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## Relevant snakes and turtle species for the risk assessment of plant protection products in Northern and Central Europe Oliver Körner, Nicolá Lutzmann, Gernot Vogel, Christian Dietzen and Jan-Dieter Ludwigs

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According to the new data requirements under the EU regulation 1107/2009, reptiles come into question regarding risk assessments of plant protection products (PPP). Although no specific data requirements on reptiles are stipulated in the respective EU documents (e.g. SANCO 11802/2010/rev July 2010), some toxicity data are available in the open literature. These data are intended to be used in the risk assessment. One potential approach for reptile risk assessment may be the way how it is successfully established for birds and mammals. The major routes of exposure in that case are diet and drinking water. In order to provide a scientific basis for reptile risk assessment, a detailed literature survey on habitat use and the biology of snakes and turtles occurring in North and Central Europe (geographical zones according to SANCO/6896/2009 rev 1) was conducted. The study focused on the habitat use of the different species, but also evaluates the different diets as a source of exposure.







The data obtained may allow the determination of relevant species at risk and how they can be linked to potential exposure in agricultural practice.

## Table 1: Habitat and diet preferences of snake and turtle species occurring in Northern (N-EU) and central Europe (C-EU)

	Species	N-EU	C-EU	Habitat	Diet
Snakes	Horned Viper Vipera ammodytes		AT, RO, SL, HU	Garden/parks, walls and rocks, grasslands, forests and forest edges, field margins	Mammals, birds, reptiles, arthropods
	Adder Vipera berus		BE, CZ, DE, LU, HU, NL, AT, PL, RO, SL, SK, UK	Forests and forest edges, bogs, garden/parks, rocks/walls, field margins, grasslands, marshes, riparian zones, lakes/rivers,	Mammals, birds, reptiles, amphibia
	<b>Asp Viper</b> Vipera aspis		DE, SI	Rocks/walls, field margins	Mammals, reptiles, birds, amphibia
	Meadow Viper Vipera ursinii		HU, RO, AT, SL	Open meadows, hillsides, steppe, meadows, traditionally farmed meadows	Reptiles, mammals , birds, arthropods
	<b>Dice Snake</b> Natrix tessellata		CZ, DE, HU, AT RO, SL	Rivers/lakes, riparian zones, walls and rocks	Fish
	<b>Grass Snake</b> Natrix natrix	DK, EE, LT, LV, FI, SE	BE, CZ, DE, LU, HU, NL, AT, PL, RO, SL	Rivers/lakes, riparian zones, garden/parks, marsh, walls and rocks, grasslands, field margins, arable lands, bogs, forests and forest edges	Amphibia, fish, mammals, birds, reptiles
	Smooth Snake Coronella austriaca	EE, LT, LV, FI, SE	BE, CZ, DE, LU, HU, NL, AT, PL, RO, SL	Vineyards, garden/parks, walls and rocks, grasslands, field margins, arable lands, forests and forest edges, marsh, rivers/lakes, riparian zone	Mammals, reptiles, birds, arthropods, fish
	Caspian Whipsnake Dolichophis caspius		HU, RO	Open landscapes, grassland, rocky slopes, vineyards, meadows and clearings in deciduous forests	Reptiles, mammals, birds
	Four-Lined Snake Elaphe quatuorlineata		SL	Hedgerows, close to woodland edges, open woodland, rocky overgrown areas, traditionally cultivated land	Mammals, birds, reptiles, arthropods
	Eastern Four-Lined Ratsnake Elaphe sauromates		SL	Vegetated areas with sandy ground, deciduous woodlands, rocky areas, swamps, river banks	Mammals, reptiles, birds,
	Balkan Whipsnake Hierophis gemonensis		SL	Dry, stony areas, scrubland, macchia, open woodlands, vineyards, olive groves, overgrown areas, rural gardens, ruins	Reptiles, mammals, birds, arthropods, amphibia
	<b>Green Whipsnake</b> Hierophis viridiflavus		SL	Dry, open well vegetated habitats, scrubland, macchia, open woodland, heathland, cultivated areas, dry river beds, rural gardens, road verges, stone walls, ruins	Mammals, reptiles, amphibia, arthropods, gastropods
	<b>Aesculapian Snake</b> Zamenis longissimus		AT, CZ, DE, HU, RO, SK, SL, PL	Forests and forest edges, orchards, grasslands, marshes, rocks/walls, garden/parks	Mammals, birds, reptiles
	<b>European Ratsnake</b> Zamenis situla		PL	Scrubland, macchia, karst, field edges, marshes, stream edges, vineyards, olive groves, stone walls, rural gardens	Mammals, reptiles, birds
	<b>Cat Snake</b> <i>Telescopus fallax</i>		SL	Rocky, shrubby landscapes, open and degraded woodland, walls and ruins, sandy beaches, montane xerophytic steppe, semi-deserts	Reptiles, mammals, birds
	Habitat: Snakes do not appear to show any clear preference for specific farmland areas. Only a few species are known to inhabit PPP-exposed areas such as vineyards, orchards, olive groves, grassland and garden/parks. However, several species do use field margins and the edges of forests within close proximity to cultivated areas. Food: The major food items of snakes are small mammals (particularly mice and shrews). Snakes will also take birds (mostly nestlings), amphibians, small lizards and arthropods. For a small number of species fish is an important component of the diet.				
Turtles	European Pond Turtle Emys orbicularis	DK, GB, LT	DE, AT, HU, RO, SL, SK, CZ,	Rivers/lakes, riparian zones, marshes	Arthropods, gastropods, plants, fish, amphibia







Habitat: The preferred habitats of turtles are aquatic and semi-aquatic (ponds, lakes and backwaters). One non-native species is often found in ponds located in parks and gardens. Food: Arthropods are the main food of turtles, but gastropods, plants and occasionally small vertebrates (fish, amphibians and reptiles) are also taken.

According to the available literature, only a few number of species are found in agricultural areas such as vineyards, orchards, olive groves and grasslands. Most species live in field margins or areas where no PPP use or drift is expected (e.g. forests and scrubland). Field margins are generally characterized by a high diversity of different structural elements (hedges, trees, deadwood, rocks and walls) and have almost 100% vegetation cover resulting in interception values of up to 90% (FOCUS Groundwater GD, 2011). Accordingly, it is likely that uptake via inhalation or dermal contact resulting from direct exposure to the spray or drift will be very limited. Therefore, the major route of PPP exposure appears to be the consumption of small vertebrates which are previously exposed to PPP. Unlike terrestrial species, aquatic reptiles such as the dice snake and turtles are less likely to come into direct contact with PPP. Nevertheless, there might be an exposure via drift, run-off and drainage of active substances into nearby water bodies. However, exposure to PPPs can be expected to be low as long as any contamination of surface water remains low and the active substance does not bio-accumulate. Most of the work on reptiles reported in the literature was conducted in typical reptile habitats (e.g. sun-exposed structures such as rocks, walls or deadwood) rather than in farmland (e.g. cereal or vegetable fields). This may result in a potentially biased data set suggesting that reptiles have a low affinity for arable land. For instance, Wisler *et al.* (2008) provided evidence that monocultures (such as potato or cereals crops) display a significant component of grass snake habitats. It is therefore necessary to conduct appropriate generic field studies in a range of crops before any firm conclusions can be drawn regarding the potential for European reptiles to be exposed to PPPs applied to these areas.



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