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Effectiveness of lotilaner against ticks of the genus *Amblyomma* spp. in three naturally infested cane toads (*Rhinella horribilis*)

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The efficacy of lotilaner was evaluated in three tick-infested cane toads. A single oral administration of lotilaner eliminated all ticks from all three toads from Day (D)1. Environmental samples collected from toad enclosures were negative for ticks until D30.

Introduction

The Mesoamerican cane toad, *Rhinella horribilis*, is a species with a worldwide distribution found from the west of the Andes and Mexico (distributed on the Pacific and Gulf coasts near the margins of water sources and human settlements).[1,2] Nine species of ticks are known to parasitise toads of the genus *Rhinella*, with *Amblyomma dissimile* and *Amblyomma rotundatum* being the most common. These generally use amphibians and reptiles as hosts; however, they can accidentally parasitise birds and mammals (including humans).[3] Parasitism by these ticks leaves clear cutaneous lesions on the toads, weakening the animal and directly increasing the risk of subsequent infections.[3]

Isoxazolines, labelled for use in dogs for the control of ectoparasites, acts on the gamma-aminobutyric acid (GABA) receptor and L-glutamate-activated chloride channels, and has been shown to have excellent efficacy against *Ambylomma* spp. in dogs with few adverse effects.[4] The isoxazolines also have been used successfully against several ectoparasites of exotic animal species.[5–7] The present study was carried out with the objective of evaluating the effectiveness of lotilaner against ticks of the genus *Amblyomma* spp. in cane toads.

Case description

Three cane toads (*R. horribilis*) were presented for consultation. Sexes were unknown and the toads weighed 119, 112 and 76 g, respectively. The toads had been captured in the Pilón river basin in the municipality of Montemorelos, Nuevo León, one week before presentation, and had been naturally infested with ticks (Figure 1). At the time of the examination they did not show signs of disease other than small erythematous skin lesions. Until the time of their clinic visit, they had been housed in an acrylic terrarium at an average temperature of 28°C and 100% humidity. Feeding was based on crickets (*Acheta domesticus*) and juvenile Madagascar cockroaches (*Gromphadorhina portentosa*). Ticks were collected for later visualisation under the microscope and morphometric identification.[8]

On Day (D)0, each individual received a single dose of 20 mg/kg lotilaner per os (Credelio, Elanco Animal Health; Greenfield, IN, USA) calculated by allometric scale, using the base dose of 20 mg as reported in dogs.[4] The dose was calculated using a dose of 20 mg/kg live animal, taking its total dose by the weight of each animal. A 56.25 mg tablet was ground and mixed with 10 mL distilled water, making a liquid suspension that then was administered by orogastric tube. The toads were kept in individual plastic enclosures at 100% humidity and 26–28°C, and clinical evaluations were repeated on D1, D3, D10, D20 and D30 post-treatment with lotilaner. The animals were

Figure 1. Tick feeding on Cane Toad.

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sampled by direct swab and acetate tape to detect the presence of ticks on the skin, and were observed for any changes in feeding and defaecation, weight loss or development of skin lesions. White paper was used as the floor of the enclosure to facilitate the observation of live and/or dead ticks, and was replaced daily and at each evaluation.

On D1 post-treatment the group was negative for the presence of live ticks, and their respective enclosures harboured six, seven and five dead ticks, respectively. From D3 to D30, no live or dead ticks were found on any of the toads or within their enclosures.

Discussion

Rhinella spp. are in constant contact with humans and domestic animals, and are commonly parasitised by ticks, which also are potential vectors of pathogenic microorganisms (*Rickettsia* spp., *Anaplasma* spp. and *Borrelia* spp.).[1,3] However, pharmacological data for ectoparasiticides are lacking for amphibians, and therapeutic regimens often are formulated from anecdotal information or by extrapolation from other species.[9] The administration of ivermectin in amphibians has been reported to be safe at doses of 0.2–0.4 mg/kg p.o., subcutaneously or intramuscularly, 2 mg/kg applied topically or 10 mg/kg in a bath, while 20 mg/kg i.m. showed toxicity.[10] Although ivermectin has been used with relative safety, several applications may be required for efficacy and a dose of 0.4 mg/kg transcutaneously on mite-infested frogs resulted in two deaths.[11] The safe and efficaceous use of an isoxazoline (afoxolaner) for treatment of *Ophionyssus natricis* mites in snakes[7] led us to hypothesise that compounds in this class could be safe and effective options for treatment of ectoparasites in amphibians. A single dose of lotilaner at 20 mg/kg p.o. was effective for the elimination of ticks of the genus *Amblyomma* in three cane toads within 24 h of administration, with no adverse effects observed.

Author Contribution

Braulio Alejandro Fuantos Gámez: Conceptualization; Project administration; Resources; Supervision; Validation; Writing-original draft. **Jocelín Selene Sánchez Cisneros:** Conceptualization; Resources; Supervision; Validation; Visualization; Writing-review & editing. **José Pablo Villarreal Villarreal:** Conceptualization; Methodology; Resources; Supervision; Visualization; Writing-original draft. **Laura Miranda Contreras:** Investigation; Supervision; Validation; Visualization; Writing-review & editing. **Camilo Romero Núñez:** Investigation; Project administration; Supervision; Validation; Visualization; Writing-review & editing.

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Résumé – L'efficacité du lotilaner a été évaluée chez trois crapauds buffle infestés de tiques. Une seule administration orale de lotilaner a éliminé toutes les tiques des trois crapauds à partir du jour (J)1. Les échantillons environnementaux prélevés dans les enclos des crapauds étaient négatifs pour les tiques jusqu'à J30.

Resumen – Se evaluó la eficacia de lotilaner en tres sapos de caña infestados por garrapatas. Una sola administración oral de lotilaner eliminó todas las garrapatas de los tres sapos desde el día (D) 1. Las muestras ambientales recolectadas de los recintos de sapos fueron negativas para garrapatas hasta el D30.

Zusammenfassung – Die Wirksamkeit von Lotilaner wurde an drei mit Zecken befallenen Kröten untersucht. Eine einzige Verabreichung *per os* eliminierte alle Zecke von allen drei Kröten mit dem ersten Tag (D1). Proben aus den Krötengehegen war bis zum D30 frei von Zecken.

要約 – マダニに感染した3匹のオオヒキガエルにおいて、ロチラネルの有効性を評価した。ロチラネルの単回経口投与により、3匹のヒキガエルのすべてのマダニがD1日目から駆除された。ヒキガエルの囲いから採取した環境サンプルはD30までマダニが陰性であった。

摘要 – 评价被蜱侵扰的3只藤条蟾蜍使用洛替拉纳的疗效。从第(D)1天开始, 单次经口给予洛替拉纳可消除3只蟾蜍身上的所有蜱。直至D30, 从蟾蜍围栏采集的环境样本中, 蜱均为阴性。

Resumo – A eficácia do lotialaner foi avaliada em três sapos-boi infestados por carrapatos. Uma única administração de lotialaner eliminou todos os carrapatos de todos os sapos no Dia (D) 1. Amostras ambientais coletadas dos terrários dos sapos foram todas negativas para carrapatos até o D30.

