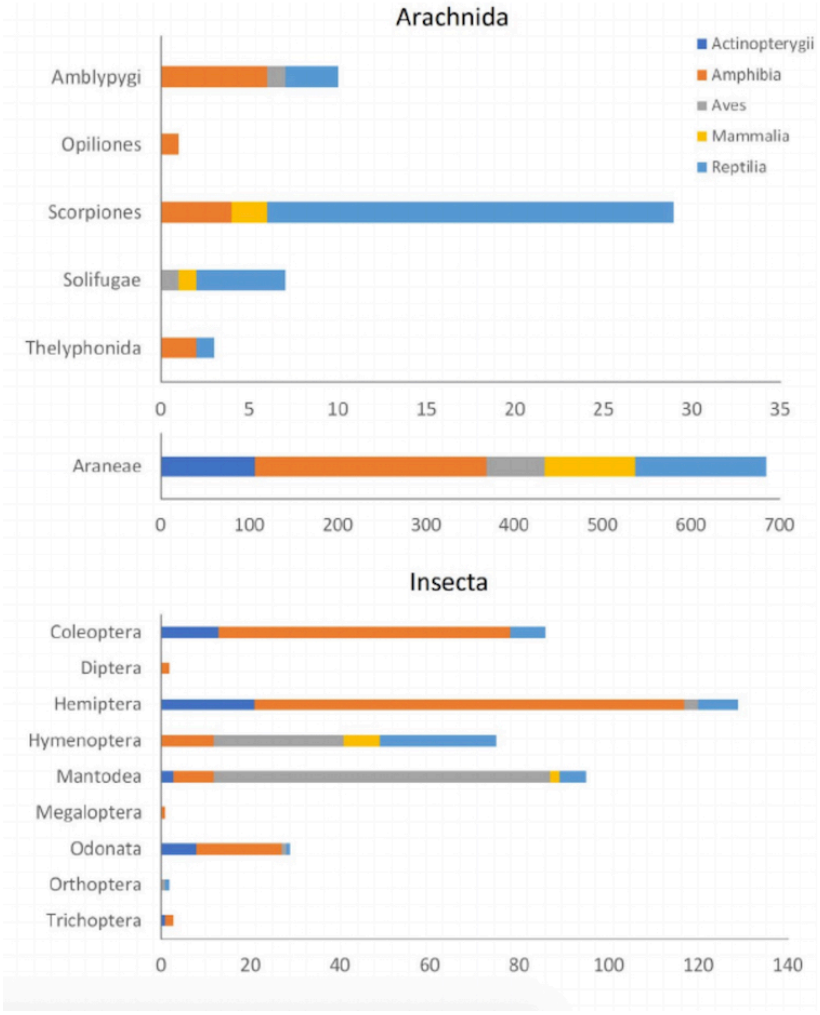
17. In 2019, the international airport in **what North Central Branch city** unveiled its new logo, featuring a large butterfly behind the silhouette of boxer Muhammad Ali?

18. **What three-word term** is defined by Barbosa (1998) as "the use of tactics and approaches that involve the manipulation of the environment...of natural enemies so as to enhance their survival...resulting in enhanced effectiveness?" The concept explained by this term has also been called *ecological engineering* (Settele and Settle 2018) and is often treated as an alternative to *augmentation* and *importation*.

19. Böhm bristles, hair plates (groups of mechanosensory hairs), and campaniform sensilla are all mentioned in Catherine Loudon's overview of **what body part's** structure and function? Her article was published in the Encyclopedia of Insects, 2nd Edition, appearing shortly after the section entitled "Anatomy: Head, Thorax, Abdomen, and Genitalia."

20. Young & McMillian (1979) and McCord & Yu (1987) were the first entomologists to study the mechanism of fall armyworms' resistance to **what acetylcholinesterase-inhibiting insecticide?** In the years between publication of these two studies, a factory that produced this insecticide came under fire for exposing thousands of people to toxic methyl isocyanate gas.

21. This figure is from a manuscript entitled "Arthropods as _____ _____: A Review of Global Patterns" (Valdez 2020). **What specific behavior** is described by the two words that were removed from the title? This behavior has been observed in tiger beetles, giant water bugs, and giant Amazonian ants, although as the figure indicates, it is more frequently reported in spiders. [Note: Your answer does not have to exactly match the title, but it must be specific enough to accurately describe what the figure represents]



22. Although California populations of the western fence lizard are heavily utilized as hosts by immature *Ixodes pacificus* ticks (Casher et al. 2002), they are not competent reservoirs of **what bacterial pathogen** that is vectored by *I. pacificus*? We are looking for the **scientific name of the pathogen**, NOT the name of the disease caused by the pathogen.

23. McCutcheon & Turnipseed's (1989) study of *Chrysodeixis includens* parasitoids, Knight & Gurr's (2007) review of *Nezara viridula* management strategies, and Mensah et al.'s (2005) search for *Aphis glycine*-resistant plant cultivars are all scientific articles with the general goal of minimizing economic losses of **what widely produced food crop?**

24. The colony of lab-reared parasitoid wasps informally known as the "Harris strain" was developed in Hawai‘i in the 1980s. The Harris strain has since been used for biological control of Mediterranean fruit flies and melon flies, but according to Harris and Okamoto (1991) it was originally tested for its ability to parasitize **what other invasive pest?**

25. Wóóneeshch'ịịdii (Navajo), laulukaskas (Finnish), isihlonono (Zulu), kuliglíg (Tagalog), and tatarakihi (Maori) are all words historically used in their corresponding languages to refer to members of **what hemipteran family?**

26. "The **X** of a predator is a progressive change in the amount of progeny in relation to prey density, and female predatory mites can vary their offspring production at different prey densities. In phytoseiid predatory mites, the **X** is linked to the density of prey mites."

What two-word term has been replaced twice by the letter '**X**' in the above excerpt from an article on biological control of two-spotted spider mite (Fathipour et al. 2020)?

27. The fictional character on the left (from a 2005-2014 CBS sitcom) and the real person on the right both share a name with **what banned organochlorine insecticide**, which has the chemical formula C12H8Cl6?

[Left image © 2011 *Quentin Meulepas*; licensed under the Creative Commons Attribution License - Version 2.0. Right image is in the public domain]

28. When using transgenic plants to deliver insecticidal endotoxins to crop pests, it is important to confirm that these toxins will not indirectly harm beneficial predators of the target pest species. For example, it was determined by Riddick and Barbosa (1998) that spotted lady beetles (*Coleomegilla maculata*) could safely eat larvae of the pest species *Leptinotarsa decemlineata* that contained toxic Cry proteins. In this study, the *L. decemlineata* specimens had obtained Cry proteins by eating transgenic versions of **what economically important food crop?**

29. "Surely no one who is acquainted with how slowly the ant-lion recovers from injuries could, for a moment, consider anything intellectual which induces it to passively submit to portions of its legs and of its mandibles being amputated. Its letisimulation may be an emotional response, but it certainly is not intellectual."

In the above excerpt from Turner (1923**),** the term *letisimulation* is used to describe **what type of behavior**, which is usually referred to as *tonic immobility* or *thanatosis* in current literature?

30. A phylogenetic study from Evangelista et al. (2019) proposed the new name Tutricablattae for the monophyletic group that contains termites (Isoptera) and **what family of cockroaches?**

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31. The Kay Hagan TICK act is a US federal spending bill that funds research and treatment of vector-borne diseases. It was named after Senator Kay Hagan, who died in 2019 after getting infected with **what virus**, the only tick-borne flavivirus known to occur naturally in North America (Kemenesi & Bányai 2018)?

32. Lewis (1997) divides the economically important species of North American termites into three ecological groups, one of which is *subterranean*. **Name either one of the other two groups.** The termites in one of those groups are "primarily restricted to fallen logs rotting on the forest floor" whereas the termites in the other group "do not require contact with soil and moisture for survival."

33. According to Evenhuis' (2020) list of the insect and spider collections of the world, the abbreviation FMNH refers to a museum of natural history located in **what large U.S. city?** Entomologists associated with the museum in this city include Petra Sierwald (Associate curator), Alfred Newton (Curator emeritus) and Margaret Thayer (Curator emeritus). [Note: Name the city, not the museum]

34. Advanced microscopy techniques such as SEM and TEM have been used to study insect compound eyes since the 1950s. But Singleton-Smith & Philogene (1982) were the first to apply those same techniques to the study of **what simpler insect visual organs**, also known as *lateral ocelli*?

35. This insect image appears on the social media pages of **what indie band**, self-described as an "entomological post-folk duo," that released the singles "Tiny House" and "Black Lung" in summer 2020? Don't overthink it; they chose this image for a reason.

[Image copyright © 2020 Becca Young and [name of band]]

36. An invasion of human ears by *Cyclocephala borealis* during a Pennsylvania Boy Scout Jamboree (Maddock & Fehn 1958), a gastrointestinal infestation of *Lasioderma serricone* in a Chinese infant (Sun et al. 2016), and the presence of *Tenebrio molitor* inside a patient's skin ulcer at a Colombian hospital (Rodriguez-Morales et al. 2018), are all examples of a relatively rare phenomenon in medical entomology that is best known by **what one-word term?** This term was coined by Hope (1840) with specific reference to larvae, but in some recent literature the definition has expanded to include adults.

37. The organic insecticide marketed under the name PyGanic has been shown to effectively control pest populations of bagrada bugs (Grasswitz 2013) and whiteflies (Razze et al. 2016) via **what mode of action?** According to IRAC, insecticides with this mode of action are capable of "causing hyperexcitation and, in some cases, nerve block."

38. The recent practice of DNA-barcode-based species descriptions has proven controversial. Although it is a faster, more efficient form of description that yields better estimates of true species richness, some taxonomists have concerns about the reliability of descriptions that lack morphology-based diagnoses. Zamani et al. (2020) recently published an opinion piece that specifically discusses this matter with regards to 18 barcode-based species descriptions in Agathidinae (Meierotto et al. 2019), which is a subfamily of **what species-rich insect family?**

39. The sphragis, which has been observed on the external abdomens of nearly 300 butterfly species (Carvalho et al. 2017) is a specific example of **what type of structure?** Internal versions of this structure have also been observed in bumblebees (Duvoisin et al. 1999) and *Drosophila* (Lung et al. 2001). We are looking for a **two-word answer.**

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40. The journal *Apidologie* has published articles by Kanga & Somorin (2012) and Neumann et al. (2018) that use the initialism SHB to refer to a specific pest that belongs to **what insect family?**

41. Sallam et al. (2013) were motivated to study the distribution of the mosquito *Culex tritaeniorhynchus* because it caused an outbreak of **what *Phlebovirus* disease** in Saudi Arabia in the year 2000? Although this particular outbreak occurred in the Middle East, the disease is instead named after a geographic region of Africa, where the *Phlebovirus* was first identified in 1931.

42. The notonectid *Anisops debilis* was recently evaluated as a biological control agent (Rapatsa & Moyo 2020). This was a highly unusual case of biological control because the target species, *Coptodon rendalli,* was not considered a pest. However, the introduction of *A. debilis* prevented overcrowding and allowed the surviving *C. rendalli* to grow larger and increase their marketability. *Coptodon rendalli*, and its economically important relatives in the genus *Oreochromis*, are best known by **what common name?** [Note: *Coptodon* and *Oreochromis* do not have an ESA-approved common name because they are not arthropods. Please provide the common name used in the cited article, which is also the common name most frequently used in USDA publications.]

43. According to Peña et al. (1998), one of the key pests on mangos is the weevil *Sternochetus mangiferae*, which is best known for damaging **what specific part of the mango plant?** Although there is no official ESA common name for this weevil, the common name used by Peña et al. contains the plant part in question.

44. In a New York Times article from August 10, 2020, public health entomologist Manuel Lluberas expressed hope that **what newly registered mosquito- and tick-repelling chemical** "would be accepted by people who fear synthetic repellents...and could be made cheaply enough to be bought by foreign aid programs?" This natural insecticide is a ketone that has been extracted from Alaska yellow cedar trees and was indirectly named after the Nuu-chah-nulth indigenous peoples from western Canada.

45. **What term** is used by Mitcham (2002) and Mbata & Warsi (2019) to describe the type of IPM associated with management of stored-product pests and management of pathogens that damage agricultural products during storage and marketing?

46. Alvin Simmons ends his monthly President's Corner messages with the signature "Alvin M. Simmons, Ph.D., FRES." Helen Roy, Sir Vincent Wigglesworth, and Dame Miriam Rothschild are other people that could include FRES in their signature. **What does the acronym FRES stand for?**

47. The coin pictured here was created by Emily Damstra and Renata Gordon as part of the US Mint's series of "America the Beautiful" quarters. **What two-word midwestern ecosystem** has been redacted from the top of the coin? The families Acrididae, Andrenidae, Cicadellidae, Formicidae, Miridae, and Nymphalidae all contain species known to be specialists of this ecosystem (Reed 1996).

[Image in the public domain]

48."Grasshopper and Iris," an ukiyo-e woodblock print dating back to the 1820s, was originally made by **what iconic Japanese artist?** This artist is arguably best known for "The Great Wave off Kanagawa," the first print in his series "Thirty-six Views of Mount Fuji."

[Image in the public domain]

49.What word, from the Greek for 'upon the earth,' was used by Allen & Hagley (1990) to refer to adult carabid and staphylinid beetles that live on the surface of the ground? This word is also used by some ecologists (e.g., Pinheiro et al. 2010) to describe ants that live in leaf litter on top of soil, as opposed to ants that live in nests underneath the soil.

50. Thomas et al. (2020) used the genera *Heterobathmia*, *Agathiphaga*, and *Micropterix* as outgroup taxa for their phylogeny of **what insect order?**

Tiebreaker: According to Simmons and Leal (2018) **exactly how many people attended the 2016 International Congress of Entomology in Orlando**? It is still the largest gathering for an entomological event to date.