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Identifying parasites as substitution causes in populations of local and allochthonous turtles in Lower Austria

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1. Background information: In Lower Austria a few reproductive populations of the native, endangered European pond turtle *Emys orbicularis* exist (7), stressed by until now non-reproductive populations of derelict pet terrapins (6), mainly neoarctic species as *Trachemys scripta*, *Pseudemys concinna*, *P. nelsoni*, and *Graptemys sp.* (all Emydidae) (10, 11). Whereas almost all the free-living American individuals were primordially hatched in US-breeding farms, and they all were abandoned within the lifespan of a pet turtle, the proveniences of the domestic *Emys*-populations are much more complicated. Having almost completely been extinct in Austria till the mediaeval times, pond turtles were thereafter imported from Brandenburg and Hungary as Lenten food in tremendous numbers. Animals escaped from breeding plants in monasteries as Mauerbach hermitage or were discarded if nonmarketable. Some individuals were brought to Lower Austria from Southern Europe as live-stock refreshment within the last two centuries, especially by k. u. k. army officers away on leave. Thus, one might expect not only a tessellated genetic configuration of the native turtle populations, but a fragmental and inchoate parasite spectrum also. Before claiming any deleterious impact of the alien terrapin species on the persistence and the welfare of the native pond turtle populations (1), any infectious organism actually realizing a biohazard risk to the local fauna has to be designated and evaluated with regard to its invasive potential.

The Good

Emys orbicularis
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2. Issue: Anthropogenic environmental changes in terms of releasing exotic pet reptiles into the native fauna usually cause the emergence of new infectious diseases in wildlife (3) and major damages to the native herpetofauna due to competition (1). No data are available on the parasite infestations of the domestic, endangered European pond turtle, *Emys orbicularis*. Data interpolation is difficult as almost all the Austrian Emys-populations raised from imported individuals centuries ago. Thus, the impact of some recently introduced alien parasites on the native turtle fauna is enigmatic. At the moment the mechanisms of an assumed parasite interaction have to be clarified.

The Bad

Trachemys scripta elegans
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Graptemys ouachitensis
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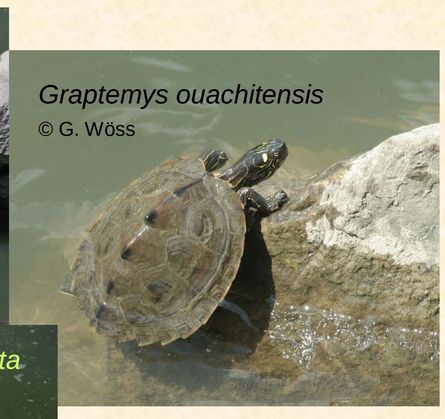
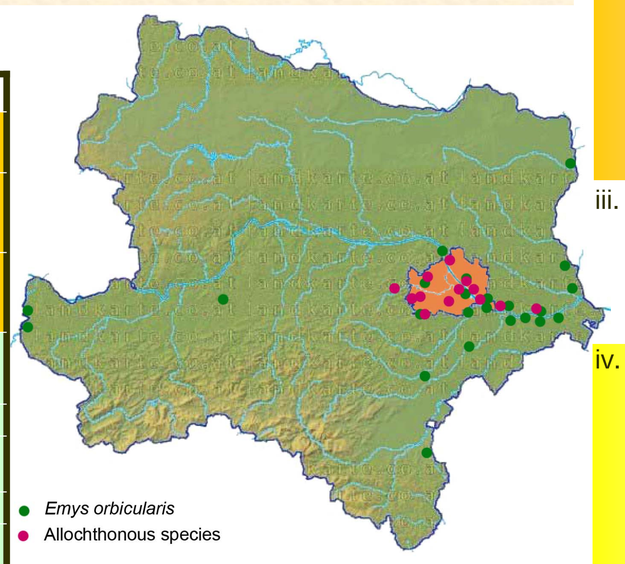


Trachemys scripta scripta
© A. Kleewein

3. Results:

taxon	location	realm	host	vector	family	class	reference
Spiroxys contortus	stomach	holarctic	freshwater turtles		Spiruridae	Nematoda	(13), (15), (4), (16), (9), (12)
Falcaustra donanaensis	intestine	palearctic	*Emys orbicularis, Mauremys leprosa, Trachemys scripta*		Kathlanidae	Nematoda	(8)
Serpinema microcephalus	intestine	holarctic	*Emys orbicularis, Mauremys leprosa, Trachemys scripta*		Camallanidae	Nematoda	(16), (8), (9), (13), (2)
Haemogregarina stepanowi	blood	palearctic	*Emys orbicularis*	*Placobdella costata, P. catenigera*	Haemogregarinidae	Apicomplexa	(13), (5)
Eimeria delagei	tissue	palearctic	*Emys orbicularis*		Eimeriidae	Apicomplexa	(14)
Spirhapalum polesianum	blood	palearctic	*Emys orbicularis*		Spirochiidae	Trematoda	(18)
Patagium lazarewi		palearctic	*Emys orbicularis*		Plagiorchiidae	Trematoda	(16)
Plagiorchis mutationis	intestine	palearctic	*Emys orbicularis*		Plagiorchiidae	Trematoda	(9)
Telorchis assula	intestine	palearctic	*Emys orbicularis*		Telorchiidae	Trematoda	(9)
Telorchis parvus	intestine	palearctic	*Emys orbicularis*		Telorchiidae	Trematoda	(9)
Telorchis stossichi	intestine	palearctic	*Emys orbicularis*		Telorchiidae	Trematoda	(9)
Polystomoides ocellatum	oesophagus & lung	palearctic	*Emys orbicularis*		Polystomatidae	Trematoda	(9)
Spironoura armenica		palearctic	*Emys orbicularis*		Kathlanidae	Nematoda	(16), (9), (12)
Physaloptera sp.	intestine	palearctic	*Emys orbicularis, Mauremys leprosa*		Physalopteridae	Nematoda	(8)
Aplectana sp.	intestine	palearctic	*Emys orbicularis, Mauremys leprosa*		Cosmocercidae	Nematoda	(8)
Placobdella costata	ectoparasite	palearctic	*Emys orbicularis*		Glossiphoniidae	Hirudinea	(5)
Trypanosoma chrysemydis	blood	nearctic	freshwater turtles	*Placobdella parasitica, P. ornata*	Trypanosomatidae	Euglenozoa	(5)
Eimeria spp.	intestine	nearctic	freshwater turtles		Eimeriidae	Apicomplexa	(14)
Serpinema trispinosus (= Camallanus pipientis)	intestine	nearctic	*freshwater turtles*		Camallanidae	Nematoda	(13), (15), (4), (2)
Placobdella ornata	ectoparasite	nearctic	freshwater turtles		Glossiphoniidae	Hirudinea	(5), (17)
Placobdella papillifera	ectoparasite	nearctic	freshwater turtles		Glossiphoniidae	Hirudinea	(5), (17)
Placobdella parasitica	ectoparasite	nearctic	freshwater turtles		Glossiphoniidae	Hirudinea	(5), (17)

ii.	native parasite species known to invade allochthonous terrapins
i.	putative native pond turtle parasite species
iv.	probable invasive turtle parasite species



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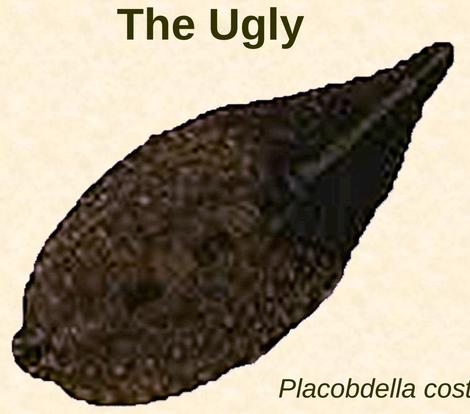
4. Insights: a. Relevant models of parasite distribution:

I. The derelict allochthonous pet terrapin individuals have low and species-poor parasite burdens due to preceding long-time pet keeping and farm breeding.
II. Moreover, some of the recently introduced alien parasites cannot establish a domestic life-cycle due to the absence of suitable vectors or essential hosts.
III. Any established life-cycle of a recently introduced parasite is highly damageable by habitat malfunctions, resulting in an extinction of the poorly adapted parasite.

b. Turtle populations as parasite reservoirs:

i. The local European pond turtles harbour the habitual, native parasites without an observable interaction with any alien parasite. Alien turtle parasites may not have invaded Lower Austria until now because of the biased parasite fauna of pet animals.
ii. The local European pond turtles harbour the habitual, native parasites which colonise rapidly the immunological naive allochthonous terrapins and which may damage their fitness subsequently. In that case the native parasite fauna broadens its host spectrum and benefits from the pet turtle ditching. Such an epidemiological situation has been uncovered in Southeastern Spain (8).
iii. The allochthonous terrapins harbour some non-invasive, persistent parasite species which do not substitute the local parasite fauna. Until now indications supporting this thesis were not found.
iv. The allochthonous terrapins disseminate alien parasites which harm the native turtles. Such a case was not detected until now, but some parasites may have the potential to act as that. Especially the establishment of some alien vectors like the American turtle flukes may change the epidemiological situation fundamentally.

The Ugly



Placobdella costata
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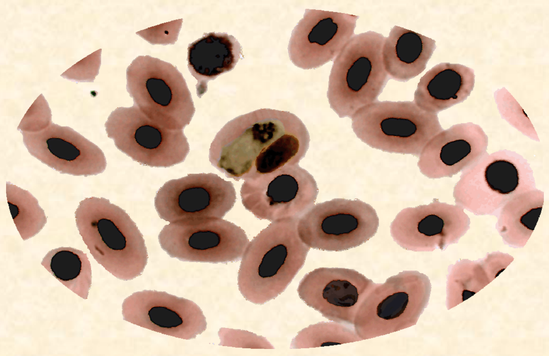

Reptilian haemogregarina
© A. Hassl

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