Defence behaviour of reindeer in response to flying parasitic Diptera.

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Summary: Similar defence behaviours were exhibited by a reindeer when experimentally exposed to three different species of tethered, flying parasitic Diptera, *Cephenemyia trompe* (Modeer), *Hypoderma tarandi* (L) and Tabanid. Defencive behavioural responses appeared to be related to attack angle, and were not elicited by auditory stimuli. These observations raise questions about the validity of parasite species-specific defence responses in reindeer.

Key words: behaviour, Oestridae, parasite, rangifer, reindeer, Tabanidae.

Rangifer, 9 (1): 14—16

Karter, J. A. & Folstad, I. 1989. Forsvars-adferd hos rein angrepet av flyvende, parasittiske diptera.

Sammendrag: Likeartet forsvars-adferd ble utvist av en rein som ble eksperimentelt utsatt for tre forskjellige arter av bundne, flyvende parasittiske diptera, *Cephenomyia trompe* (Modeer), *Hypoderma tarandi* (L) og Tabanid. Den forsvarsmessige adferd syntes å ha sammenheng med parasittenes angreps-vinkel og ble ikke utløst av lydstimuli. Disse observasjoner reiser spørsmål om gyldigheten av parasittære arts-spesifikke forsvarsreaksjoner hos rein.

Rangifer, 9 (1): 14—16

Karter, J. A. & Folstad, I. 1989. Poron puolustuskäyttäytyminen lentäviä kaksisiipisiä (Diptera) hyönteisiä vastaan.

Yhteenveto: Poro käyttäytyi samalla tavalla kun se joutui tekemisiin kolmen kiinniolevan lentävän kaksisiipisen hyönteisen: saulakan (*Cephenemyia trompe* Modeer), kurumupaarman (*Hypoderma tarandi* L) ja parman kanssa. Puolustuskäyttäytyminen riippui hyönteisen lähestymiskulvät kysymyksiä lajispesifisen puolustuskäyttäytymisen esiintymisestä proolla hyönteisiä vastaan.

Rangifer, 9 (1): 14—16

The questions of whether reindeer are able to distinguish between different species of flying, parasitic and blood sucking Diptera (the reindeer nose bot fly, *Cephenemyia trompe* (Mooder); the reindeer warble fly, *Hypoderma tarandi* (L) and horse flies, Tabanidae) and if so, by which stimuli, have been poorly understood. Two distinct defence reactions to *Cephenemyia trompe* and *Hypoderma tarandi* have been described in the literature (Bergman, 1917; Hadwen, 1927; Skjenneberg and Slagsvold, 1968). It is suggested (Hadwen, 1927; Espmark, 1967; Skjenneberg and Slagsvold, 1968) that *C. trompe* elicits a more intense reaction then *H. tarandi,* with the reindeer displaying violent sneezing, head shaking, and rubbing the nose in the ground. Additionally, Bergman (1917) suggests that tabanids elicits very little defence reactions among reindeer.

There exists conflicting reports concerning the causality of reindeer's specific defence reactions to these three parasites. Espmark (1967) has done the most extensive work on the subject, emphasizing both visual and auditory stimuli. He suggested that reindeer detect the approaching flies first through auditory cues, and then keys onto visual cues, but refers to reindeer's poor eyesight. Additionally, it is suggested (Natvig, 1929; Espmark, 1967) that when exposed to attacking Oestridae, reindeer do react, although not violently, to the sound of the flying insect in the absence of visual stimuli. Nogge and Staack (1969) documented that cattle responded with rigorous and «typical» defence reactions to the tape-recorded sound of *Hypoderma bovis.* Contradictory findings are reported by Bergman (1917) who suggests that experiments wiht reindeer show that auditory stimuli alone is not enough to produce defence behaviour in reindeer. Additionally, inaudible flight during attaek has been reported for two oestridae species, *H. tarandi* (Bergman 1917) and *Cephenomyia jellisoni* (Anderson 1975).

There is a common problem facing all of these behavioural experiments. How is one to distinguish a defence behaviour that is particular to a given flying parasite species from one which is general to all flying insects? Could it be that what is so often categorized as a parasite-specific defence response is a reaction to the rather stochastic behaviour of the attacking insect and not necessary indieative of any particular species?

We conducted a simple experiment during the summer 1988. *C. trompe, H. tarandi* and *Hybomitra* sp. (Tabanidae) females were collected in a CO_2-baited flight trap (described by Anderson & Olkowski, 1968) in Soluvoumi, Norway. At Holt Experiment Station, University of Tromsø, Norway, the insects were «tethered» (Weintraub, 1961; Anderson, 1975) by gluing meter-long, fine thread to the thorax of each insect. A tame, adult female reindeer, first with and then without blindfold, was exposed to the three tethered insect species, for five minute periods, in the following order: *C. trompe, H. tarandi* and *Hybomitra* sp. The reindeer's defence reactions were video-recorded and later studied at normal and slow speed. Only one of the available reindeer was sufficiently tame for human presence not to be an over-riding factor in the experiment. The lack of replicates precludes any generalizations, however the results were interesting and warrant a report.

When all three species of Diptera flew close to the head of the blindfolded reindeer, it showed no typical defencive behaviour other than movement of the ears, seemingly to follow the sound. Our findings, in agreement with Bergman (1917), suggest that auditory cues alone were not enough to elicit the species-specific defence reactions described in the literature. However it is possible that both Bergman's (1917) and our experimental results were an artifact of the experimental conditions. (Bergman had the flies in a silk pouch and we used flies tethered on fine thread).

The blindfolded reindeer shook violently or exhibited localized fasciculation in response to light touch in the absence of fly sounds. The same response was observed when a tethered fly landed on its back or sides. When touched on the front or hind leg, it would lift that leg rapidly and immediately snap it back in place. When the blindfold was removed, the reindeer reacted similarly to light touch regardless of the object. When exposed head on to tethered flies, the reindeer attempted to follow the fly with her eyes as well as her ears. The reindeer dipped her head down, occasionally rubbed her nose on the ground, and kicked or stiffened, when any of the fly species flew in close proximity of her snout. When exposed to *C. trompe* and *H. tarandi* she occasionally sneezed violently and repeatedly closed her nostrils. We were unable to observe this response to the tabanid during the five minute exposure period, although a longer exposure may have evoked the response. Otherwise, we found no visible distinctions in the reindeer's reaction to *C. trompe, H. tarandi* or the tabanid whether the reindeer was blindfolded or not. Each fly elicited a similar defence response that seemed dependent on attack angle and on whether it landed on the reindeer or not.

It is conceivable that exposing the reindeer to a different order of fly species could, contrary to our findings, result in distinct, species-specific defence behaviour. However the presence of one order of exposure (the one used in this experiment) failing to elicit such specific behaviour is sufficient cause to quest-

ion the validity of predicting the species of attacking fly based on the reindeer's behaviour alone.

In conclusion, auditory cues alone were not enough to elicit a defence reaction to tethered, flying Diptera in this experiment. Visual cues such as insect's attack angel and whether the fly came in physical contact with the reindeer were important causal factors in elicitation of the reindeer's defence reactions. We observed that *H. tarandi* flying towards the reindeer's head region could elicit a «*C. trompe*-like» response, while a *C. trompe* flying by the reindeer's hind quarters could elicit a «*H. tarandi*-like» response. Although *C. trompe's* attack to the head region and *H. tarandi's* attack to the flanks, legs and back may be by far the most prevalent species-specific attack angle, there is very likely a good deal of non-characteristic attack angles. If attack angle and touch are the dominant stimuli, and not categorically species-specific but rather probabilistic, then it is logically incorrect[1] to infer which parasite species is harassing a reindeer based on the observation of «typical» defence reactions.

[1] This is called «confirming the consequent», a common error in inductive logic.

Acknowledgements

We would like to express our gratitude to Julie Greenstein for her theoretical insight and patient field assistance, Arne C. Nilssen for valuable discussions and comments, and the Fulbright Foundation, The Norway-America Association, The Jastro-Shields Graduate Research Schoolarship Foundation and Utviklingsfondet for Reindrift for economical support.

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Manuscript received 5 November, 1988.