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# Cicadas in Japanese video games and anime

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If you ever watched an anime, chances are at some point you have heard an incessant buzzing sound in the background. Those are cicadas, the sound of summer in Japan. Summer only truly arrives when the cicadas start singing (Kendall, 2014).

Whenever it is summer in an anime, TV series, movie, or game, you can be almost sure to hear cicadas on the background. Their sound is an easy and straightforward way to set the atmosphere and impart the feel of a Japanese summer (McKirdy, 2019).

Many people don't pay much attention to nature, be it the real thing or in fiction, so if you think you have never heard cicadas, just go back to one of the almost-mandatory episodes in your favorite anime (summer holidays, festival/fireworks, beach trip) and check it out. They are so prominent that, as a Redditor put it, they are the best supporting character in every anime.



**Figure 1.** For instance, while I was writing this article, a new (summer) episode of *The Devil Is a Part-Timer!* came out, featuring this cicada with a rather generalized design. Screen capture from the anime (season 2, episode 05; Studio 3Hz, 2022).

The cultural importance of the sound of cicadas is nothing new in Japan. Sei Shōnagon herself makes several mentions to these animals in *The Pillow Book* (written through the 990s to 1002), like this one: "(...) I had gone to Kiyomizu Temple for a retreat and was listening with deep emotion to the loud cry of the cicadas (...)" (translation by I.I. Morris, 1967).

Not everyone likes cicadas, though. Their sound can be almost deafening at times and they can also cause damage to infrastructure (Cyranoski, 2007; McKirdy, 2019; Moriyama & Numata, 2019). Besides, they are usually not very pretty, to put it mildly, and they fly and collide with people walking by. Entomologists who research cicadas will tell you, however, that these creatures are among the "most charismatic insects" (Marshall et al., 2018: 4). Whether you agree with them or not, that's entirely up to you.



Figure 2. Urusai!!! Screen capture from *Gakuen Utopia Manabi Straight!* Screen capture from the anime (episode 07; Ufotable, 2007).

<sup>&</sup>lt;sup>1</sup> Murasaki Shikibu is also famous for her metaphorical use of cicadas in *The Tale of Genji* (ca. 1020) comparing the robes of one of Genji's lovers to the empty husk left by a cicada after molting.

Love them or hate them, cicadas are still part of nature and also have a role in different cultures around the world. But what exactly is a cicada anyway? In this article, I'll go over their basic biology (what they are, how they live, etc.), showcase some common species in Japan, and tie it in with Japanese games and anime.

#### WHAT'S A CICADA?

Starting from the most general to more specific, cicadas are insects that belong to the Order Hemiptera. Hemipterans are also called "true bugs", and contain diverse groups like shield bugs, stink bugs, assassin bugs, bed bugs, kissing bugs, aphids, leafhoppers, treehoppers, and, of course, cicadas. Cicadas are a superfamily within the order Hemiptera, called Cicadoidea.

Within that superfamily, there are two families: Tettigarctidae and Cicadidae. The first one, Tettigarctidae, is mainly known from fossils and only two species of this family still live, both in Australia (Dietrich, 2003; Marshall et al., 2018). The rest of the 3,000 to 4,000 species of cicadas all belong to the family Cicadidae, and are distributed worldwide, being more common and diverse in the tropics (Brambila & Hodges, 2008; Sanborn, 2008). While the number doesn't look that impressive when compared to other insect groups, that's still a lot of species. As a comparison, the total number of mammal species is around 6,400 (Burgin et al., 2018).

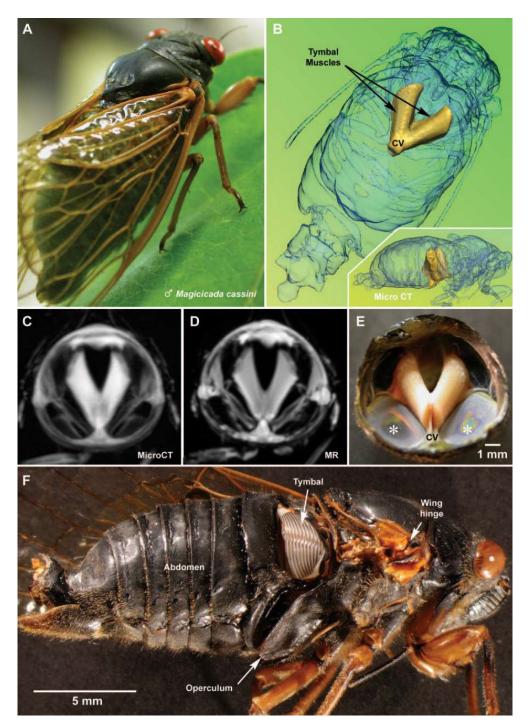
The Tettigarctidae have a long evolutionary history, the oldest fossils date back to the final part of the Triassic period, circa 205 to 201 Ma (millions of years ago) (Grimaldi & Engel 2005; Moulds, 2018). Cicadidae, on the other hand, are a much younger group. They have been around since the Paleocene, a geological epoch that lasted from circa 66 to 56 Ma (Grimaldi & Engel 2005; Moulds, 2018).



**Figure 3.** An 19th-century naturalist illustration of cicada species, showing a bit of their diversity in India and neighboring regions. Image extracted from Distant (1889–1892: pl. 3).



**Figure 4.** Examples of fossil cicadas. The one on the left, *Minyscapheus dominicanus* (from the Dominican Republic), is preserved inside a piece of amber. The one on the right, *Miocenoprasia grasseti* (from France), is a "regular" fossil, preserved in stone. Images extracted from Moulds (2018: pl. 3, figs. 4, 5).



**Figure 5. A.** A male of the species *Magicicada cassini*. **B.** Same cicada, tomography scan with the tymbal muscles highlighted in yellow. **C-E.** A view of the muscles and tymbals (marked by an \* in 'E') in cross-section. 'C' is a tomography scan, 'D' is a magnetic resonance image, and 'E' is a normal view of dissected specimen. **F.** Specimen with wing removed to show the location of tymbal in the first abdominal segment. Image extracted from Nahirney et al. (2017: fig. 1).

# LIFE AND TIMES OF A CICADA

As all members of the order Hemiptera, cicadas are hemimetabolous animals. That means that the baby cicada that emerges from the egg (called a nymph) is a miniature version of the adult. They grow grad-

ually, molting their old exoskeleton when they do, until they reach their final adult stage, called imago. That is different from the "most usual" holometabolous insects such as butterflies and beetles, which have a larval (maggot) stage, and then a pupa (or chrysalis) stage when they undergo metamorphosis into the adult.

Cicadas, both nymphs and adults, feed by puncturing plants and drinking their sap. After hatching from the egg, the nymphs burrow in the ground and feed on the sap of roots (Dietrich, 2003). Nymphs stay underground for a long period, going through several molts. While most species have a life cycle that lasts from 2 to 5 years, some live was longer, emerging only after 13 or 17 years (Sanborn, 2008). The latter typically appear on the news (for instance, Wong & Sinnen, 2021).

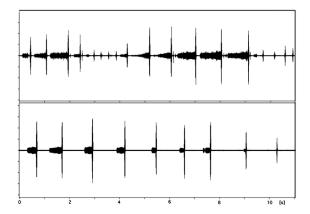
After they emerge, they will cling to tree trunks and other surfaces and molt one final time. The empty husks we find are from this last molt. The adults will also cling to those surfaces while singing. Male cicadas sing during their reproductive phase to attract females. I mean, that is generally referred to as a "song", like for birds. However, several other nouns and verbs are commonly applied to whatever it is cicadas do: the neutral and perhaps more biologically accurate "call", but also "cry", "shrill", "chirping", and "buzzing".

Cicadas produce their song using a pair of specialized organs on the base of their abdomen, called tymbals (Fig. 5). The tymbals resemble ribbed membranes. The superfast contraction and relaxation of a pair of muscles inside the cicada's body make the tymbals rattle (buckling inward and then returning to their original relaxed state), thus producing the sound (Moulds, 2003; Nahirney et al., 2017). The region of the abdomen where the tymbals are located is hollow, so it works as an acoustic resonator (Moulds, 2003).

Each cicada species has its own song and the females recognize the songs of males of the same species (Moulds, 2003; Sanborn, 2008). That happens even when there is more than one species singing at the same time and when the songs of two species appear to be very similar to one another (Endo & Osawa, 2017).

With a bit of training, even we can recognize different species singing. That also

means that we can discern the presence of a species in a given area solely by sound, just like we do when we hear the song of a blackbird or song thrush before actually seeing one. Of course, even though our ears work reasonably well with bird song, it is more difficult to deal with insects. So, researchers also use graphs that represent sounds, such as sonograms and oscillograms (Fig. 6).



**Figure 6.** Visualization of cicada songs as oscillograms. Both songs are from members of the species *Cicadetta cerdaniensis*. The top one is by a Polish *C. cerdaniensis* and the bottom one by a Slovenian *C. cerdaniensis*, showing that there is even regional differences ("accents" if you will) in the song of the same species. Image extracted and adapted from (Gogala & Trilar, 2004: fig. 3b, d).

Male cicadas can "turn off" their hearing while they are singing, thus avoiding being deafened by their own song (Moulds, 2003). We're not so lucky. But even though their singing can be anywhere from annoying to unbearable to a few people, cicadas are not harmful insects in any other way, barred for a few crops and ornamental plants (Sanborn, 2008; Marshall et al., 2018). Curiously, the structure of cicada wings has served as inspiration for the creation of surfaces that are water-proof, antireflective (e.g., to reduce glare), or even antibacterial (Marshall et al., 2018).

# **JAPANESE CICADAS**

The general Japanese word for cicada is セミ (semi), typically written in katakana in biological contexts. Each species of cicada has a name that is 'something'-semi, or A few species can have completely unique names, like *Tanna japonensis* or  $\not\vdash \not\supset$  (higurashi). Yes, those higurashi; I'll get to it, hold on. This species also has a common name in English: evening cicada.

There are circa 35 species of cicadas in Japan (Hayashi & Saisho, 2015), the exact number depending on whether some populations are interpreted as subspecies or full species. They are distributed throughout 15 different genera, so it's a quite diverse assemblage. Some species are more widespread throughout the country, while others are restricted to certain regions. They also vary in the time they emerge and in the sound of their calls.

The go-to book on Japanese cicadas is Hayashi & Saisho (2015), though it is only available in Japanese. However, the second author of the book, has a handy website (<a href="http://zikade.world.coocan.jp/Zikade-e.html">http://zikade.world.coocan.jp/Zikade-e.html</a>), where you can find some information and also hear to the calls of the different species of cicada.

So now, let's take a closer look in the two cicada species most commonly featured in anime, then one species that appears in the game *Fate/Grand Order*, and finally an (obvious) example of a fictional cicada.

### Hyalessa maculaticollis

The min-min cicada is probably the most common background noise you hear in anime. They are shown singing throughout the day, often when it is very hot. Try hearing their call on the species' Wikipedia page and it will no doubt sound familiar to you.

And no wonder it is a common sound in anime: this species can be found throughout most of Japan, from southern Hokkaido to Kyushu (not to mention the Korean peninsula and adjacent eastern Russia and China; Hayashi & Saisho, 2015; Liu et al., 2017). Besides, they seem to perform well in human-altered environments and are therefore very common in urban areas (Nguyen et al., 2018).



Figure 7. *Hyalessa maculaticollis*, photographed on Mount Ibuki. Source: Wikimedia Commons (photo by Alpsdake, 2012).

The adults can be up to 6.5 cm long (including the wings) and start to sing in late July. The Japan Meteorological Agency keeps an eye (or an ear) out to record the first cicada cries heard and the date seems to be getting earlier every year, which is potentially an effect of climate change (Ellwood et al., 2012; Hayashi & Saisho, 2015).

<sup>&</sup>lt;sup>2</sup> That's a phonetic process called Rendaku. If you're curious, here's a nice explanation: <a href="https://www.tofugu.com/japanese/rendaku/">https://www.tofugu.com/japanese/rendaku/</a>.

# Tanna japonensis

The evening cicada, or higurashi, is the second most common species heard in anime. Particularly in the anime that has this species on the title, *Higurashi no Naku Koro ni* (Studio Deen, 2006), based on the eponymous visual novel.<sup>3</sup>

Higurashi (the cicadas, not the anime) are about 4.5 cm long, counting the wings, with females being a bit larger than males. It can be found from Hokkaido in the north to the Amami Islands in the south (Hayashi & Saisho, 2015). While this species is considered to be a late summer to early autumn species (singing from September to October), it can actually be heard from the end of June to the end of August (Hayashi & Saisho, 2015). That matches the story of the anime, btw, which takes place in June.



**Figure 8.** Female *Tanna japonensis*, photographed on the Yumihari Mountains. Source: Wikimedia Commons (photo by Alpsdake, 2012).

Males of *Tanna japonensis* sing mainly in the twilight hours of dawn and dusk, but sometimes also during the day (Hayashi & Saisho, 2015). Their song is simple, but somehow rather beautiful in a sense. No wonder higurashi have a special place in Japanese culture. Their song is considered to evoke a sense of melancholy and has been used in literature since early times. Sei

Shōnagon mentions them, as expected of Japan's first super famous writer.



**Figure 9.** Artistic interpretation(?) of Sei Shōnagon. Screen capture from *Fate/Grand Order* (Delightworks/Lasengle, 2015–present).

# Cryptotympana facialis

The kumazemi are big bugs, as their name implies. They can reach up to 7 cm in length, counting their wings. They can be found from the Kanto region<sup>4</sup> of Honshu in the north to the Yaeyama Islands near Taiwan in the south (Hayashi & Saisho, 2015). However, they are expanding northwards in Japan, as urbanization and increasing temperatures make more habitats suitable to them (Saito et al., 2016). In fact, *Cryptotympana facialis* is starting to displace other cicada species in urban areas like Osaka (Moriyama & Numata, 2019).

Kumazemi are gregarious and you can find many individuals perched and singing on a single tree trunk. In mainland Japan, they can be heard from early July to early September (Hayashi & Saisho, 2015). And the sound of these cicadas can be deafening. They start singing at sunrise until around 11 AM and their chorus can exceed 90 db (Cyranoski, 2007; Hayashi & Saisho, 2015; Moriyama & Numata, 2019). That is akin to the noise of a leaf blower, a jackhammer, or a concert; prolonged exposure to these levels of sound can result in hearing loss.

Their "song" can be really annoying to people, contrary to the min-min cicada and the higurashi. I suppose that's why we don't

<sup>&</sup>lt;sup>3</sup> There are several other side stories, sequels, reboots-that-are-not-reboots, etc. in this series. Honestly, I watched only half of the first one.

<sup>&</sup>lt;sup>4</sup> Curiously, they cannot be found in Kanto region of Gen. I.

hear kumazemi in anime.<sup>5</sup> Nevertheless, it makes an appearance in *Fate/Grand Order* — without the sound effects — during the 2022 Summer Event (US version), with Illya and Gudako<sup>6</sup> talking about how loud the cicadas are.



Figure 10. Cryptotympana facialis, photographed in Aichi prefecture. Source: Wikimedia Commons (photo by Alpsdake, 2013). Have you realized that this Alpsdake person is the one who took all the best photos of cicadas available on Wiki Commons?



**Figure 11.** Gudako is showing off her entomological knowledge in this scene. Though the translators have failed miserably; I can forgive the lack of italics, but the scientific name must start with a capital letter. Bad civ! Screen capture from *Fate/Grand Order* (Delightworks/Lasengle, 2015–present).

Like the min-min cicada above, the kumazemi is also shifting its seasonal schedule and hatching earlier. This is related to the rainy season, which is happening earlier every year because of climate change (Moriyama & Numata, 2011, 2019).

As a weird side note, female kumazemi in Osaka were laying eggs inside optical fiber cables, mistaking them for twigs (Holden, 2007). That was causing major losses every year and it has led to the development of a new type of cable that is resistant to kumazemi (Itou et al., 2010).

### FICTIONAL CICADAS

It can't be helped, I must also talk about the potentially most prominent of fictional cicadas in Japanese pop culture, the Pokémon Ninjask or  $\overline{\tau}$  " $\tau$ " (Tekkanin).



**Figure 12.** Ninjask, official artwork from *Pokémon* (The Pokémon Company). Source: Bulbapedia.

Bulbapedia (2022) says Ninjask is similar to the species *Megatibicen dorsatus*. This is ether a rather naïve assertion or an extremely biased take, because *M. dorsatus* is a species found only in the central region of the USA (Sanborn & Phillips, 2013). Now why would Pokémon designers choose an American cicada of all things, when these

<sup>&</sup>lt;sup>5</sup> But do let me know if you have heard it in an anime before.

<sup>&</sup>lt;sup>6</sup> That is the correct way of playing. If you went for Gudao instead, please review your choice.

<sup>&</sup>lt;sup>7</sup> Even though it's not one of the most famous Pokémon, I'd say the other Japanese cicada monsters (like the Boring Bug from *Dragon Quest* or the Dream Cicada, Oily Cicada, and Cicada King from *Yu-Gi-Oh!*) are even less known. Also, I'll focus solely on Ninjask here, which is the adult cicada. Nincada is the nymph and Shedinja is the empty husk left behind after molt.

insects are so important in their home country? They didn't, of course.

Ninjask was based on Japanese cicadas, more specifically those of the genus Au-ritibicen ( $\bot$ )  $\forall$   $\exists$  or ezozemi). There are 24 species in this genus, most of them living in China, but with representatives in eastern Russia, the Korean Peninsula, and Japan (Lee, 2015; Wang et al., 2018). The species in this genus all look very similar to one another and can be distinguished by fine anatomical features (Lee, 2015). Notably, Auritibicen cicadas have a particular color pattern on their "backs" (on the mesonotum, on the dorsal surface of the thorax) that looks like a 'W', with the "arms" of the W varying in length (Wang et al., 2018).



**Figure 13.** Ninjask sprite from *Pokémon HeartGold/ SoulSilver* (Game Freak, 2009). Source: Bulbapedia.



Figure 14. Auritibicen flammatus, photographed in Niigata province. Source: iNaturalist (rivavui, 2019).

In Japan, there are six species of ezozemi (Hayashi & Saisho, 2015; Lee, 2017): *A. bihamatus* (コエゾゼミ or koezozemi), *A. esakii* (

ヤクシマエゾゼミor Yakushima ezozemi), A. flammatus (アカエゾゼミ or akaezozemi [red ezozemi]), A. japonicus (エゾゼミ or ezozemi), A. kyushyuensis (キュウシュウエゾゼミ or Kyushu ezozemi), and A. shikokuanus (シコクエゾゼミ or Shikoku ezozemi). Some have a pattern on their mesonotum that more closely resembles Ninjask's upside-down 'Y' pattern. These cicadas are about 4 to 6 cm in length (with their wings folded) and can be seen and heard from mid-July to the end of August (Hayashi & Saisho, 2015; Wang et al., 2018).

# **CONCLUSION**

That's it — all that you wanted (and didn't want) to know about Japanese cicadas. Now, I don't expect to turn anyone into a cicada enthusiast (I'm not even one myself!). But I do hope that the next time you hear cicadas singing, be it IRL or in an anime, you'll pay closer attention to it. Maybe you'll remember some random facts from this article or perhaps you'll even be able to identify what species it is.

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<sup>&</sup>lt;sup>8</sup> This website has a nice compilation of cicadas in anime: <a href="http://www.russelldjones.ru/cicada.htm">http://www.russelldjones.ru/cicada.htm</a>, though it unfortunately seems it hasn't been updated in a while. You'll notice that while some anime will have very generic-looking cicadas (like Fig. 1 above), in some cases you'll actually be able to identify the species.

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#### ABOUT THE AUTHOR

Dr. **Rodrigo Salvador** is a biologist that specializes in the study of land snails. Nevertheless, he is also interested in other invertebrates, including insects. In spite of his long-term exposure to cicada sounds in anime, he never even once thought about writing about them. That is, until in the latest FGO summer event, Gudako somehow knew the scientific name of the singing cicadas.