



Male-male Aggression in the Introduced Cuban Brown Anole, *Anolis sagrei* (Reptilia: Dactyloidae), in Honduras

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The Cuban Brown Anole (*Anolis sagrei* Duméril and Bibron 1837) is native to Cuba, the Bahamas, and the Cayman Islands (Powell and Henderson 2012; McCranie

and Köhler 2015; Antúnez-Fonseca et al. 2022), and has been widely introduced throughout tropical and subtropical regions of the world (e.g., Kraus 2009; Uetz et al. 2021). Like



Fig. 1. Male-male aggression in Cuban Brown Anoles (*Anolis sagrei*) in Honduras: (A) Invader oriented horizontally and resident in a vertical position; note also the presence of a Brown Basilisk (*Basiliscus vittatus*), which is a known predator of smaller lizards; (B) resident male; (C) invading male; (D) defensive displays that preceded physical aggression; (E) males attacking and biting each other; (F) after the aggressive encounter, the invader withdraws from the resident’s territory and retreats to a nearby woodpile. A video of the encounter is available at: <https://www.youtube.com/watch?v=ghdMrW0ThwY>. Photographs © Fausto A. Elvir-Valle (A–E) and Lorakin Joyner (F).

other anoles, male Cuban Brown Anoles are territorial and announce their dominance with headbobs and by extending their large orange dewlaps (e.g., Tokarz et al. 1998, 2002; Paterson 2002; Calsbeek and Marnocha 2006), although an essentially similar display is used to attract females (Echelle et al. 1978; Tokarz 1998; Kodric-Brown et al. 2006; Driessens et al. 2015). We herein describe male-male physical aggression by Cuban Brown Anoles in Honduras.

On an overcast afternoon at 1630 h on 18 February 2015, we observed an agonistic interaction between two adult male *A. sagrei* (Fig. 1; video available at: <https://www.youtube.com/watch?v=ghdMrW0ThwY>) in the Casa-Hospedaje Daniela, Cuyamel, Omoa Municipality, Cortés Department, Honduras; (15°39'35.0"N, 88°11'27.0"W; WGS84; elev. 19 m asl; Fig. 2). A Brown Basilisk (*Basiliscus vittatus*) was nearby (Fig. 1A); although it never interacted with the large male anoles, basilisks are known predators of smaller lizards (e.g., Stroud and Giery 2016). The interaction between the two male anoles occurred on a staircase positioned horizontally toward a wooden promontory covered with plastic. Both males appeared to be in the final stages of shedding their skins (Fig. 1B–D) and were facing each other about 5 cm apart with vertebral crests erected (Fig. 1D). The larger male with a darker hue appeared to be the

resident (Fig. 1B), whereas the smaller individual with a slightly lighter hue (Fig. 1C) had apparently invaded the former's territory. Physical aggression involving reciprocal bites to the neck and head and both vertical and horizontal movements of the head began when both attempted to take ownership of the top of a ladder (Fig. 1D–E). When they separated, both performed headbobs, push-ups, gaped, and expelled air (vocalizations). The interaction lasted approximately 10 min and ended with the withdrawal of the invader, which fled to a woodpile located about 2 m away, whereas the resident remained in his territory (Fig. 1F).

Such physical aggression between adult male *A. sagrei*, which occurs only during very intense encounters, is less frequently observed than ritualized aggressive behaviors (Tokarz 1985; Paterson 2002; Calsbeek and Marnocha 2006). The latter typically involve series of agonistic signals without physical contact (e.g., head jerking, abdominal puffing, flexion, gaping, and elevating and laterally compressing the body; Jenssen 1977; McMann 2000; Paterson 2002; Perry et al. 2004; Vigil 2006). We believe that the event described herein was triggered by the defense of an established territory against an invader and that the outcome was predictable, as larger combatants nearly always win, those on the higher perch usually prevail, and residents have an advantage over interlopers (e.g., Jenssen 1977; McMann and Paterson 2003).

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Literature Cited

- Antúñez-Fonseca, C.A., E.P. Hofmann, A.A. Reyes-Barahona, D.I. Ordoñez-Mazier, F.J. Dubón, H.D. Reyes, and J.H. Townsend. 2022. New records and range expansion of the introduced *Norops sagrei* (Squamata: Dactyloidae) in Honduras highlight the importance of citizen science in documenting non-native species. Nuevos registros y expansión de ámbito de *Norops sagrei* (Squamata: Dactyloidae) en Honduras resaltan la importancia de la ciencia ciudadana en la documentación de especies no nativas. *Caldasia* 44: (early view). <https://doi.org/10.15446/caldasia.v44n2.94568>.
- Calsbeek, R. and E. Marnocha. 2006. Context dependent territory defense: the importance of habitat structure in *Anolis sagrei*. *Ethology* 112: 537–543. <https://doi.org/10.1111/j.1439-0310.2006.01194.x>.
- Dinerstein, E., D. Olson, A. Joshi, C. Vynne, N.D. Burgess, E. Wikramanayake, N. Hanh, S. Palminteri, P. Hedao, R. Noss, M. Hansen, H. Locke, E.C. Ellis, B. Jones, C.V. Barber, R. Hayes, C. Kormos, V. Martín, E. Crist, W. Sechrest, L. Price, J.E.M. Baillie, D. Weeden, K. Suckling, C. Davis, N. Sizer, R. Moore, D. Thau, T. Birch, P. Potapov, S. Turubanova, A. Tyukavina, N. de Souza, L. Pintea, J.C. Brito, O.A. Llewellyn, A.G. Miller, A. Patzelt, S.A. Ghanzafar, J. Timberlake, H. Klöser, Y. Shennan-Farpon, N. Kindt, J.B. Lillesø, P. van Breugel, L. Graudal, M. Voge, K.F. Al-Shammari, and M. Saleem. 2017. An ecoregion-based approach to protecting half the terrestrial realm. *Bioscience* 67: 534–545. <https://doi.org/10.1093/biosci/bix014>.
- Driessens, T., K. Huyghe, B. Vanhooydonck, and R. van Damme. 2015. Messages conveyed by assorted facets of the dewlap, in both sexes of *Anolis sagrei*.

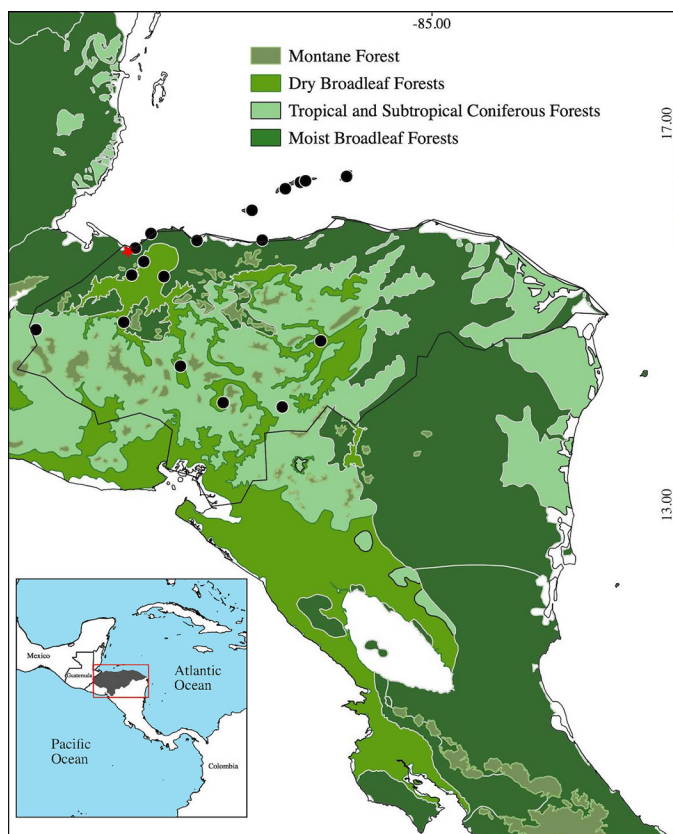


Fig. 2. An ecoregional map of Honduras showing distributional records of the Cuban Brown Anole (*Anolis sagrei*). Black dots indicate records in Antúñez-Fonseca et al. (2022); the red star marks the location of the encounter described herein. Adapted from Dinerstein et al. (2017) by Juan C. Díaz-Ricaurte.

- Behavioral Ecology and Sociobiology* 69: 1251–1264. <https://doi.org/10.1007/s00265-015-1938-5>.
- Echelle A.G., A.A. Echelle, and H.S. Fitch. 1978. Inter and intraspecific allometry in a display organ: The dewlap of *Anolis* (Iguanidae) species. *Copeia* 1978: 245–250. <https://doi.org/10.2307/1443558>.
- Jenssen, T.A. 1977. Evolution of anoline lizard display behavior. *American Zoologist* 17: 203–215. <https://doi.org/10.1093/icb/17.1.203>.
- Kodric-Brown, A., R.M. Sibly, and J.H. Brown. 2006. The allometry of ornaments and weapons. *Proceedings of the National Academy of Sciences of the United States of America* 103: 8733–8738. <https://doi.org/10.1073/pnas.0602994103>.
- Kraus, F. 2009. *Alien Reptiles and Amphibians: A Scientific Compendium and Analysis*. Springer Science and Business Media. Berlin, Germany.
- McCranie, J.R. and G. Köhler. 2015. The Anoles (Reptilia: Squamata: Dactyloidae: *Anolis: Norops*) of Honduras. Systematics, Distribution, and Conservation. *Bulletin of the Museum of Comparative Zoology* 16: 1–280. <https://doi.org/10.3099/0027-4100-14.1.1>.
- McMann, S. 2000. Effects of residence time on displays during territory establishment in a lizard. *Animal Behaviour* 59: 513–522. <https://doi.org/10.1006/anbe.1999.1319>.
- McMann, S. and A. Paterson. 2003. The relationship between location and displays in a territorial lizard. *Journal of Herpetology* 37: 414–416.
- Paterson, A.V. 2002. Effects of an individual's removal on space use and behavior in territorial neighborhoods of Brown Anoles (*Anolis sagrei*). *Herpetologica* 58: 382–393. [https://doi.org/10.1655/0018-0831\(2002\)058\[0382:EOAIR O\]2.0.CO;2](https://doi.org/10.1655/0018-0831(2002)058[0382:EOAIR O]2.0.CO;2).
- Perry, G., K. Levering, I. Girard, and T. Garland, Jr. 2004. Locomotor performance and social dominance in male *Anolis cristatellus*. *Animal Behaviour* 67: 37–47. <https://doi.org/10.1016/j.anbehav.2003.02.003>.
- Powell, R. and R.W. Henderson (eds.). 2012. Island lists of West Indian amphibians and reptiles. *Bulletin of the Florida Museum of Natural History* 51: 87–168.
- Stroud, J.T. and S.T. Giery. 2016. Nesting behavior of introduced Brown Basilisks (*Basiliscus vittatus*) in southern Florida. *Reptiles & Amphibians* 23: 104–107. <https://doi.org/10.17161/randa.v23i2.14116>.
- Tokarz, R.R. 1985. Body size as a factor determining dominance in staged agonistic encounters between male brown anoles (*Anolis sagrei*). *Animal Behaviour* 33: 746–753. [https://doi.org/10.1016/S0003-3472\(85\)80006-3](https://doi.org/10.1016/S0003-3472(85)80006-3).
- Tokarz, R.R. 1998. Mating pattern in the lizard *Anolis sagrei*: implications for mate choice and sperm competition. *Herpetologica* 54: 388–394.
- Tokarz, R.R., S. McMann, L. Seitz, and H. John-Alder. 1998. Plasma corticosterone and testosterone levels during the annual reproductive cycle of male brown anoles (*Anolis sagrei*). *Physiological Zoology* 71: 139–146. <https://doi.org/10.1086/515907>.
- Tokarz, R.R., S. McMann, L.C. Smith, and H. John-Alder. 2002. Effects of testosterone treatment and season on the frequency of dewlap extensions during male-male interactions in the lizard *Anolis sagrei*. *Hormones and Behaviour* 41: 70–79. <https://doi.org/10.1006/hbeh.2001.1739>.
- Uetz, P., P. Freed, R. Aguilar, and J. Hošek (eds.). 2021. *The Reptile Database*. <<http://www.reptile-database.org>>.
- Vigil, S. 2006. Brown Anole (*Anolis sagrei*). Natural History Publication Series NHS –06 - 06. Warnell School of Forestry and Natural Resources, University of Georgia, Athens, Georgia, USA.