Authors: Richard Linxweiler[1]
Affiliations: pforzheim university of applied sciences[1]
Orcid ids: 0009-0006-2197-2652[1]
Contact e-mail: richard.linxweiler@hs-pforzheim.de

DOI: 10.14293/PR2199.002669.v1
Preprint first posted online: 25 December 2025
Keywords: Lure-stick-method, camera trap , silver vine, catnip, valerian , European wildcats

Wildcats drunk on silver vine

The effect of various cat attractants on European wildcats *(Felis silvestris silvestris)* in their natural habitat

Richard Linxweiler

Abstract: The effect of various cat attractants on European wildcats (*Felis silvestris silvestris*) in their natural habitat - Field study using plants of silver vine (*Actinidia polygama*), catnip (*Nepeta cataria*) and valerian (*Valeriana officinalis*) with the lure-stick-method and video monitoring. This study is the first to investigate the attractive effect of silver vine, catnip and valerian on the European wildcat, following a study of Bol et al. (2017) that demonstrated significantly stronger effects of the before mentioned attractants compared to valerian on domestic cats. The findings indicate a superior efficacy of silver vine compared to valerian. Additional insights into the wildcat responses were obtained through the use of wildlife cameras.

Key words: Lure-stick-method, camera trap, silver vine, catnip, valerian, European wildcats

Résumé: L'effet de différents attractifs pour chats sur les félins sauvages européens (*Felis silvestris silvestris*) dans leur habitat naturel. Étude de terrain utilisant la vigne d'argent (*Acitinidia polygama*), la cataire (*Nepeta cataria*) et la valériane (*Valeriana officinalis*) avec la méthode de piégeage et de suivi, en intégrant la vidéomonitoring. Cette étude est la première à examiner l'effet attractif de la vigne d'argent et de la cataire sur le chat sauvage européen, suite à une étude de Bol et al. (2017) qui a démontré des effets signicativement plus forts des attractifs par rapport à la valériane, couramment utilisée pour le suivi des chats sauvages. Les résultats indiquent une efficacité supérieure de la vigne d'argent par rapport à la valériane. Des informations supplémentaires sur la population de chats sauvages ont été obtenues grâce à l'utilisation de caméras de surveillance.

Mots-clés: chat sauvage européen, méthode de piégeage et de suivi, caméras de surveillance, vigne d'argent, cataire, valériane,

1. Introduction

The assessment of wildcat populations (*Felis silvestris silvestris*) in Europe and Germany is commonly performed using the lure-stick method, primarily employing valerian (*Valeriana officinalis*) (VA) as an attractant (König et al. 2021, Nussberger 2021, Gerngross et al. 2021, Hupe & Simon 2007). However, according to a study on domestic cat (*Felis catus*) (Bol et al. 2017), valerian was clearly outperformed by other attractants in terms of its attracting effect. The higher attractiveness of silver vine (*Actinidia polygama*) (SV) and catnip (*Nepeta cataria*) (CN) compared to valerian root in domestic cats inspired a practice-oriented field study to investigate to what extent these effects also apply to European wildcats in their natural habitat. Notably, for silver vine, no published studies on European wildcats exist, and for catnip, only a few published investigations are available (Gruber et al. 2025, Sforzi & Viviani 2025, Viviani et al. 2024) (as of 11/2025).

1.1 Background

This project builds upon studies by Abramson et al. (2012), Bol et al. (2022), Borges (2024), Chen et al. (2024), Uenoyama et al. (2021), and Zhang et al. (2022). In a controlled laboratory study in the USA by Bol et al. (2017) involving 100 neutered domestic cats (*Felis catus*), it was shown that almost 80 percent of the animals (72% strongly, 7% mildly) responded to the galls of silver vine (*Actinidia polygama*), and 67 percent of the cats (51% strongly and 16% mildly) responded to catnip (*Nepeta cataria*), while only 45 percent (38% strongly and 7% mildly) of the tested domestic cats responded to valerian root (*Valeriana officinalis*) (Fig. 1). Among the cats in that study that did not respond to catnip, almost 75 percent did respond to silver vine (Bol et al. 2017). Significantly more cats responded positively to silver vine and catnip than to valerian root. The reactions to silver vine were more intense than to catnip ($p = 0.02$) (Bol et al. 2017). In a study on the European wildcat in Italy (Sforzi & Viviani 2025), where valerian and catnip were used, a review of additional attractants was recommended due to the weaker effect of valerian compared to catnip. Viviani et al. (2024) preferred the use of catnip over valerian due to its deficiencies in attractant effect.

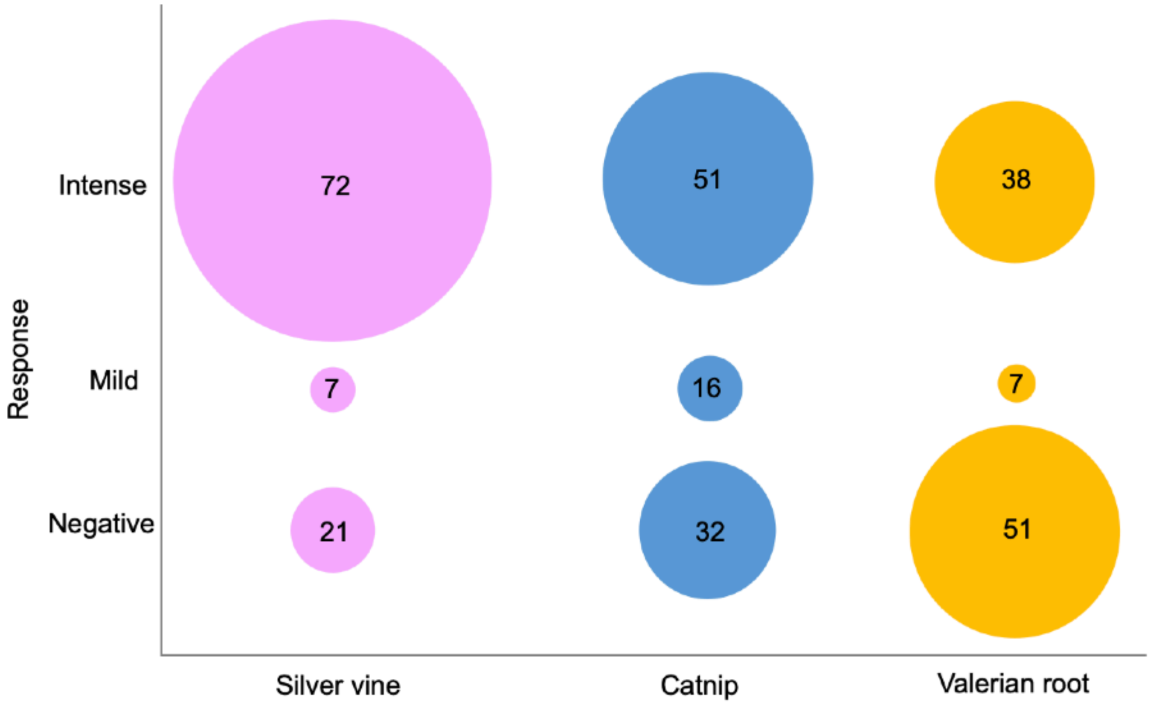

Fig. 1: Response of domestic cats to silver vine (gall fruits), catnip and valerian roots Bol et al. (2017) Source: modified after Bol et al. (2017, p 7)

2. Objectives

The aim of this four-month field study (from late January to early June 2025) is to obtain the following insights:

a) Do the observed attractive effects of silver vine, catnip, valerian, or combinations thereof from the Bol et al. (2017) study also apply to the European wildcat? Based on this understanding, can wildcat populations be surveyed more comprehensively than through the exclusive use of valerian tincture as an attractant?

b) What additional information can the use of wildlife cameras at lure sites provide? Can data on phenotype, individual categorization (domestic cat/wildcat, young/adult, healthy/injured, time of appearance), and animal behavior toward the lures lead to new discoveries?

c) Do wildcats respond year-round outside of their main mating season to any of the lures, as seen in neutered domestic cats (Bol et al. 2017) and if so, to what extent?

d) Placing lure sticks at three potential roaming and habitat areas (1. *forest edge* (W), 2. *hedgerow to forest* (H), 3. freestanding *field woodlands* (F)) should also reveal how often these areas are frequented by wildcats, to what extent the species crosses open cultural landscapes without cover, and what these findings imply for the species' dispersal/migration potential (Jerosch 2021).

3. Methods

3.1 Study Area

The Saarland is the first federal state in Germany to be completely populated by the European wildcat since 2019 (Welt 2019). The approx. 12 km² (4×3 km) study area is located in the northeastern Saarland within the hunting district of the municipality of St. Wendel, district of Werschweiler. It spans a landscape section in the central Ostertal about six kilometers southeast of the district town St. Wendel, at an elevation of 293–413 m above sea level. The area is predominantly agricultural, with an annual average temperature of 9.5°C and annual precipitation of approx. 900 mm/m² (2024). The dominant soil is brown earth overlying Rotliegend rock. The study region is typical of the mid Saar-Nahe hill country, offering arable land (grain, maize, rapeseed), grassland use, and cattle or horse grazing. Forest use consists of mixed forest with beech, oak, and some conifers. The environment is distinguished by a balanced proportion of structural elements such as tree groups, hedgerows, orchard meadows, dry grasslands with shrub vegetation, and field woodlands with tree cover.

3.2 Monitoring sites

Seven grid cells were selected for monitoring with lure sticks and wildlife cameras, at sites expected to attract wildcat visits (Fig. 2). The distances between lure sites were at least 350 meters each. Three typical roaming and cover habitats were considered in choosing lure locations:

Field woodland sites (F): Field woodlands in open cultural landscapes not used for agriculture, characterized by hedges, grassland, and tree cover. They may serve as cover or temporary/permanent retreat areas for wildcats (Jerosch 2021). These sites were deployed in four (locations 5, 6, 8, 9) of the seven grid cells, each at least 300 meters from substantial forest cover. The aim was to test which and how often wildcats appeared at these sites.

Hedgerow sites (H): Lure stick sites located in hedgerows directly connected to closed forest and near streams (locations 2, 3, and 4) also employed three lure sticks each. These sites were intended to reveal the extent of hedgerow use for movement between forest areas (locations 1, 3, 4) and stream affinity.

Forest edge sites (W): Two further sites (locations 2 and 7) were placed at the edge of closed forest stands at locations suspected or confirmed by prior studies as frequented by wildcats. No lure sticks were placed within the closed forest itself.

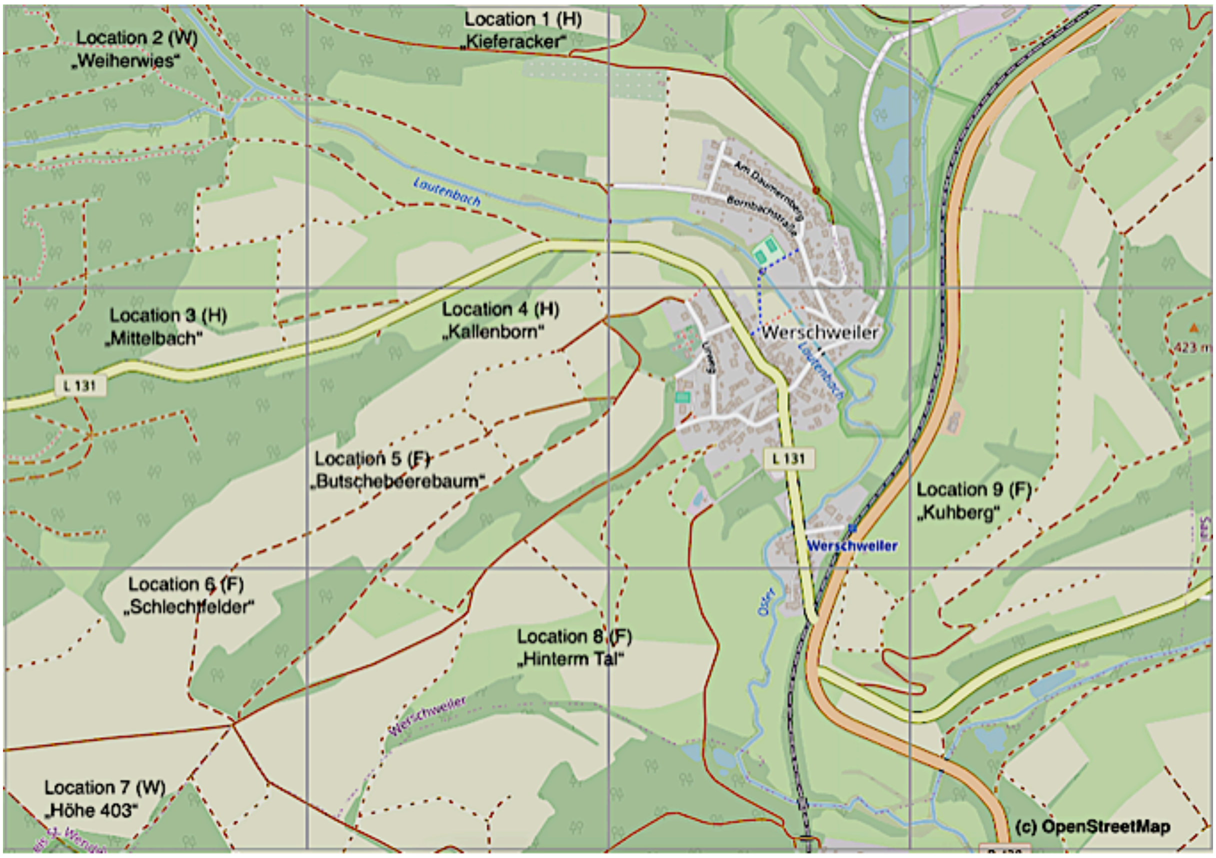

Fig. 2: Grid cells in the study area Werschweiler, 12 cells (4x3), (cell length 1x1 kilometers), locations 1-9, (H):= *Hedgerow sites*, (W):= *Forest edge sites,* (F):= *Field woodland sites*

3.3 Lure sticks and lure substances

A total of 27 (3x9) roughened, pointed round wooden posts were prepared to collect hair from wildcats rubbing against the wood for later sampling. The end grain of the posts was drilled with one hole and three smaller side holes. Cotton wool was inserted into grain hole, sprayed

Fig. 3: Lure stick and triangular positioning, market by the wildcat (silver vine lure stick)

with the respective lure, and protected with a paper cup as rain shield. The lure sticks were placed in a triangular arrangement with a distance of one meter between each post (Fig. 3). Each set of three lure sticks per location was inspected every eight days during the study period. Hair samples were collected, if present, the sticks were flame-sterilized, and sprayed all around with commercial lure substances. The following lure substances (in 3x3 spray bottles) were taken from a single batch to ensure consistent mixtures at all lure stick locations:

Matatabi silver vine (*Actinidia polygama*), brand name: "Trixi Matatabi Play Spray": Ingredients per the supplier (amazon): water, Matatabi extract, containing a mixture of Methylchloroisothiatolinone and Methylisothiazolinone 3:1
CatNip Spray (catnip (*Nepeta cataria*)), brand name: "Karlie Catnip Spray": Ingredients per the supplier (amazon): water, propylene glycol, alcohol, *Nepeta cataria, Coriandrum sativum,* aroma*, Mentha arvensis, Sodium benzoate*
Valerian tincture (*Tinctura valerianae*): Ingredients per the supplier: (70%) 1:5, API, PH.EUR 8.0, ethanol content V/V 66.4%, constituents (sesquiterpene acids) 0.017%
Anise oil (*Pimpinella anisum*): pure anise essential oil, 100% steam distilled, no additives
Orange oil (*Aurantii dulcis aetheroleum*): 100% pure natural orange oil for consumption (umbrella brand name: "Emma Grün")

The safety of the lures/substances used for cats in this study is ensured by the national market approval of the products employed. For silver vine, a study by Uenoyama et al. (2023) underscores its safety and suitability regarding stress or toxicity.

The distribution of lures on the sticks over the study period is listed below (Table 1):

Table 1: Monthly changes in lure stick provisioning

Monthly intervals	Lure stick A (SV)	Lure stick B (CN)	Lure stick C (VA)
Jan./Feb. 01/28/25 – 03/02/25	Silver vine (SV)	Catnip (CN)	Valerian (VA)
Mar./Apr. 04/03/25 – 04/06/25	*SV/Anise oil (AO)*	CN	*VA/CN*
Apr./Mai 04/07/25 – 05/04/25	*SV/Orange oil (OO)*	*CN/SV*	*VA/OO*
Mai/Jun. 05/05/25 – 06/01/25	SV	*CN/AO*	*VA/SV*
Jun. 06/02/25 – 06/09/25	*SV/CN/VA*	*CN/OO*	*VA/OO*

Study period: January 28, 2025, to June 8, 2025; inspection: weekly, every monday morning. From march 3, 2025, lure sticks were treated with combinations of lure substances (mix). Due to individual variations in wildcat responses to silver vine, catnip, and valerian (Bol et al. 2017, 2022), combinations of lures per stick were tested to capture possible mix effects. Effects of additional substances mixed with the plant extracts on other wildlife were also investigated. Orange oil (*Aurantii dulcis aetheroleum*) is reported in the literature (Cozzi et al. 2022) as a lure for foxes. Anise oil (*Pimpinella anisum*) is used by hunters as a universal lure for wild boar and roe deer. Since these lure mixtures (with the exception of VA/CN and SV/AO) dit not exhibit any appreciable effects, they were omitted from the analysis.

3.4 Use of trail cameras

Monitoring of the lure sites was conducted using trail cameras (Digital Trail Camera Mini 301) (Klangwald & Vergne 2018). They were installed following the guidelines of the relevant data protection regulations and with the registration/permission from the authorities, including necessary signage labeling and placement at knee height in close proximity to the lure sites. The cameras were set to a recording duration of 20 seconds with a pause of 5 seconds and were activated 24 hours a day. In addition to the date and time, outside temperature was also recorded. The timing of the recordings was informed by experiences from the preliminary study conducted in 2024. Reasons for monitoring with trail cameras: Findings from a preliminary study with occasional video use indicated that visits by wildcats to lure sites sometimes occurred without direct contact with the lure stick. The use of cameras provides more detailed information due to precise observation of behavior at contact points than capturing data solely through hair samples without camera use. Wildcat identification was made through careful review of the species-specific morphological characteristics and individual species-typical markings of the photographed animals (pronounced neck and shoulder stripes, dorsal stripe to the base of the tail, heel pads only on the soles (*Nehring spot*), little to no fur patterning on the flanks, absence of a dark collar, absence of dark hair on the crown, clearly defined tail rings, see Fig. 4).

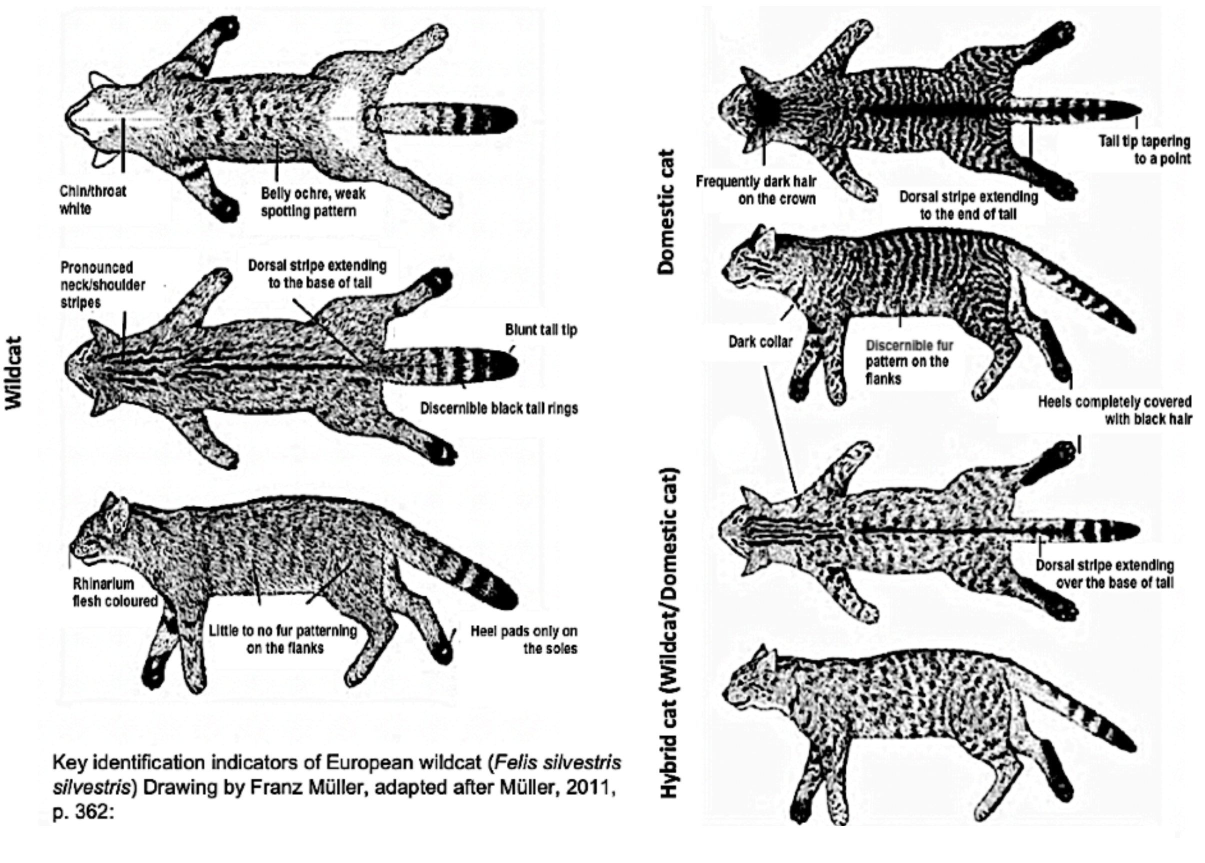

Fig. 4: Identification characteristics of the wildcat, domestic cat, and hybrid cat (after Müller 2011)

The suitability of trail camera videos and images for morphological identification and reliable distinction between wildcats and domestic cats cross-checked against corresponding DNA analyses were confirmed by Maronde et al. (2020). As this was a field study aimed at providing general insights into the effectiveness of the mentioned attractants, DNA analysis of cat hairs was omitted for financial reasons. An additional aspect favoring the use of cameras: With normal inspection intervals of eight days by the lure-stick-method without video evidence, hair samples are sometimes registered as single contacts, while in this study, video analyses recorded multiple lure site contacts by wildcats within the weekly intervals.

3.5 Microscopic examination of hair samples

In addition to camera trap evaluation, microscopic hair analyses (Leitz HM Lux-3) were performed to assess whether significant differences exist between wildcat and domestic cat hair. In a preliminary and the current study, collected hairs from lure sticks were examined (Fig. 5) with a focus on the inner hair structure, including vacuolated medulla (Schacker et al. 2018, Teerink (1991). In the microscopic comparison between several domestic cat hairs (Fig. 5a) and wildcat hairs (Fig. 5b), significant differences in the structure and numbers of medulla bubble patterns were not found.

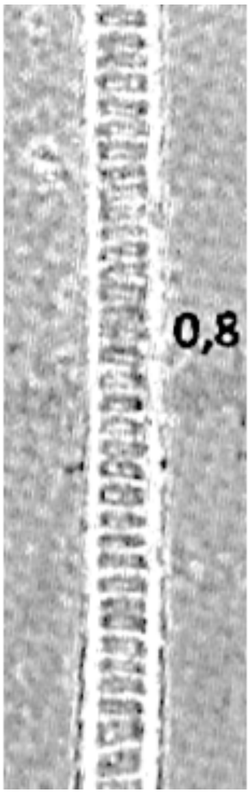

Fig. 5: Microscopic pictures of the medulla (hair core) of domestic cats and wildcats with hollow bubble inclusions

Fig. 5a: *Hair (medulla)* ***domestic cat*** Fig. 5b: *Hair (medulla)* ***European wildcat***
(Micr. magnification 100x – thin face hair 0.8 subdivisions x 30µm=24µm cat hair diameter)

Microscopic examination data showed the maximum difference (Fig. 5) in the number of hollow inclusions per equal measurement segment of 4 (wildcat= 36 and domestic cat= 32) and a *medulla factor* of 1.12 (wildcat/domestic cat). Concerning the shapes and spatial arrangement of medullary inclusions, no significant differences were observed between wildcats and domestic cats, based on the range of variation within the sampled specimens.

Lehmann & Steffen (2020) found no significant differences in signatures on the hair surface between domestic and wildcats in the comparative study of morphological/microscopic hair analysis focusing on the hair coat (cuticle). Only the hair length of wildcats (>5cm) could be significantly attributed to this species.

3.6 Data generation and measurement of contacts

Recorded were the video recordings of animals that approached the lure sites within 0.5m (registered as "sighting without contact") as well as videos of animals that made physical contact with the lure sticks (registered as "sighting with contact"). These were evaluated according to the duration of contact with the lure sticks in four (1-4) categories/effect points: Duration of direct contact >40 seconds = "intensive," weighted with ordinal value 4; direct contact >20 seconds = "strong," weighted with ordinal value 3; direct contact >10 seconds = "moderate," weighted with ordinal value 2; direct contact >1 second = "fleeting," weighted with ordinal value 1. Contactless sightings were weighted with ordinal value 0.

3.7 Statistical evaluation of findings

Preliminary note: The study used for comparison was a controlled laboratory study with a fixed sample size of 100 neutered domestic cats (Bol et al. 2017). Our uncontrolled field study could not establish constant sample sizes and was subject to external influences of the wild (environmental influences, disturbances from noise, fertilization input, temperature, weather influences, marking of other wildlife species etc.). A statistical density estimation of the wildcat population per square kilometer using the *Spatially Explicit Capture-Recapture method* (SECR) was not feasible for this study, as at least 50 individuals needed to be recorded for a valid estimate (in this case: 43 sightings of 10 different wildcats). On the selection of statistical models: The Friedman test was not applied because it measures only a single within-subject factor. However, in this case there are two such factors (number of repeated measurements and attractant), as well as a clustering level (lure sites). Therefore, three models were computed as an approximation. Due to the ordinal scaled data (rank scale 1-4) and more than two independent groups (SV, CN, VA) as well as a non-parametric distribution and data from single-contact sample size (n = 22), the *Kruskal-Wallis* test was used to check for significant differences between the three groups. In addition, pairwise comparisons using the *Dwass-Steel-Critchlow-Fligner method* was used. Additionally the GAML test method (Generalized Linear Mixed Model) was conducted. The data can be found in the results section.

4. Results

4.1 Sightings/records of wildcats at the lure sites

The following Figure 6 shows a total of 43 wildcat sightings distributed across nine locations. At the three hedge stripe (H) lure sites (location 1, 3, and 4), 20 sightings were recorded, accounting for 46 percent of all observations. In two of four fieldwood islands (F) 8 and 9, 16 sightings (37 percent) occurred. Only 16 percent of the captures (seven sightings) were made at two lure sites (location 2 and 7) at the forest edge (W). At locations 5 (F) and 6 (F), no wildcats were registered despite their direct proximity to a longtime established reproduction area of the wildcat (parcel "im Katzenloch" *(cat hole entrance),* recorded in the land register since 1843).

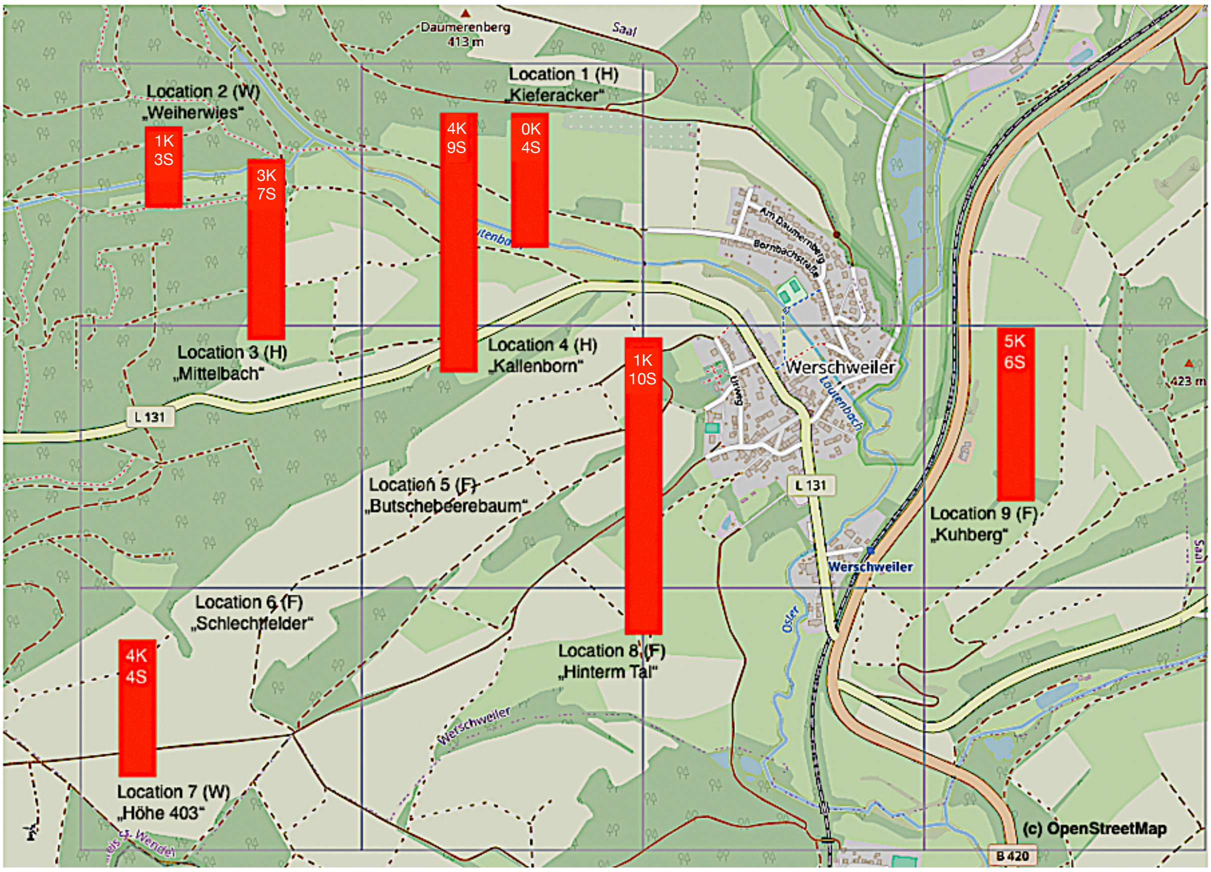

Fig. 6: 43 wildcat sightings (S) at the locations 1-9; (H):=hedgerow sites, (W):= Forest edge sites, (F):= Field woodland sites; column labels, e.g.: 1K/10S:= 1 contact/10 sightings

4.2 Overall results of sightings/contact records

During the study period, 43 sightings of wildcats were recorded via video analysis. A total of 25 sightings occurred without contact with the lure sites and 18 wildcat contacts occured with the lure sites.

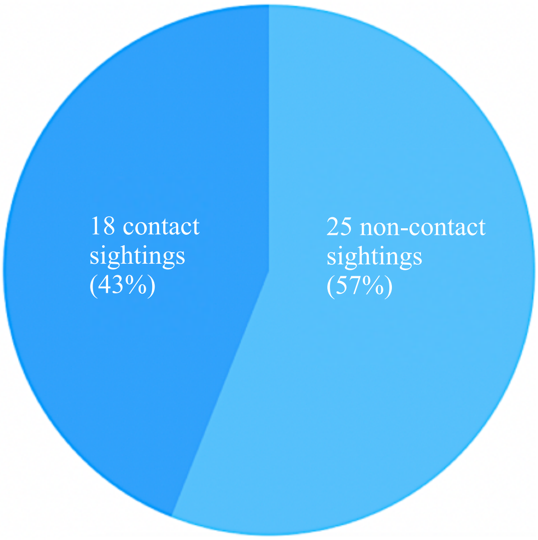

Fig. 7: Contact and non-contact wildcat records at the lure sites

As shown in Figure 7, the majority, 57 percent of wildcat visits, were not associated with direct contact at the lure sticks. Monitoring solely using lure sticks without cameras would not capture these visits without contact at the locations. Consequently, only 43 percent of the actual wildcat visits would be recorded, leading to correspondingly inaccurate findings regarding the presence of wildcats. Notably, there was an almost complete avoidance of any contact at location 8 ("behind the valley") during nine out of ten visits, despite the direct crossing of the animals between the lure sites and minimal external disturbances.

Table 2: Distribution of lures and *individual* contacts of wildcats at luresticks (without mix)

Monthly intervals	Lure stick A (SV)	Lure stick B (CN)	Lure stick C (VA)	Single contacts (C)	pts.
01/28/25 – 03/02/25	Silver vine (SV) (9 contacts/23 pts.)	Catnip (CN) (2 contacts/2 pts.)	Valerian (VA) (9 contacts/14 pts.)	20	39
(04/03/25 – 04/06/25)	*SV/Orange oil (OO) (0 contacts) (not attributable)*	CN (1 contact/2 pts.)	*VA/CN (1contact 1x4=4 pts.) (not attributable)*	1 *1*	2 *4*
(04/07/25 – 05/04/25)	*SV/Anise oil (AO) (1x3, 1x2, 1x1pts. = 6pts.) (Not attributable)*	*CN/SV (0 contacts)*	*VA/AO (1 contact/1 pt.) (not attributable)*	0 *4*	0 *7*
(05/05/25 – 06/01/25)	SV (1 contact/ 2 pts.)	*CN/AO (0 contacts)*	*VA/SV (0 contacts)*	1 *0*	2 *0*
(06/02/25 – 06/09/25)	*SV/CN/VA) (0 contacts)*	*CN/OO (0 contacts)*	*VA/OO (0 contacts)*	*0*	*0*
without mix *Incl. mix*	10 contacts / 25 pts. *13 contacts / 31 pts.*	3 contacts / 4 pts. *3 contacts / 4 pts.*	9 contacts / 14 pts. *11 contacts / 19 pts.*	22 *27*	43 *54*

As shown in Table 2, during the first four weeks the lure sticks were sprayed weekly with the attractants silver vine (SV), catnip (CN), and valerian (VA). During this period, 20 individual contacts with the lure sticks were recorded. In the remaining 13 weeks, only seven individual contacts were observed. From week five onward, the lure sticks were additionally treated with combinations of attractants (mix; indicated in italics in the cells of Table 2) to assess whether the mixtures generated an additional attractive effect. As no attributable effects were detected, these combinations were excluded from further analyses.

The following figure 8 illustrates the intensities/total effects of 22 individual lure site contacts, excluding the lure combinations.

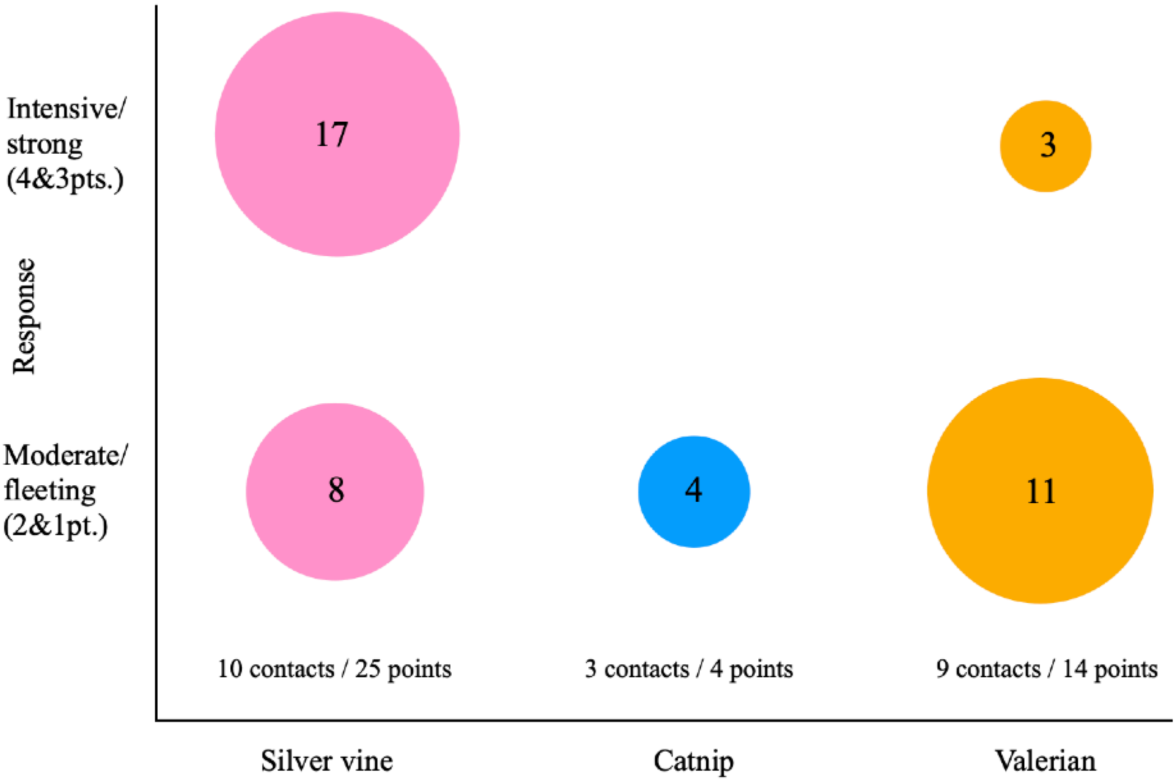

Fig. 8: Intensities of European wildcats' contacts (22) (without mixes); (pts.: = points)

Among the ingredients without a mix, silver wine had 10 contacts and 25 effect points, followed by valerian with 9 contacts and 14 effect points, and catnip with 3 contacts and 4 effect points (Tab. 2, Fig. 8). These results indicate that the total effectiveness of silver wine at 25 effect points was much higher than that of valerian at 14 effect points and catnip at 4 effect points. These results predominantly arose in the first-time interval in february. After that, wildcat contacts declined significantly. An explanation for this abrupt decline could be attributed to the end of the core mating season as well as external disturbances at the lure sites (e.g., disruptions at location 9 "Kuhberg" starting february 22, 2025). Additionally, the unexpectedly weak effect of catnip spray in our study may have distorted the overall assessment of effect distributions. Both the domestic cat studies by Bol et al. (2017) and similar investigations involving valerian and catnip on European wildcats demonstrated better results (Sforzi & Viviani 2025, Viviani et al. 2024).

4.3 Statistical Analyses

The statistical analyses of the data yielded the following results: The contact effects were calculated using the statistical program "Jamovi" (3rd generation statistical spreadsheet, jamovi.org) without consideration of combinations and additional attractants, as no substantial conclusions could be drawn regarding the synergistic effects of silver vine/catnip, catnip/valerian, nor were conclusive results expected when including anise oil and orange oil into the dataset. Regarding the additives (orange oil and anise oil), which were applied starting with the month of march, no significant contacts with wildcats were observed (Table 2).

Without the mixture of the five combined attractants (22 of the 27 individual contacts), the following results were obtained: In the pairwise comparisons based on the Kruskal–Wallis test (Dwass–Steel–Critchlow–Fligner): (SV/VA: $p = 0.214$, SV/CN: $p = 0.336$, VA/CN: $p = 0.907$), no $p < 0.05$ was found. Also the GAML (Generalized Linear Mixed Model) - test showed no significant results. Accordingly, the results did not reach statistical significance.

The boxplot below (Fig. 9) illustrates the quartile distribution of the effect points for the attractants with the medians for silver vine at effect point 2.5 and valerian at effect point 1 located, and the means indicated with square dots (based on Kruskal-Wallis-Test).

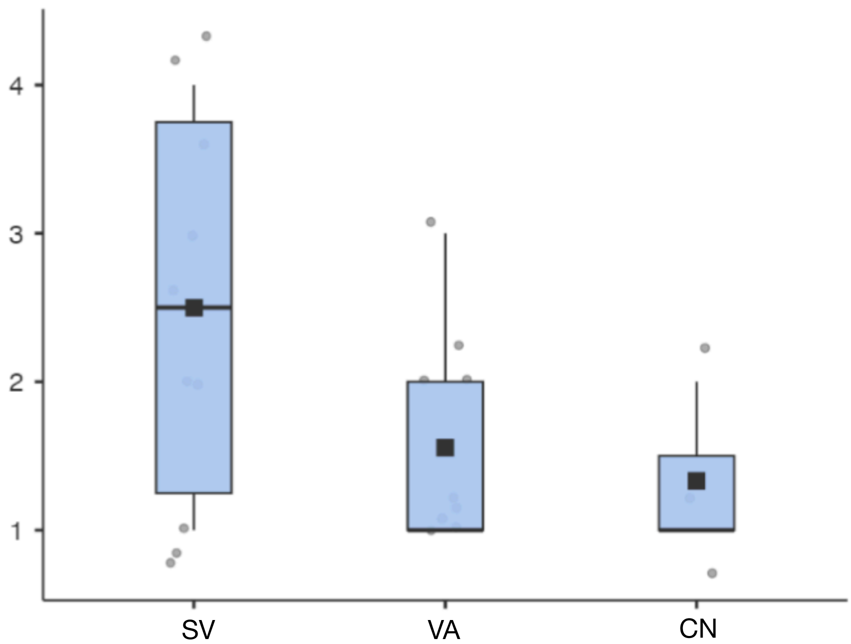

Fig. 9: Boxplot for 22 individual contacts with silver vine (SV), catnip (CN), valerian (VA)

4.4 Venn diagram

The distribution and overlap of contacts (single and multiple contacts) across three attractants (SV, CN, VA) are illustrated in the Venn diagram below (Fig. 10), based on 18 wildcat contacts, excluding 5 contacts with attractant mixture (Tab. 2). In these 13 contact sightings, 22 individual contacts occurred at the attractant stations. The overlaps of contacts among the attractant stations suggest potential synergistic effects of the attractant substances present.

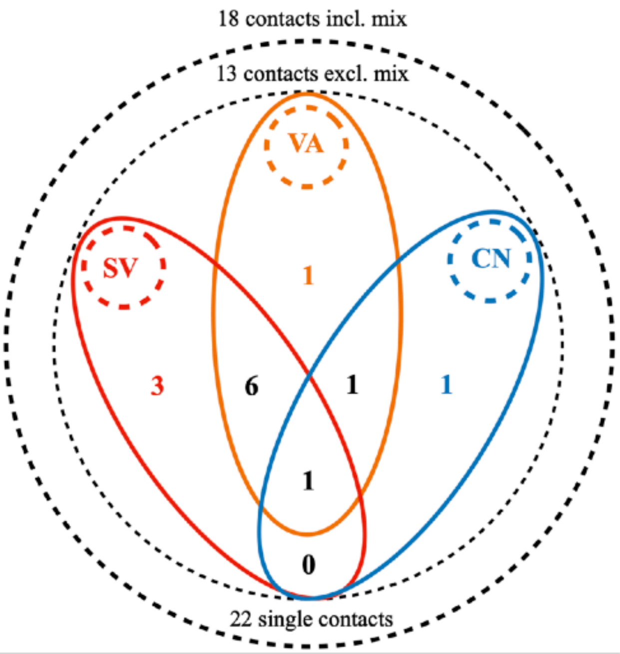

Fig. 10: Venn diagram of lure sightings and lure contacts (without mixed lures)

The silver vine attractant station (SV) recorded three single contacts compared to one single contact at the valerian attractant station (VA) and one single contact at the catnip station (CN). Six wildcats contacted both the silver vine lure stick and the valerian lure stick, and one wildcat contacted the catnip lure stick as well as the valerian lure stick. One wildcat interacted with all three lure sticks during their visits to the sites. Hypothetically, a two-way combination of silver vine and valerian at one lure site would lead to a total of 10 direct contacts (3 + 6 + 1). A three-way combination of SV, VA, and CN at one lure site would, following previous considerations, result in 13 contacts (3+6+1+1+1+1). Whether and in what configuration such a combination would yield the desired effects at a lure site remains to be examined in a separate study. In a study from Hungary (Gruber et al. 2025), a drop of catnip was added to the attractant station alongside valerian to achieve an additional attraction effect due to diverging individual sensitivities of the wildcats (Kitchener 1991).

4.5 Number of distinct individuals and their mobility between locations

Based on visual assessment of characteristic wildcat features (see fig. 4), individual differences were identified using three still frames from video recordings for each wildcat. Ambiguous or unclear coat patterns, blurred video footage, and corresponding indistinct individual characteristics (including potential hybrid cats at Locations 1 and 8) resulted in exclusion from the dataset. This applied to seven individuals. A total of ten wildcats could be reliably assigned as distinct individuals, half of which were recorded exclusively at Location 9 ("Kuhberg"). The remaining individuals, AK–EK (AKatze–EKatze), were detected at Locations 4, 7, and 8.

Figures 11 and 12 below present all phenotypically individualised wildcats, labelled with abbreviated identifiers. The most distinctive features used for individual identification were the shoulder and neck markings (Fig. 11), particularly in the region of the dorsal stripe origin (start of the dorsal stripe pattern on the back) in individuals AK, BK, DK, and EK. In addition, individual C (CK) was identified by clearly juvenile facial features. Further distinguishing characteristics included the pronounced variation in dorsal stripe morphology among individuals recorded at Location 9 ("Kuhberg") (Fig. 12) and, for all cats, the number, shape, and pattern of the tail rings.

AK BK CK DK EK

Fig. 11: Five distinct individuals of wildcats were identified on location 7 „Höhe 403“ (AK, BK, CK), location 4 „Kallenborn“ (EK) and location 8 „hinterm Tal“ (DK)

FK GK HK IK JK

Fig. 12: Five distinct individuals of wildcats identified on location 9 „Kuhberg“ (FK, GK, HK, IK, JK)

The spatial occurrence and mobility of the animals between lure sites, insofar as individual identification was possible, are presented in Table 3, including abbreviated identifiers and sex (m/f) of the individual cats. Accordingly, no movements of wildcats from this side of the Oster stream (AK–EK) (Fig. 6) to the opposite side (Kuhberg), nor movements of wildcats from the Kuhberg side (FK–JK) to the other side, were detected.

Table 3: Sightings of individual wildcats on locations 1 - 9 (L5 and L6 without sightings)

Location Wildcat	1 Kieferacker (H)	2 Weiherwies (W)	3 Mittelbach (H)	4 Kallenborn (H)	7 H 403 (W)	8 hinterm Tal (F)	9 Kuhberg (F)
AK					AK (m)		
BK			BK	BK	BK	BK	
CK					CK	CK	
DK				DK		DK	
EK				EK			
FK							FK
GK							GK (m)
HK							HK (f)
IK							IK (m)
JK							JK (f)

In conclusion, it can be stated: the strong attraction of silver vine compared to valerian was demonstrated, albeit without statistical significance. In contrary to our expectations, catnip proved surprisingly weak as an attractant, necessitating further investigation into its effects. Overall, valerian demonstrated attractant efficacy, though not as strongly as anticipated. A particularly high number of wildcats (6) showed interest in both valerian and silver vine. The use of wildlife cameras proved to be a reliable monitoring tool, providing multiple valuable insights into the study subject as well as its faunistic environment (marking of attractant stations, sequence of visits to attractant stations, duration of active stays at attractant stations, behavior while marking attractant stations, and numerous visits by other wildlife species to the attractant locations).

5. Discussion

The four-month field study aimed to provide the following insights:

a) Can the findings from the domestic cat study by Bol et al. (2017), which highlighted a dominant effect of silver vine over valerian, be extrapolated to the European wildcat? The results from our study revealed pronounced attractant effects of silver vine on European wildcats (Fig. 8) which, while relevant, are statistically non-significant (see statistical evaluation). Overall, silver vine had a stronger effect than valerian, with a ratio of 25:14. In contrast, catnip performed poorly in our tests when compared to the other two substances, exhibiting a score of 4:14:25. In the findings of Bol et al. (2017), catnip demonstrated a significantly better effect compared to valerian. The weak responses to catnip observed in our study could be attributed to the suboptimal active ingredients in the commercially available product ("Karlie Catnip Spray"). This was corroborated by subsequent field tests with new "Karlie Catnip Spray" products. A limitation of this study is that the effects of the three attractants were not pre-tested on domestic cats. Nevertheless, the results provide new insights in this relevant research field and suggest further consideration using silver vine and or catnip as an attractant for wildcats. Thus, the study's objective has been partially achieved. Our study also suggests that wildcats respond very differently to the attractants, as indicated by previous studies from Bol et al. (2017, 2022). Our study did not demonstrate combining or simultaneously applying the three attractants led to greater responses in wildcats in comparison to the traditional use of a single attractant (valerian). This will be further investigated in a follow-up study during the core breeding season with pre-tested attractants.

b) What additional information could be obtained by using wildlife cameras at the lure sites? Can data on phenotypes, categorization (domestic cat/wildcat, sex, juvenile/adult, healthy/injured, times of occurrence), and animal behavior towards the attractants yield novel insights? Our monitoring, utilizing nine wildlife cameras, provided valuable supplementary information. With few exceptions, we were able to obtain usable videos of the wildcats for the identification of ten individuals, as well as the categorization of domestic vs. wildcats and, in part, sex. The behavior of the wildcats at the attractant stations provided revealed information regarding scent rubbing, marking of the attractant, interaction with the attractant stations, and the extent and duration of contacts at the attractants. Additionally, information was generated on visits from other wildlife species, allowing for phenotypic identification and behavioral analysis at the lure sites. The video recordings ensured comprehensive documentation of all occurrences at the lure sites, including sightings of wildcats without direct contact and hair deposits, as well as multiple visits by cats between weekly check intervals. The videos also provided additional insights into how the wildcats behaved when lure sticks were marked by another species (e.g., marten, fox etc.). Accurate screenshots for documenting typical morphological features were possible through the videos, facilitating animal individualization. The wildlife cameras were standard, commercially available models that could potentially have been of higher quality.

c) Do wildcats also respond to any of the attractants outside of their core breeding season, and if so, to which ones and to what extent? If our hypothesis had been confirmed, year-round monitoring would have been an effective method for assessing wildcat populations in a habitat, including tracking juvenile wildcats seeking new territories at the age of 5 to 6 months (Kora 2025). However, our study revealed that post-breeding season (from around mid-March), wildcat visits to attractant stations were only sporadic, and they did not elicit the strong responses observed previously. Our hypothesis that some of the employed attractants contained substances (e.g., beta-endorphin stimulants) that could trigger strong responses in wildcats even outside their breeding season or sexual maturity, as observed in castrated domestic cats in the study by Bol et al. (2017), was not supported. Furthermore, a review of the relevant literature yielded no reliable insights regarding differences in behavior between neutered domestic cats and wildcats concerning the offered attractants. This remains an open question.

d) The placement of lure sites in three potential home range and habitat areas (forest edge (W), hedgerows adjacent to the forest (H), and isolated field wood islands (F)) aimed to elucidate how frequently these areas are visited by wildcats, the extent to which the species can navigate open agricultural landscapes without cover, and the implications of these findings for the species' dispersal/migration potential (Jerosch 2021). The placement at the forest edge (W) was conducted at locations deemed likely for wildcat presence based on long-term observations by local hunters. Together, both forest edge sites yielded only seven wildcat sightings. Three sightings were recorded at Location 2 *"Weiherwies"* (W) and four at Location 7 *"Höhe 403"* (W), representing approximately 16 percent of total observations. An evaluation here is speculative due to external influences during the study (significant noise impact from heavy traffic during the installation of wind turbines near Location 7). The localization of attractant locations in hedgerows (H) was informed by potential pathways for wildcat migration between closed forest stands and adjacent habitats, as well as long-term observations by hunters. Here, four sightings were recorded at Location 1 *"Kieferacker"* (H), seven sightings at Location 3 *"Mittelbach"* (H), and nine sightings at Location 4 *"Kallenborn"* (H). With 20 sightings (46 percent of total), particularly in hedgerows adjacent to streams, the orientation of cats towards watercourses (Lowry & Kern 2024) appears further validated.

The deployment of lure sites in isolated field wood islands (F), positioned at least 300 meters from closed forest stands, aimed to provide insights into the extent to which wildcats traverse open spaces without cover for their movements and migrations (Jerosch 2021). Two field wood islands were not accepted at all (location 5 and location 6), despite location 5 being accepted four times in the preliminary study of 2024. Conversely, in the 2025 study, the field wood island *"hinterm Tal"* location 8, was visited ten times, contrasting with only one visit in the preliminary study of 2024. No notable external disturbances were identified between 2024 and 2025 in both locations. Location 9 *"Kuhberg"* yielded the most significant observations, with six sightings between January 28, 2025, and February 17, 2025, and five distinct individuals. External disturbances, such as large-scale solid manure application near the field wood island's surrounding areas starting from February 22, 2025, or unclear other external/internal factors, evidently may have stressed the wildcats. Nevertheless, the sightings in both field wood islands (16 times = 37%) can be interpreted as evidence that wildcats are indeed capable of crossing open areas of more than 300 meters, especially during the breeding season.

6. Methodological reflection

The practical approach of this study (uncontrolled field study) conducted as part of a project by the association (NatureLAB St. Wendel e.V.), with active participation from local hunters and consultation from scientists, aimed to provide preliminary information addressing the central research questions. For practical considerations, we relied on commercially available testing materials (Matatabi silver vine cat spray, Karlie Catnip spray, Valerian tincture) without prior verification to ensure the products contained the active ingredients in adequate amounts, as conducted in the controlled comparative study by Bol et al. (2017). Furthermore, it was not feasible to rely on a fixed sample of animals. To assess the effect of the attractants on wildcats outside their breeding season, the duration of the study could have extended over an entire year; however, this was impractical. Given the limited spatial coverage (12 km² with 27 attractant stations and 10 distinct individuals) of this study, in comparison to a regionally adjacent study (Schneider et al. 2021a) with greater spatial coverage in the Hunsrück/Hochwald National Park (100 km² with 264 attractant stations and 97 distinct individuals in 2018) (Schneider et al. 2021a), the results are numerically comparable but offer limited conclusions due to differing objectives, habitats, and methodologies. In the aforementioned study on genetic wildcat monitoring, only valerian was used as an attractant for DNA analyses, and no monitoring was conducted using wildlife cameras. Coordination regarding future studies by the NatureLAB association with the adjacent national park appears to be warranted.

Overall, it can be concluded that the results of our field study are deemed noteworthy, as they demonstrated distinctive effects of the additional attractant silver vine compared to valerian, even though we could not statistically validate our hypotheses. The study also highlighted that such initiatives, with strong engagement from hunters and non-profit organizations, can yield interesting and discussion-worthy results.

Acknowledgments go to the Werschweiler hunting community, particularly to Mr. Horst Müller and Mr. Norbert Linxweiler, as well as to Prof. Dr. Winfried Linxweiler for their expert advice and support during the study period. We also extend our gratitude to Dr. Michael Altmoos and Dr. Bernd Trockur (Ministry for Environment, Climate, Mobility, Agriculture, and Consumer Protection, Saarland) and Mr. Peter Volz, conservation officer for the city of St. Wendel/Werschweiler district, along with NatureLAB e.V. St. Wendel, for valuable support, advice, and critical review of this manuscript.

There are no conflicts of interest among the authors of this study.

The authors received no financial support for investigations or the authorship of this article.

This study was conducted within the framework of a “Wildcat Monitoring” project by the non-profit association NatureLAB e.V., 66606 St. Wendel, (naturelab-wnd.de) during the years 2024 (preparatory) and 2025.

Address of the first author:
Richard Linxweiler
Wurzelbach 12
D- 66606 Oberlinxweiler

richard.linxweiler@hs-pforzheim.de

Prof. em. Richard Linxweiler, former faculty of Pforzheim University of applied sciences

(Baden-Württemberg, Germany)

Current: active member of the nonprofit association NatureLAB e.V. St. Wendel

Norbert Linxweiler and Horst Müller

Active Member of the Werschweiler hunting community

References

ABRAMSON, C. I., LAY, A., BOWSER, T. J., VARNON, C. A. (2012): The use of silver vine (*Actinidia polygama Maxim*, family *Actinidiaceae*) as an enrichment aid for felines. — Issues and prospects: 21-27. https://doi.org/10.3844/ajavsp.2012.21.27

BOL, S, CASPERS, J., BUCKINGHAM, L., ANDERSON-SHELTON, G., D., RIDGWAY, C., BUFFINGTON, C., T., …& BUNNIK, E., M. (2017). Responsiveness of cats (Felidae) to silver vine (*Actinidia polygama*), Tatarian honeysuckle (*Lonicera tatarica*), valerian (*Valeriana officinalis*) and catnip (*Nepeta cataria*). — BMC veterinary research **13**(1): 70. https://doi.org/10.1186/s12917-017-0987-6

BOL, S., SCAFFIDI, A., BUNNIK, E. M., FLEMATTI, G. R. (2022): Behavioral differences among domestic cats in the response to cat-attracting plants and their volatile compounds reveal a potential distinct mechanism of action for actinidine. — BMC Biol **20:** 192. https://doi.org/10.1186/s12915-022-01369-1

BORGES, R. M. (2024): Convergent evolution: What do cats, catnip, aphids, and mosquitoes have in common? — Journal of Biosciences **49**(4): 98. https://doi.org/10.1007/s12038-024-00483-2

COZZI, F., IACONA, E., FERETTI, F., CORLATTI, L. (2022): Effectiveness of a commercial lure to attract red fox. — Mammal Research **67**(4): 511–517. https://doi.org/10.1007/s13364-022-00642-6

CHEN LI, HF SONG, JX LIU, XX JIANG, J AI, ZX WANG, YP WANG (2024): Genome-wide identification and expression profiling of the SWEET family in *Actinidia polygama* (Sieb. & Zucc.) Maxim. — Fruit Research **4**(1). https://doi.org/10.48130/frures-0024-0010

GERNGROSS, P., SLOTTA-BACHMAYR, L., HAGENSTEIN, I. (2021): Ist die Europäische Wildkatze (*Felis silvestris*) zurück in Österreich. — Säugetierkundliche Informationen **58**: 51–62. [PDF] naturschutzbund.at

GRUBER, Á., CSERKESZ, T., KISS, C., LANSZKI, J. (2025): Living on the edge: Detections and activity pattern of wildcats (*Felis silvestris*) and domestic cats (*Felis catus*) by camera trapping in areas of low wildcat population density. — Applied Animal Behavior Science **282**: 106472. https://doi.org/10.1016/j.applanim.2024.106472

HUPE, K. & SIMON, O. (2007): Die Lockstockmethode – Eine Nicht Invasive Methode zum Nachweis der Europäischen Wildkatze (*Felis silvestris silvestris*). — Informationsdienst Naturschutz Niedersachsen, **27**(1): 66-69. http://www.jagdeinrichtungsbuero.de/10_Hupe%2B-Simon_LockstockWK.pdf

JEROSCH, S. (2021) Die reichstrukturierte Agrarlandschaft – ein unbeachteter Lebensraum für die gefährdete Europäische Wildkatze (*Felis silvestris*). — Diss. Dresden. [PDF] qucosa.de

KITCHENER, A. C. (1991): The Natural History of the Wild Cats. — Cornell University Press, New York.

KLANGWALD, C. & VERGNE, E. (2018): Camera trap monitoring: A new protocol for German national parks? [PDF] researchgate.net

Kora (2025): Raubtiere Ökologie und Wildtiermanagement. Portrait Wildkatze. — Stiftung KORA.

KÖNIG, N., STIER, N., KRUK, M. & ROTH, M. & WILDTIERFORSCHUNG A.G. (2021): Wildtiermonitoring der Jäger Sachsens Monitoringbericht 2020/21. — www.tu-dresden.de abgerufen 29.10.2025. [PDF] tu-dresden.de

LEHMANN, L. & STEFFEN, C. (2020): Hairs of wild *Felis silvestris silvestris* and domestic Felis catus–are they distinctive after all? (Carnivora: *Felidae*). — *Lynx,* series nova **51**(1). https://doi.org/10.37520/lynx.2020.006

LOWRY, J. & KERN, L. (2024): Projekt Netzwerk Wildkatze Korridorstudie: Darstellungen von Barrieren und Vernetzungsnotwendigkeiten in Österreich. [PDF] naturschutzbund.at

MARONDE, L., ZIMMERMANN, F., KUNZ, F., BREITENMOSER-WÜRSTEN, C. H. & BREITENMOSER, U. (2020): Bestimmungshilfe zur Unterscheidung von Wild- und Hauskatzen anhand von Fotofallenbildern aus dem Schweizer Jura. — KORA Bericht **92:** 1422–5123. Muri b. Bern. Bestimmungshilfe zu Wildkatze – Hauskatze – KORA

MIYAZAKI, M. & UENOYAMA, R. (2021): Chemical Pest Defense by the Innate Response to Silver Vine and Catnip Plants in the Domestic Cat. — In: Symposium of Chemical Signals in Vertebrates. Cham: Springer International Publishing: 435–449. https://doi.org/10.1007/978-3-031-35159-4_21

MÜLLER, F. (2011): Körpermerkmale als Unterscheidungskriterien zwischen wildfarbenen Hauskatzen (*Felis silvestris catus*) und Wildkatzen (*Felis silvestris silvestris*, Felidae) aus Mitteleuropa. — Beiträge zur Jagd- und Wildforschung, **36:** 359–368. https://doi.org/10.37520/lynx.2020.006

NUSSBERGER, B. (2021): Wildkatzenmonitoring Schweiz: Verbreitung, Dichte und Hybridisierung der Wildkatze in der Schweiz. https://www.wildtier.ch/fileadmin/wildtier/docs/de/Wildkatzenmonitoring/BerichtWKM2018-20_v4.pdf

SCHACKER, U., SCHATZL, M., HECHT, W., KERN, T., GÖGLER, M., KOENEN, A. (2018): Tierhaaranalytik in der Forensik Zeiss Lichtmikroskop. — abgerufen 10.10.2025. https://asset-downloads.zeiss.com/catalogs/download/mic/2eebc78a-2a40-4f01-8b8f-dc2eeab5f1fe/DE_wp_Animal-Hair-Analytics_Forensic.pdf

SCHNEIDER, A., EBERT, C. & PRÜSSING, A. (2021a): Genetisches Wildkatzenmonitoring im Nationalpark Hunsrück-Hochwald. — Forschungsband NLPHH **B12:** 112–119. https://share.google/ttbSW0SY6H5TwlY0K

SFORZI, A. & VIVIANI, L. (2025): Use of lure sticks for non-invasive genetic sampling of European wildcat populations: lessons learnt and hints for future insights. — Mammal Review **55**(2): e12375. https://doi.org/10.1111/mam.12375

STEYER, K., SIMON, O., KRAUS, R.H.S., HAASE, P., NOWAK, C. (2013): Hair trapping with valerian-treated lure sticks as a tool for genetic wildcat monitoring in low-density habitat. — Eur J Wildl Res **59**: 39–46. https://doi.org/10.1007/s10344-012-0644-0

TEERINK, B. J. (1991): Hair of West-European mammals. — Cambridge University Press, Cambridge.

UENOYAMA, R., MIYAZAKI, T., HURST, J. L., BEYNON, R. J., ADACHI, M., MUROOKA, T., ONODA, I., MIYAZAWA, Y., KATAYAMA, R., YAMASHITA, T., KANEKO, S., NISHIKAWA, T., MIYAZAKI, M. (2021): The characteristic response of domestic cats to plant iridoids allows them to gain chemical defense against mosquitoes. — Science Advances **7**(4): eabd9135. https://doi.org/10.1126/sciadv.abd9135

UENOYAMA, R., OOKA, S., MIYAZAKI, T., MIZUMOTO, H., NISHIKAWA, T., HURST, J. L. & MIYAZAKI, M. (2023): Assessing the safety and suitability of using silver vine as an olfactory enrichment for cats. — iScience **26**(10): 107848. https://doi.org/10.1016/j.isci.2023.107848

UENOYAMA, R. (2025): The behavioral response induced by a variety of iridoids in silver vine with high safety is conserved among a large part of Felidae species. — Doctoral dissertation, Iwate University, Morioka.

VIVIANI, L., NONNIS MARZANO, F., MATTUCCI, F. & SFORZI, A. (2024): Non-invasive monitoring of the European wildcat in a recently colonized area in the Northern Apennines (Italy). — Eur J Wildl Res **70**(2): 22. https://doi.org/10.1007/s10344-024-01777-4

DIE WELT (2019): Wildkatzen besiedeln wieder das ganze Saarland 01.07.2019. — welt.de (abgerufen 1. Juli 2019)

ZHANG, L., BIAN, Z., LIU, Q & DENG, B. (2022): Dealing with stress in cats: what is new about the olfactory strategy? — Frontiers in veterinary science **9:** 928943. https://doi.org/10.3389/fvets.2022.928943