Petr Necas - Water management in chameleons - a what is the edge of nature and captivity?
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In the wild, the water management happens through two mechanisms, regulating:
1. WATER INTAKE
2. WATER LOSS

WATER INTAKE
Happens through two mechanisms :
DRINKING (digestive tract involved only, respiratory in small extent in extreme condition during stealth drinking - see further)
RESORBTION (respiratory tract mainly involved such as lungs and in minor importance the mucous of the nasal and mouth cavities, unlike many other vertebrates, skin plays an minute to no role in that process as it is no permeable for water)

Water is delivered through three conditions, in which water is available in the wild:
1. LIQUID WATER
2. FOG
3. VAPOR

ad 1/ liquid water is ingested from:
A. Dew (condensed droplets of water aggregating mostly on leaves and licked actively during early morning)
B. Rain that is a source of water:
a) continually (within normal rainy season when chameleons hide from rain and if it is intense, associated signer with darkness and or inevitable exposure to it, they even sleep in, also to protect their eyes from the hypotonic water droplets entering the eyes, and goo it to drink after the rain is over) or
b) occassionally (after long dry season or long period without rain, they might hunt for every droplets of water exposing themselves even to rain to hysterically hydrate in a state of acute dehydration and even practice a mechanism called stealth drinking, using the sucking power of their hyoid apparatus creating such negative pressure in their throats that wather intake happens both through mouth as well as nostrils)
The water intake from rain is actively happening only during the daytime. At night, chameleons do not drink and if, then only if they have been “forced” to it through circumstances such as sleeping not in cover of leaves when sudden night rain comes and/or covering nasal openings with water inducing the necessity of reflexive stealth drinking

Ad 2/ fog that consists of microscopic droplets of water still „dissolved“ in air at the special physical state of combination of water vapor content in the air and special pressure and temperature rates ycalled “dew point”, is inhaled and resorbed through lungs. This happens on a daily basis even in desert environments where long months or even years, there is exclusively NO rain. This mechanism is in desert or savannah species (C. namaquensis, C. gracilis) or in species from areas with several month lasting dry seasons (C. calyptratus) so important and dominant that in fact it facilitates their survival and for many montane species it is the only water intake mechanism so that they do drink at all, as they not need to.
Ad 3/ Similarly as above, playing more role in water loss management, but high air humidity hydrates as well

WATER LOSS
happens through basically three mechanisms:
1. Defecation and urination
2. Breathing
3. Evaporation from mucous membranes

Ad 1/ defecation loss is substantial because every dropping is necessary containing water. This however at least in species from dry environments is regulated through re-resorption as much of water back to the blood through the intestine wall as possible remaining the dripping so dry that it almost falls apart in pieces once defecated (not like the sluggish watery amorphous badly smelling poop that we see in the captivity, as a sign of overhydration). Same is true for urination, the liquid primary urine is subject of re-resorption of water back to blood and the white toothpaste-like urates, sometimes with crystalline orange particles, forming up to 25% of their volume in the wild, are formed. The hysteria about orange urates in the urine in captivity is inadequate, as orange crystalline urates are normal and natural in the approximate amount stated above. Totally white urates for long period of time are rather a clear sigh of hyperhydration.

Ad 2/ breathing of course delivers water vapor into the air: the drier the air (the lower the air humidity, it means the less water vapor dissolved in the air) and the higher the temperature and the lower the air pressure, the more water is lost. This is also why under normal circumstances the adult Veileds are so vigorous drinkers, as all the mentioned environmental factors apply: it is warm at daytime, it is extremely dry and they live at high altitudes far above 3000ft. This is also why they foul us so much with their vigor to drink. In fact, they do not need to drink so much as we offer to them in he captivity as a rule and as-libitum drinking is not good for them same as ad-libitum feeding (this for another reason). In species from humid areas with high air humidity, the losses are of course lower.
Ad 3/ evaporation from mucous membranes is of really minute importance in chameleons in our context and it is limited (except of the above mentioned breathing where all mucous of the whole respiratory tact takes place from nasal cavity till the air sacs behind lungs) to mouth (that is actually kept closed normally, except of situations when water loss while overheating cools down the body thanks to the expansion effect of the evaporated water and except of pathologic situations like RI, where opening the mouth is induced through the necessity to hyperventilate and water loss is inevitable - this is why through pulmonary infections suffering animals tend to drink much above the norm)

So, what are the implications of this in captivity?!

Very simple and technically widely available solutions can help us to restore the natural water management process of chameleons, which has he following three principles to be adjusted for each species in the necessary intensity (and abscond from unnatural and extreme techniques such as regular exposing the chameleons to showers):

Provide them:
1. Fog in the night
2. Dew in the morning
3. Water in liquid form during the day

How to do it?

1. Use fogger at night and make sure there is a significant night drop in the temperatures (not at daytime!, on contrary fog at high temperature kills, as it promotes the growth of bacteria and fungi and causes mycoses and respiratory disease that can not be kept under control neither through UV not through natural ATBs contained in Pollen)
2. Use misting techniques incl. automated misters in the early morning to allow them to drink from leaves (best from living plants, not from fake ones, as there are big risk of contamination from both chemicals contained in them as well as bacteria and fungi growing on them or resting on them in form of spores)
3. Provide adequately liquid water best trough automated dripers or through hand drinking from a syringe etc. (fountains and bowls have proven inefficient and risky over years, so this is not a real option)

General rule: adjust as per natural requirements of the species and take into consideration the individual condition, health, age and preference of the concrete individual!

High humidity is good for those species that live in high humidity but big caution is recommended: High humidity levels are as a rule in the wild combined with low temperatures (either at night for all species or at daytime for rainforest floor species only. Even species from cloud forests like T. quadricornis actively seek sun exposed branches during, thus reducing the surrounding humidity to surprisingly low levels (50% and less) through drying effect of the sun rays and drying effect of the moving air/wind.

Simulating rains is Ok for species from areas with heavy rains but if all the above is adjusted, the drinking mechanism is enough for simulating the function of the rain in the environment and is no need to be simulated normally, he mental construct follows...
Rain is as stated above usually not what is the chameleon exposed to, so simulating it is not smart. We should understand, what rain for a chameleon is..
So, rain is coming... let us take a regular rain lasting several tenths of minutes, not a tropical storm and not a light shower or mist...
Rain, it is drops of condensed distilled water that are big enough to be forced through gravity to fall down to earth from the height of the clouds. The temperature of the rain is between 0 and 27C. The size of a big rain drop is about 5mm and it falls with a speed of 9km/h or 20mph.
Why chameleons do not like the touch of raindrops? It is simple: they do not like their bodies being touched. And it might seem that the rain drops hit quite gently. But a surface affected by the fall of an average rain drop is equal to approx 1 square centimeter. If we take an average size of a chameleon body e.g. 6 in by 2in (one side), the total body area exposed to the rain would be from either direction approximately 80 square centimeters. So, with one drop, about 1,25 per cent of their bodies are affected. It feels same as if a human body would be attacked in an area 2 by 2 inches! And this happens at least in 10% of the area of the body at once (as not
Only one drop hits but many) and this happens repeatedly every half second or even less... The potential impact of rain on small animal like chameleon is much more intense than it seems to us, big humans!
So, The chameleon retreats to the bush to hide and escape the hits of the rain drops. And under ideal conditions he either does not get exposed to rain drops at all or gets them slowed down an poured gently on his body through leaves with much less intensity and impact.
Saying this, here is one exception of this rule: rarely, you can see a chameleon sitting in the rain. It it in he situation, when heavy sudden rain surprised him on a place where it was not possible or feasible to search shelter. The hit of the rain drops cause a reflexive freezing, in fact akinesis (read my separate post on these mechanisms) and it falls in a specific state of lethargy, tetanically cramping the muscles, inflating or deflating the body, forcefully closing the eyes and retracting them into the eyeholes and sitting motionlessly... Until the rain is over.
The ambient temperature drops during he rain! The imagination that tropical rains are warm is false. They have the temperature of maximum 27C but mostly much less! The raindrops partly soak and cover the environment with water, partly evaporate and cause the humidity to raise up to 100%.
So, what this is? It is a situation similar or almost equal to the night! And this is what chameleons also perceive and they behave accordingly. They coil themselves together and close their eyes and sleep while breathing in the cold humid air!

When the rain is over, they go out and if they are thirsty, they drink the droplets from vegetation around. And, they immediately bask if sun is available: to dry their bodies and increase the temperature back to higher levels, as they were cooled down through the rain.
So, this is rain from the perspective of a chameleon.
Does it have any sense to simulate it? Merely! It is just a situation of lowered activity that equals to situation that we anyway (if done properly) simulate for many hours during the night time!
The rain as such is namely equal to night conditions and the drinking after rain is to be facilitated easily while giving them opportunity to drink!

This is why for me, showering animals has limited sense only for forceful water intake, for emergency rehydration needs, as there is NO benefit but stress only in soaking he animal in the water and as the skin can not absorb water anyway.
Moreover, if we compensate through forcefully unnatural shower our inability to provide enough water the natural way, then it is for me also not acceptable. We need to try to simulate the natural conditions, not to find inadequate stressful substitutes.
Moreover, as both rain weather as well as fresh water is dramatically hypotonic to tissue liquids, one should always take in mind, that intake of big amounts of pure water can cause heavy tissue damage through osmosis (both in the intestines as well as in the nasal cavities and eyes) and therefore a big rehydration or hydration need should be strictly covered using isotonic saline solutions!!!
Drinking big amounts of pure or distilled water kills! I have seen it several times!
Thus, other mechanisms should be used delivering water to the natural gates:
Mouth and digestive tract (liquid)
Nostrils and respiratory tract (fog)
As described above for the wild natural
conditions and for the recommended mechanisms in the captivity.