

Results of the toxicological analysis of unhatched saker falcon eggs (2009)

The laboratory investigation revealed the presence of chemical agents belonging to three groups of toxicants: organochlorines, organophosphates and carbamates. The toxic effects of the compounds can be briefly summarized as follows:

p,p-DDE

- endocrine disruption: anti-androgenic, oestrogenic effect (influencing the sex ratio)
- anti-thyroidal effect (inhibition of T3, T4 function)
- reduction of eggshell thickness (anti prostaglandin effect disrupting Ca transport)
- 2,6-3 mg/kg – results in 40-29% reduction of breeding success; over 3,7 mg/kg - total breeding failure (brown pelican egg DDE concentration (Lawrence, 1984))
- probable carcinogen

p,p-DDD

- endocrine disruptor
- probable carcinogen

beta-HCH

- immunosuppressive, endocrine disruptor
- acute toxicity to aquatic organisms, oestrogenic effect in fishes
- neuro- and hepatotoxic
- reduction of nestling fitness
- reproductive disorders
- probable carcinogen

Chlorpyrifos, pirimiphos-metil and sulphotep

- acute toxicity, cholinesterase inhibitor

Carbofuran

- acute toxicity, cholinesterase inhibitor

Substance	Concentration in eggs (mg/kg)			LD ₅₀ (mg/kg)
	Average	Min	Max	
beta-HCH	0,029909	0,012	0,055	(122 – gamma-HCH) (Colinus virginianus)
p,p-DDD	0,013727	0,01	0,019	4814 (Anas platyrhynchos)
p,p-DDE	0,562294	0,035	1,812	825 (Colinus virginianus)
Carbofuran	0,00975	0,007	0,013	(0,4)-0,71 (Anas platyrhynchos)
Chlorpirifos	0,0442	0,021	0,058	32 (Gallus gallus)
Pirimiphos-metil	0,0135	0,013	0,014	1695 (Anas platyrhynchos)
Sulphotep	0,089			25 (Gallus gallus)

Among the detected organochlorines beta-HCH is a metabolite of Lindan, while p,p-DDE and p,p-DDD are products of DDT degradation. These toxicants persist in the environment for a long time and they accumulate at the top of the food chain as exemplified by the above measurements.

All the above measured values are below acute toxicity levels. Yet in the case of the higher carbofuran concentrations the possibility of direct toxic effects may not be excluded, especially since metabolisation and environmental effects can both reduce the initial toxin concentrations significantly. The compound with the highest potential to influence the breeding success of birds is p,p-DDE.

The eggshell thinning effect of DDT can be attributed directly to this metabolite. The measured concentrations are below the values associated with calcium excretion disorders during egg formation, thus it can be assumed that this effect of DDE is not present in the population. The direct embryotoxicity of DDE is probably also negligible, though it is uncertain whether it can be ruled out completely. However, DDE may have an effect on the sex ratio of hatchlings and the impaired development of male reproductive organs resulting in infertility through its endocrine disruption and anti-androgen function.

To sum up, we can assume, that the detected toxicants may have an unfavourable effect on the hatching and fledging success of the affected saker falcon broods. The exact extent and nature of this potential effect is hard to estimate due to the lack of directly relevant data in the scientific literature and because of the constraints on sample collection. Thus, we have to rely on scientific evidence published from studies of other species and draw analogies from general descriptions of the patho-mechanism of these compounds, which can rarely be directly applied. Nevertheless this could be attempted by additional studies and the analysis of the existing data on breeding success, sex ratio, etc..

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