

First evidence of same-sex mounting behaviour in *Pipistrellus kuhlii* (Chiroptera: Vespertilionidae)

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Abstract:

Documenting rare intrasexual interactions is crucial to improving our understanding of the social and sexual diversity of bats. Here, we present the first confirmed observations of same-sex mounting in Kuhl's pipistrelle (*Pipistrellus kuhlii*), as recorded during routine monitoring at the Austrian Bat Rehabilitation Centre. Two of the interactions involved adult male *P. kuhlii*, who maintained stable mounting postures and rhythmic pelvic thrusts for several minutes after initiating the interaction. A third, brief male-male mounting interaction was observed between *Pipistrellus pygmeus* and an adult *Pipistrellus kuhlii*. All interactions were calm, showing no aggression or avoidance behaviour. These observations emphasise the importance of recognising and documenting such rare behaviours in order to expand our knowledge of bat's social and sexual diversity.

Keywords: Chiroptera, social behaviour, *Pipistrellus kuhlii*, sexual diversity, same-sex mounting.

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Same-sex mounting in *P. kuhlii*

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First evidence of same-sex mounting behaviour in *Pipistrellus kuhlii* (Chiroptera: Vespertilionidae)**Running title: Same-sex mounting in *P. kuhlii*****Abstract**

Documenting rare intrasexual interactions is crucial to improving our understanding of the social and sexual diversity of bats. Here, we present the first confirmed observations of same-sex mounting in Kuhl's pipistrelle (*Pipistrellus kuhlii*), as recorded during routine monitoring at the Austrian Bat Rehabilitation Centre. Two of the interactions involved adult male *P. kuhlii*, who maintained stable mounting postures and rhythmic pelvic thrusts for several minutes after initiating the interaction. A third, brief male-male mounting interaction was observed between *Pipistrellus pygmeus* and an adult *Pipistrellus kuhlii*. All interactions were calm, showing no aggression or avoidance behaviour. These observations emphasise the importance of recognising and documenting such rare behaviours in order to expand our knowledge of bat's social and sexual diversity.

Keywords: Chiroptera; *Pipistrellus kuhlii*; same-sex mounting; sexual diversity; social behaviour

Same-sex sexual behaviour (SSB), defined as sexual or courtship-like interactions between individuals of the same sex, has been documented across diverse animal taxa, most commonly in birds and mammals, but also reported in some reptiles and invertebrates, and is increasingly recognised as part of behavioural diversity in vertebrates (Bailey & Zuk, 2009; Poiani, 2010; Gómez et al., 2023). In bats, observations of same-sex interactions, ranging from affiliative to sexual contexts, have been discussed in relation to social and reproductive behaviour (Ricucci, 2010; Mann et al., 2011). Such behaviour can arise in different social or ecological contexts and may influence social bonding, reduce tension, or maintain dominance relationships rather than serving direct reproductive purposes (Bailey & Zuk, 2009; Poiani, 2010; Ricucci, 2010). Comparative analyses suggest that SSB repeatedly emerges in in mammalian species with social systems characterized by close contact and cooperative interactions (Gómez et al., 2023), a social structure also observed in bats (Mann et al., 2011).

Among bats, documented cases of SSB remain surprisingly few given their complex communication systems and mating strategies (Dorrestein et al., 2024). The review by Ricucci (2010) compiled observations from about twenty species, describing behaviours such as grooming, genital contact, and same-sex mounting in both sexes. Most reports, however, were anecdotal and lacked photographic or video evidence, leaving uncertainty about frequency and function (Ricucci, 2010; Gómez et al.,

2023; Anderson et al., 2024). This implies that the occurrence of SSB in bats is likely underestimated, and its adaptive significance remains largely unexplored.

Here, we document multiple occurrences of same-sex mounting in Kuhl's pipistrelle (*Pipistrellus kuhlii*). *P. kuhlii* is a widespread and highly social species occurring throughout Europe and Mediterranean regions (Russo & Jones, 1999). It uses diverse social calls and displays during mating and colony interactions (Russo & Jones, 1999; Pfalzer & Kusch, 2003). Despite this behavioural richness, no male–male sexual interaction has previously been reported for *P. kuhlii*. The events described below were recorded in a mixed-species group of adult males housed under stable rehabilitation conditions. These observations provide verifiable evidence of a rarely documented behaviour and contribute to a more comprehensive understanding of social and sexual diversity within Chiroptera, offering important context for the interactions detailed in the following paragraphs.

On 13 October, 31 October, and 6 November 2025, we documented three instances of same-sex mounting behaviour among adult *Pipistrellus* spp. at the Austrian Bat Rehabilitation Center in Vienna, Austria. All observations occurred during the morning hours. These events were recorded during routine daily checks conducted as part of standard rehabilitation care and were not obtained through a systematic behavioural monitoring protocol. As such, the observations represent opportunistic records rather than data collected within a structured study design. During this period, 19 adult males representing four species were present: *Pipistrellus kuhlii* (*P. kuhlii*), *Pipistrellus pipistrellus* (*P. pipistrellus*), *Pipistrellus pygmaeus* (*P. pygmaeus*), and *Pipistrellus nathusii* (*P. nathusii*). All individuals were kept together in a single structured enclosure (Exoterrarium; glass and wire, 45 × 90 × 90 cm) equipped with perches and shelters. Microclimatic conditions across the observation days ranged from 17–18.1°C and from 59–69% relative humidity. All individuals had been identified to species upon admission by trained, experienced bat biologists using standard diagnostic criteria routinely applied at the rehabilitation centre, including forearm length, pelage characteristics, facial and tragus morphology, and male genital morphology. These traits reliably distinguish the *Pipistrellus* species present in the enclosure, minimising the likelihood of species misidentification. All bats had been sexed by genital inspection upon admission and were monitored visually daily as part of standard care routines. Three male-male mounting events were recorded and documented on video:

- 13 Oct 2025 (09:36): *P. kuhlii* ♂ mounting *P. kuhlii* ♂; stable mounting posture with rhythmic pelvic thrusts (~3 min).
- 31 Oct 2025 (08:31): *P. pygmaeus* ♂ mounting *P. kuhlii* ♂; stable mounting posture with rhythmic pelvic thrusts and nape grasp (~1.5 min). This interspecific event is reported within the same-sex behavioural context but does not constitute a conspecific record.

- 63 • 6 Nov 2025 (09:30): *P. kuhlii* ♂ mounting *P. kuhlii* ♂; stable mounting posture with rhythmic
64 pelvic thrusts and nape grasp (~4 min).

65 Short sequences of all three observations will be deposited via a persistent identifier link in the
66 PHAIDRA repository of the University of Vienna (<https://phaidra.univie.ac.at>). Representative still
67 frames from the two conspecific events are shown in Figure 1.



68 **Figure 1:** Documentation (cropped from observation videos S1 and S3) of male-male mounting
69 behaviour in *Pipistrellus kuhlii* observed at the Austrian Bat Rehabilitation Center (October–November
70 2025). **(A)** Observation from 13.10.2025: *P. kuhlii* ♂ mounting *P. kuhlii* ♂. **(B)** Observation from
71 06.11.2025: *P. kuhlii* ♂ mounting *P. kuhlii* ♂ showing a nape grasp.

72 SSB in bats has received comparatively little formal attention despite the exceptional diversity of
73 chiropteran social and mating systems (Ricucci, 2010; Dorrestein et al., 2024). In his comprehensive
74 review, Ricucci (2010) classified SSB into six behavioural categories (grooming/licking, masturbation,
75 play, mounting, coercive sex, and cross-species SSB) and compiled verified records for 22 species,
76 distinguishing explicitly between observations made in captivity and in the wild. According to this
77 framework, the behaviour documented here corresponds to the *mounting* category sensu Ricucci
78 (2010). These comparisons emphasise that SSB in bats occurs under both natural and managed
79 conditions and may serve diverse social or developmental functions.

80 The conspecific mounting events reported here add *Pipistrellus kuhlii* to the growing list of bat species
81 in which intrasexual sexual behaviour has been formally documented (e.g., Nelson, 1965; Thomas et
82 al., 1979). Within the genus *Pipistrellus*, previous reports of same-sex mounting are limited to *P.*
83 *pipistrellus* (Ricucci, 2010). An additional interspecific male-male mounting event involving *P.*
84 *pygmeus* mounting *P. kuhlii* further illustrates that same-sex mounting can occur across species

boundaries in shared captive settings. While most documented cases of same-sex mounting in bats occurred outside the mating season (Ricucci, 2010), the present observations were made during the reproductive period, suggesting that such interactions may reflect elevated sexual motivation, which in bats is not necessarily tied to immediate reproductive function (Bailey & Zuk, 2009; Poiani, 2010).

Functional explanations proposed for SSB in animals include social bonding, tension reduction, dominance expression, and practice of copulatory behaviour (Bailey & Zuk, 2009; Poiani, 2010; Sommer & Vasey, 2006). In species that form temporary aggregations or show strong social cohesion, affiliative or hierarchical interpretations are plausible; *P. kuhlii* displays complex, context-dependent social communication (Russo & Jones, 1999; Pfalzer & Kusch, 2003), with similarly rich repertoires reported for its sister species (Nouioua et al., 2024). The calm behaviour of the males and the spontaneous termination of the events could indicate a low-tension affiliative or exploratory context rather than dominance assertion.

Another possibility is that the behaviour represents hormonally driven or misdirected courtship in captivity (Crichton et al., 2000; Hosey, 2005). Male bats of several species display increased sexual activity at the onset of the breeding season, and reproductive hormones may elicit courtship-like actions even in the absence of females (Ricucci, 2010; Encarnação, 2012; Sato et al., 2023). Captive settings can modify social cues and spatial dynamics, occasionally facilitating interactions rarely observed in the wild. However, although the animals showed no visible signs of agitation, the absence of overt stress behaviour cannot rule out underlying physiological or hormonal states associated with captivity or season (Hosey, 2005; Crichton & Krutzsch, 2000). The calm external appearance should therefore be interpreted cautiously.

Evolutionarily, SSB across mammals may arise as a by-product of social complexity (e.g., Bailey & Zuk, 2009; Monk et al., 2019; Gómez et al., 2023). Bats combine gregariousness, long lifespans and individual recognition - traits linked to the maintenance of intricate social relationships (Wilkinson, 1985; Kerth, 2008). In such species, behavioural flexibility, including non-reproductive sexual interactions, may help stabilise social networks or reinforce alliances. Although this note reports only two conspecific events, it supports the notion that the behavioural repertoire of *P. kuhlii* is broader than previously recognised.

From a broader behavioural perspective, such observations challenge narrow notions of “naturalness” by highlighting that animal sexuality, including SSB, is not exclusively reproductive but can express social or affective capacities. As Balcombe (2009) notes, acknowledging pleasure and play in animal

lives broadens not only biological but also interpretive and philosophical understandings of behaviour, inviting reflection across disciplines on the richness of animal experience (Monsó et al., 2018).

Natural-history reports of rare or context-specific behaviours have repeatedly advanced chiropteran behavioural research, including studies of social discrimination among adult males (Mann et al., 2011), SSB across bat species (Ricucci, 2010), and unexpected mating behaviour at summer roosts (Encarnação, 2012). Providing concise, verifiable records such as these allows future comparative assessments and helps prevent underreporting of unusual but potentially informative social interactions.

Future research should verify whether similar interactions occur in wild colonies, particularly in all-male or transitional groups outside the breeding season. Structured behavioural monitoring would help clarify the frequency and social context of such interactions. Systematic acoustic monitoring combined with individual identification could further determine whether specific social calls accompany such interactions, offering insight into their communicative or affiliative functions. Expanding documentation of rare social behaviours - whether through field studies or rehabilitation settings - will be essential to understand how sexual and social plasticity contributes to the remarkable diversity of bat behaviour and societies.

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