Nicola Novarini, Emanuele Stival

WADING BIRDS PREDATION ON *BUFOTES VIRIDIS* (LAURENTI, 1768) IN THE CA' VALLESINA WETLAND (CA' NOGHERA, VENICE, ITALY)

Riassunto. *Predazione di uccelli acquatici su* Bufotes viridis *(Laurenti, 1768) nella zona umida di Ca' Vallesina (Ca' Noghera, Venezia).*
Viene riportata per la prima volta la predazione di rospo smeraldino da parte di due specie di uccelli acquatici, *Bubulcus ibis* e *Threskiornis aethiopicus*, in una piccola zona umida lungo il margine nordoccidentale della Laguna di Venezia.

Summary. Predation instances on the green toad by two waterbird predators, *Bubulcus ibis* and *Threskiornis aethiopicus*, are reported for the first time in a small wetland along the northwestern border of the Lagoon of Venice (NE-Italy).

Keywords: *Bufotes viridis*, predation, waterbirds, *Bubulcus ibis*, *Threskiornis aethiopicus*.

Reference: Novarini N., Stival E., 2017. Wading birds predation on *Bufotes viridis* (Laurenti, 1768) in the Ca' Vallesina wetland (Ca' Noghera, Venice, Italy). *Bollettino del Museo di Storia Naturale di Venezia*, 67: 71-75.

INTRODUCTION

Anuran amphibians are typical intermediate predators in the food-chain of wetlands, being active consumers of invertebrates, especially insects, and occasionally small vertebrates, as well as prey themselves of invertebrates, fishes, other amphibians, reptiles, birds and mammals, including man. Egrets, ibises and other wading birds often share the same wetland habitat with amphibians and are major (though opportunistic) predators of anurans, especially of the palatable ranids (KABISCH & BELTER, 1968; COOK, 1987; DUELLMAN & TRUEB, 1994; TOLEDO et al., 2007; WELLS, 2007).

A wide number of species across almost all anuran families, however, contain toxic and/or distasteful secretions in their skin glands, with bufonids generally included among the least palatable species, either as adults and larvae (LUTZ, 1971; DUELLMAN & TRUEB, 1994; TOLEDO & JARED, 1995; GUNZBURGER & TRAVIS, 2005). Nevertheless, some predators are known to safely consume toxic anuran species. Based on their sensitiveness to noxious or distasteful substances, predators can be divided in i) species apparently resistant to amphibian toxins, which eat unaffected the whole animal (cf. DE CARVALHO, 1941; HALE & WENDT, 1951; MUELLER, 1980), and ii) species that are sensitive to skin secretions and therefore eat only part of the prey body, either removing its skin, like some raptors and shrikes (e.g. AMORES et al., 1979; ANTCZAK et al., 2005), or eating only the bowels, like some crows (e.g. OLSON, 1989; QUELLMALZ, 2005).

Although several avian species prey occasionally on bufonids (KABISCH & BELTER, 1968; COOK, 1987; TOLEDO et al., 2007), extensive surveys of bird predation on European amphibians recovered very few instances of wading birds feeding on them (KABISCH & BELTER, 1968; MARTIN & LOPEZ, 1990). Nevertheless, adult green toads (*Bufotes viridis* subgroup, sensu STÖCK et al., 2001) are known to be preyed upon by diurnal and nocturnal raptors, corvids, bustards, storks and some ardeids, particularly *Ardea cinerea*, *Nycticorax nycticorax* and *Ixobrychus minutus*, whereas larvae are preyed upon by ducks, gulls, herons

 pubblicato il 06.07.2017

and crows (KABISCH & BELTER, 1968; KUZMIN, 1999; STÖCK et al., 2008; and references therein).

Here we add two more waterbird species to the list of green toad predators: *Bubulcus ibis* (Linnaeus, 1758) and *Threskiornis aethiopicus* Latham, 1790, which are well known opportunistic predators of amphibians, including other bufonid species (CLERGEAU et al., 2010; WELLS, 2007; and references therein).

RECORDS

On March 22nd, 2014, two specimens of green toad, *Bufotes viridis*, were photographed while being captured by a cattle egret, *Bubulcus ibis* (fig. 1), and an African sacred ibis, *Threskiornis aethiopicus* (fig. 2), repectively. In both cases toads were briefly "manipulated" with their beak by birds and then swallowed.

On April 7th, 2014, another cattle egret captured a green toad on a grassland, carried it to a marshy area where it was apparently knocked out and washed, and swallowed it (fig. 3).

All predation instances were recorded (by E.S.) during birdwatching sessions in the small wetland of Ca' Vallesina (Ca' Noghera, Venice, Italy - 45.520537, 12.382930), along the northwestern border of the Lagoon of Venice. In all cases, toads where ingested whole and, at least while the observer was present, no instances of rejection or ill effect in the predator birds could be noticed.

Fig. 1. Sequence of cattle egret swallowing a green toad on March 22nd, 2014. Photo E. Stival.

Fig. 2. Sacred ibis with a green toad in its bill on March 22nd, 2014. Photo E. Stival.

Fig. 3. Another cattle egret with a captured green toad on April 7th, 2014. Photo E. Stival.

DISCUSSION

Although predation of bufonids by waterbirds has been reported previously (cf. KABISCH & BELTER, 1968; COOK, 1987; TOLEDO et al., 2007; WELLS, 2007), this is the first documented instance of cattle egret and sacred ibis preying on *Bufotes viridis*.

Granular glands in the skin of metamorphosed Eurasian green toads produce toxic secretions that are a mixture of several compounds, not all of which have yet been characterized and their toxicity fully understood (cf. ERSPAMER, 1994; GELLA et al., 1995; ABDEL-RAHMAN et al., 2010).

Nevertheless, venom from members of the *B. viridis* subgroup tested for toxicity (i.e. *B. boulengeri*, *B. viridis*) has proven strongly cardiotoxic to several laboratory animals (CHEN et al., 1933; ABDEL-RAHMAN et al., 2010). Although some components of toad skin secretions that exhibit acute toxicity if injected (e.g. biogenic amines) may be armless through ingestion, others that have digitalis-like cardiotonic effects (i.e. bufodienolides) do not seem inactivated by the digestive processes (FLIER, 1978; ERSPAMER, 1994).

Both *B. ibis* and *T. aethiopicus* were observed swallowing the toads whole without negative consequences, therefore it appears that these species are unaffected by green toad poison and fall in the group of predators insensitive to toxic skin defenses, a characteristic likely shared with other waterbirds.

The presence of substantial populations of these two wading birds in northern Italy and continental Europe is rather young, due to natural range expansion for the cattle egret and to accidental anthropogenic introduction for the sacred ibis (BRICHETTI & FRACASSO, 2003; YÉSOU & CLERGEAU, 2005). Despite the likely natural coexistence of at least one of them (*B. ibis*) with other green toad species in the Mediterranean basin (e.g., the North African *B. boulengeri*), their coming into contact with *B. viridis* seems a recent event, therefore the potential impact of such "unfamiliar" predators on populations of the green toad, as well as of other local amphibians, should be carefully monitored.

ACKNOWLEDGEMENTS

The authors wish to thank G. Masato, librarian at MSNVE, for his help with the finding of several bibliographic references.

References

ABDEL-RAHMAN M.A., AHMED S.H., NABIL Z.I., 2010. In vitro cardiotoxicity and mechanism of action of the Egyptian green toad *Bufo viridis* skin secretions. *Toxicology in Vitro*, 24(2): 480-485.

AMORES F., FRANCO A., MELLADO J., 1979. Presencia de *Bufo bufo spinosus* Daudin en la dieta de Falconiformes y Strigiformes en Sierra Morena occidental. Doñana, *Acta Vertebrata*, 6(2): 238-239.

ANTCZAK M., HROMADA M., TRYJANOWSKI P., 2005. Frogs and toads in the food of the Great Grey Shrike (*Lanius excubitor*): larders and skinning as two ways to consume dangerous prey. *Animal Biology*, 55(3): 227-233.

BRICHETTI P., FRACASSO G., 2003. Ornitologia Italiana. Identificazione, distribuzione, consistenza e movimenti degli uccelli italiani. 1 Gaviidae-Falconidae. *Alberto Perdisa Editore,* Bologna.

CHEN K.K., JENSEN H., CHEN A.L., 1933. The physiological action of the principles isolated from the secretion of the european green toad (*Bufo viridis viridis*). *The Journal of Pharmacology and Experimental Therapeutics*, 49(1): 14-25.

CLERGEAU P., REEBER S., BASTIAN S., YESOU P., 2010. Le profil alimentaire de l'Ibis sacré *Threskiornis aethiopicus* introduit en France métropolitaine: espèce généraliste ou spécialiste? *Revue d'Ecologie-La Terre et la Vie*, 65: 331-342.

COOK W.E., 1987. Amphibians and reptiles: predators and prey. Amphibians and birds. *Smithsonian Herpetological Information Service*, No. 73. Smithsonian Institution, Washington DC.

DE CARVALHO A.L., 1941. Observações sobre casos de batracofagia entre as aves. *Memórias do Instituto Oswaldo Cruz*, 35(1940): 575-576.

DUELLMAN W.E., TRUEB L., 1994. Biology of Amphibians (2nd ed.). *Johns Hopkins University Press*, Baltimore and London.

ERSPAMER V., 1994. Bioactive secretions of the amphibian integument. In: Heatwole H., Barthalmus G.T., Heatwole A.Y. (eds.), Amphibian Biology, Vol. 1 - The Integument. *Surrey Beatty & Sons*, Chipping Norton (Australia): 178-350.

FLIER J.S., 1978. Ouabain-like activity in toad skin and its implications for endogenous regulation of ion transport. *Nature*, 274(5668): 285-286.

GELLA I.M., SHABANOV D.A., LEONT'EV D.A., LEVIN M.G., SHISHKIN O.V., BAUMER V.N., LAKIN E.E., 1995. Study of the bufadienolides of the skin secretion of green toads (*Bufo viridis* laur, 1758). *Pharmaceutical Chemistry Journal*, 29(7): 491-494.

GUNZBURGER M.S., TRAVIS J., 2005. Critical literature review of the evidence for unpalatability of amphibian eggs and larvae. *Journal of Herpetology*, 39(4): 547-571.

HALE J.B., WENDT R.F., 1951. Amphibians and snakes as ruffed grouse food. *Wilson Bulletin*, 63(3): 200-201.

KABISCH K., BELTER H., 1968. Das Verzehren von Amphibien und Reptilien durch Vögel. *Zoologische Abhandlungen aus dem staatlichen Museum für Tierkunde in Dresden*, 29(15): 191-227.

KUZMIN S.L., 1999. The Amphibians of the Former Soviet Union. *Pensoft*, Sofia.

LUTZ B., 1971. Venomous Toads and Frogs. In: Bücherl W., Buckley E.E. (eds.), Venomous Animals and their Venoms. Vol. II: Venomous Vertebrates. *Elsevier*: 423-473.

MARTIN J., LOPEZ P., 1990. Amphibians and reptiles as prey of birds in southwestern Europe. *Smithsonian Herpetological Information Service*, No. 82. Smithsonian Institution, Washington DC.

MUELLER N.S., 1980. Mallards capture and eat American toads. *Wilson Bulletin*, 92(4): 523-524.

OLSON D.H., 1989. Predation on breeding western toads (*Bufo boreas*). *Copeia*, 1989(2): 391-397.

QUELLMALZ B. ["bq"], 2005. Krötenkatastrophe in Altona. *Naturschutz in Hamburg*, n. 3/05: 28.

STÖCK M., GUNTHER R., BÖHME W., 2001. Progress towards a taxonomic revision of the Asian *Bufo viridis* group: Current status of nominal taxa and unsolved problems (Amphibia: Anura: Bufonidae). *Zoologische Abhandlungen aus dem staatlichen Museum für Tierkunde in Dresden*, 51(18): 253-319.

STÖCK M., ROTH P., PODLOUCKY R., GROSSENBACHER K., 2008. Wechselkröten unter Berücksichtigung von *Bufo viridis virdis* Laurenti, 1768; *Bufo variabilis* (Pallas, 1769); *Bufo boulengeri* Lataste, 1879; *Bufo balearicus* Böttger, 1880 und *Bufo siculus* Stöck, Sicilia, Belfiore, Lo Brutto, Lo Valvo und Arculeo, 2008. In: Grossenbacher K. (ed.), Handbuch der Reptilien und Amphibien Europas. Band 5 (Froshlurche II), Vol. 1. Wiebelsheim (Germany): *Aula Verlag*: 413-498.

TOLEDO R.C., JARED C., 1995. Cutaneous granular glands and amphibian venoms. *Comparative Biochemistry and Physiology A - Comparative Physiology*, 111(1): 1-29.

TOLEDO L.F., RIBEIRO R.S., HADDAD C.F.B., 2007. Anurans as prey: an exploratory analysis and size relationships between predators and their prey. *Journal of Zoology*, 271(2): 170-177.

WELLS K.D., 2007. The Ecology and Behavior of Amphibians. *University of Chicago Press*, Chicago.

YÉSOU P., CLERGEAU P., 2005. Sacred Ibis: a new invasive species in Europe. *Birding World*, 18(12): 517-526.

Authors address:

Nicola Novarini - Museo di Storia Naturale, Santa Croce 1730, I-30135 Venezia, Italy; nicola.novarini@fmcvenezia.it

Emanuele Stival - Via Ca' Solaro 4, I-30173 Favaro Veneto (Venezia), Italy; emanuelestival@gmail.com