New Species Podcast
A New Astigmatid Mite with Hemen Sendi
Published April 1st 2025

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[bright, tech-y introductory music]

Zoe: Welcome to the New Species Podcast. I'm your host, Zoe Albion. On this podcast we learn about recent discoveries of species that are new to science, but not necessarily new to nature. We ask scientists how they find these new species and why they matter. We learn what makes a new species, and hear some behind-the-scenes stories along the way. So join us as we explore the biodiversity of our planet with the scientists who help us better understand it.

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Zoe: Welcome to the New Species podcast. I'm your host, Zoe Albion, and I'm here with Dr. Hemen Sendi, postdoctoral researcher at the Zoological Institute of the Slovak Academy of Sciences. He's here today to tell me about his paper published in BMC Biology and Evolution, in which he and his coauthors describe a new genus and species of astigmatid mite from Lebanese amber. Welcome Hemen, thank you so much for coming on the podcast!

Hemen: Thank you so much for having me.

Zoe: Out of curiosity, how did you come to study specimens in amber? What was your path?

Hemen: Well, actually, I didn't want to specialize on insects in amber. Because I was raised up in the Netherlands, close to the coasts, where I started collecting fossil bones from the last ice age, I actually wanted to specialize on vertebrates. But in my first year during my studies, phallontology, I met my supervisor, who was working on fossil insects, especially cockroaches from amber, but also from sediments. And for me, it was a whole new world.

Hemen: But to this day, it's really interesting for me. I didn't change the topic so far.

Zoe: That's so great. See, the small things are so much more interesting in my opinion.

Hemen: Yeah

Zoe: Not to hate on the bigger organisms (both laugh)

Hemen: but because they are more often overlooked. Also, these mites, I believe it's very interesting to study these mites in the fossil record because not a lot of people are doing this. And also, I know just a very few amount people who are working on cockroaches, so…

Zoe: When you tell people just randomly at a bar, are people impressed?

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Hemen: Yeah, usually they are quite impressed because it's very specific. (both laugh) They're also asking why I'm doing specifically this kind of group. (both laugh)

Zoe: Cockroaches aren't very popular, are they?

Hemen: Yeah.

Zoe: Can you tell us a little bit about astigmatid mites?

Hemen: So, Astigmata is a clade of mites that belong to the order Sarcoptiformes, and a well-known example of this group that probably everybody knows is the house dust mite. And astigmatids, they're also known for having different types of relationships with their hosts. And actually, only a few species can live independently their whole life. These mites usually interact with larger organisms, such as mammals and insects. So for example, some astigmatids mites are parasites and they benefit at the expense of their hosts while others are known to have commensal relationships where only the mites benefit, but the host is unaffected.

Hemen: And additionally, there are also materialistic relationships where both the mites and the host benefit from the interaction. And unlike the closely-related oribatid mites, Astigmatid mites actually prefer to live in places with temporary food for survival. For example on rotting plants, fungi, or in the nests of vertebrates and invertebrates. And because they live in these habitats where food resources eventually will run out, they need to travel longer distances to survive.

04:55

Hemen: Mites lack wings or any adaptations for long-distance movement, so therefore they need to rely on hitchhiking on larger animals and this is also called phoresy. And I have to say that in my research I'm mostly focused on fossil co-coaches including termites, so in our recent paper my colleagues Pavel Klimov and Vasiliy Kolesnikov handled the classification of the mites, while Ninon Robin and I examined their biotech interactions with termites. And as I learned more about mites, I was quite amazed by the size of Astigmata, which includes about 10 superfamilies and 76 families. And in our study that was recently published, we described the new genus and species of mites that belong to the extant Astigmata family.

Zoe: Yeah, and I'm really excited to talk to you about that family. How did you identify this mite as a member?

Hemen: Well, mites of the family Schizoglyphidae have several ancestral traits, such as the position and the structure of the genital opening, the attachment organ, and the gnatosoma, which is the front part of the body in the mite that contain the mouth parts, and the family is actually the sister group to the remaining modern Astigmata. And furthermore, the number of the genital and the hair-like structures, also called in Latin setae, and the position and the shape

of the anal opening and the suckers with which the mites could attach to the host is very characteristic for the family Schizoglyphidae.

Zoe: Oh wow, those are such small characters. I imagine you are a little relieved that these are relatively large mites.

Hemen: Yeah, but still they were around 300 microns. We'll talk more about that later, but it is very difficult to make photographs of that. We tried a lot of methods to do that.

Zoe: Oh man. The other thing that was really interesting to me about your paper is the age of the mites. So I had never really thought about how old mites are, but your new species was found in Cretaceous amber. Can you talk a little bit about that? Can you pinpoint when this mite likely existed and tell us how old are the oldest mites on our planet?

Hemen: So Lebanese amber, where the mites were discovered has been dated to 130 million years ago. And it is actually the oldest biotic association of arthropods that was preserved in amber that we described. Direct evidence for forestry from mites has also been found in 320 million year old sediments from China. So it's much older and mites themselves are much, much older, were discovered in sediments from Scotland from around 410 million years ago.

Zoe: That is absolutely incredible.

Hemen: Sometimes it's difficult to imagine how long these time periods are for humans.

Zoe: Yes, that is incredible. So let's talk more about that phoretic association. Can you talk a little bit more about the relationship and can you tell us how do you know it's a true phoretic association and not just kind of a coincidence that they were found in this piece of amber together?

Hemen: Yeah, In our study that we published, we described a phoretic association that involved 16 astigmatid mites from the family Schizoglyphidae, I mentioned, and astigmatid phoretic nymphs often travel in groups to improve reproduction and increase their chances of establishing a population on new resources that can out-complete other colonizers. And in our amber sample, we also observe a larger group of mites, which consists of numerous individuals, and which is attached to the termite hosts.

Hemen: And these mites are non-feeding and have developed adaptations for better attachment on the host. And also some specimens show evidence of direct mite-host contact as indicated by the claws and the hair-like structures that are in direct contact with the termites' wing membrane. And this supports the idea that it's not just a random or taphonomic occurrence, but that it's a real true biological relationship.

Zoe: That's so neat. And do we see this on modern mites and termites? Like, do we see these kinds of hitchhiking behaviors?

Hemen: Well, yes, this association still exists today. I have to say that previously the family Schizoglyphidae was only known from a single species, which was discovered in Indonesia in 1978. And it was probably accidentally found on the beetle. But Astigmata are actually the most diverse group that is associated with termites. And in our paper we report not only a fossil association, but also the interactions between the modern Schizoglyphid mites and the termites.

Hemen: So for this nests of modern termites were observed iIn New Zealand, and we found that Schizoglyphids were associated with the termite genus Stolothermus. And so we have substantial fossil and modern evidence that suggests that Schizoglyphid termite associations are the oldest known ongoing relationship between mites and their hosts. And we also discovered that the ancient structures of these mites have been highly conserved over the 30 million years.

Hemen: When we look at the modern associations, it's quite notable that few Astigmatids have been reported on modern winged termites. Most are found on the body in the nests. This is a pattern that contrasts with the fossil records. We believe that this difference is due to observation bias. It's often quite difficult to detect mites on allied hosts because they're usually hidden beneath the wings.

Hemen: And also the winged termite individuals that have reproduction as an aim have relatively short lifespan. So they occur only in a certain time of year and they lose their wings directly after the flight when they're forming new colonies. On the other hand, also winged termite individuals from amber are not so uncommon.

Zoe: That's really interesting. It sounds like there is a lot more that we don't know about both of these groups and also these really old specimens in Cretaceous amber. Do you have any plans for the work you might do in the future on these and on other samples in amber?

13:04

Hemen: Well, for now, the under sample will be housed at the Lebanese University in Beirut. But it will be certainly interesting to study the mites again, if imaging techniques could advance in the future.

Zoe: So speaking of examining and imaging the specimens, the termites are a little larger but as you mentioned, the mites are extremely small. I'm really curious. How did you and your colleagues find and identify these new mites in the first place?

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Hemen: Yes, you're right. The mites are extremely small. They have a length of less than 300 microns. So that means that they are less than 0.3 millimeters. And photographing the mites was quite challenging. We experimented with many different microscopes and lighting conditions to achieve sufficient results. And also the host of the mites, a termite, was already described as a new genus and species in 2011. So the ideal way to photograph the mites would have been to create thin slices of the amber, but this was not possible without damaging the termite holotype. So capturing clear images of the mites was quite challenging since they were not on the surface of the amber.

Hemen: However, Enrico Bonino, an expert in extreme macro photography, provided valuable assistance in the end. And I believe that we achieved great results because we were able to successfully document many important morphological features of the mites that were essential for their classification.

Zoe: That's great. And your paper has some of these pictures. I think they're remarkably good, I mean, to my untrained eye. And I think they're just really neat organisms to look at as well. As far as the amber, so that was mined in Lebanon. How did the amber come to you and how long was it in the collection before you were able to examine it? Because I know sometimes things can sit in museums for a very long time before they're worked with.

15:26

Hemen: So the amber sample had been part of the collection at the Lebanese University in Beirut for quite some time. And the termite holotype to which the mites are attached was described in 2011, as I mentioned, and has been since deposited. The amber piece was discovered by Professor Dany Azar who discovered many amber localities in Lebanon. And lots of fossil insects in amber from Lebanon are extremely important because it's the oldest ember containing numerous insects, which can offer us a window to the past.

Hemen: And during this time period, ecosystems actually transitioned into those that we recognize today because since this period angiosperms started to diversify. So my colleague Ninon, who is working on biotech interactions in the fossil records, borrowed the sample from Professor Danny Azar, and I was invited for a research visit to study the amber sample.

Zoe: That's really neat. So were you the one who noticed the mite, or was it somebody else?

Hemen: The mites were actually noticed when the termite was being described, but they were not documented. It was just mentioned in the paper that there were some mites on the termites. So this is the first time that we documented the mites in detail.

Zoe: It's such a cool form of collaboration, I think, in so many aspects of science and especially entomology, people have in some cases bycatch. So they set a trap and there are extra insects and arthropods floating around in the trap. Also, you have sometimes a specimen preserved

with other specimens. I think it really is just proof that we need to collaborate because you never know what someone may find when they're looking for something else. I think this is a really cool example of that.

Hemen: Yeah, I totally agree. I think with these kinds of collaborations, you can achieve sometimes great results.

Zoe: We already kind of talked about where your types were deposited, but do you want to say anything more about that?

Hemen: Well, so as I mentioned, the amber sample was deposited in the Natural History Museum, Lebanese University in Beirut. It's not so far away from the locality where it was discovered. It was discovered in a very famous locality where many fossils, insects were discovered in Lebanon. Lebanon is a very small country. So it's easy to travel around the country, but there are a lot of amber localities. And I think it has a huge potential in the future to find many more interesting discoveries.

Zoe: Did you enjoy your time there?

Hemen: Yeah, I was there in 2016, I believe, for two weeks. It was a nice, nice time, but I don't know how it's there now. I don't think nowadays it's that nice as back then. Because there were some conflicts in the area.

Zoe: When there's conflict, in addition to all of the really awful destruction and loss of human life, there are also disruptions and oftentimes loss to science, know, specimens, holotypes. I Think of all the holotypes of, you know, museums and institutions that have been bombed. It's really sad reality and something we have to work to prevent in the future.

Hemen: Yeah, definitely. And I think if it would be more, if there wouldn't be any conflicts in Lebanon and also countries like Myanmar, it would be much more attractive for the scientists to visit and to do research. So it's definitely, I really hope that in the future it will be peaceful.

Zoe: Me too, definitely. Just to move on to a slightly lighter topic, I was wondering if you could talk about the name of your new species.

Hemen: Well, the species and the genus name was named by my colleague, Pavel Klimov who is a specialist on mites. And the genus name *Plesioglyphus* consists actually of two Greek words, namely Plesio- which means ‘nearby’ and it's often used in scientific terms to indicate similarity or closeness in evolutionary relationships and -glyphus means ‘carved’ and it's also widely used to for names in astigmatid mites.

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Hemen: And the species named *lebanotermi* was chosen based on the name of the termites, which is the host of the mites. This kind of naming is quite common in some of these organisms that have these biotic interactions.

Zoe: Definitely. I've really enjoyed learning about this paper and all of your work. I wonder, your mites are so old, they're from the Cretaceous period, and you yourself work on a ton of other specimens and amber that really are not extant, like they don't exist in our time. I wonder why you think it's important to describe species of mites like these, and why does the description of new species matter?

22:13

Hemen: So, phoretic associations in modern minds are quite common, but their evolutionary origins remain quite poorly understood, I think. And by describing ancient mite species, we can help piece together the puzzle and gain insights into the evolutionary history of these associations. And the description of new species is also crucial because it not only broadens our understanding of biodiversity, but also provides key information about the ecological and the evolutionary processes that have shaped these relationships over time. And I think that some of these interactions have been largely overlooked. So it's important to study them.

Zoe: Definitely. And it sounds like you have a lot to uncover still. So I'm looking forward to following your work. Do you have any exciting projects coming up?

Hemen: Well, there is. I have a couple of ongoing projects, but they are a little bit different than this one. For example, we are also working together with Royce (Cummings) now on some Alienopteridae names. These are a group of Dictyopterans that are quite familiar to the ones that we described before. It's an extinct family of Dictyopterans, which is a very unique morphology. They're very different from modern cockroaches.

Zoe: Yeah, it sounds great. I'm looking forward to it. And thank you so much for speaking with me today.

Hemen: Thank you very much.

23:44

[bright, tech-y music returns]

Zoe: Thanks for listening to this episode of the New Species Podcast. This podcast is created by Brian Patrick, and is edited and produced by Zoe Albion. If you would like to support us, please consider subscribing to our Patreon at https://www.patreon.com/NewSpeciesPod. And if you'd like to get in touch with questions or feedback, please e-mail us at newspeciespodcast@gmail.com.

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24:00

Hemen: I don't know if I did not make a mistake somewhere, but if I made somewhere a mistake, you can let me know.

(both laugh)

Zoe: No, it sounded great! It sounded great.