



Butterfly Puddling Behaviour: A Fascinating Phenomenon

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Adult Lepidoptera, comprising butterflies and moths, frequently exhibit a behaviour known as mud-puddling, which involves seeking out damp areas like soil, sweat, tears, faeces or animal carcasses to absorb water and dissolved nutrients. Although this behaviour occurs in both temperate and tropical regions, it is more commonly observed in tropical environments. Mud-puddling is not restricted to butterflies but is also seen in various other insect orders such as Orthoptera, Hemiptera, Hymenoptera, Diptera and Blattodea. This behaviour serves the crucial purpose of helping insects obtain essential micronutrients, including sodium and proteins necessary for their physiological functions.

Key butterflies engaging in puddling

Skippers, Blues and coppers, Yellows and Swallowtails are among the prominent butterfly species known for engaging in mud-puddling. These butterflies actively search for puddling sites, which can include mud, decaying fruit, bird droppings, dung and carrion. This behaviour is not only about acquiring nutrients but also significantly contributes to their reproductive success.

Nutrient gathering in butterflies

Butterflies often gather in large groups near puddles primarily to access essential adult resources, particularly sodium. Similar to moths, butterflies exchange complex sperm packets known as spermatophores during mating. These spermatophores contain various substances, including sodium, calcium phosphate and nutrients like amino acids. Sodium is particularly important as it is typically scarce in terrestrial plants yet essential for many land herbivores, including humans. Butterflies primarily obtain sodium and protein through mud-puddling, a behaviour that enhances male mating success, courtship displays and flight behaviour.

Evolutionary adaptations

Caterpillars, which primarily feed on herbaceous diets, often face sodium deficiency due to the low levels of sodium ions in terrestrial plants. Consequently, there is a strong evolutionary pressure for adult Lepidoptera to replenish mineral stocks. Mud-puddling may have evolved from the simple need to drink water, especially in arid habitats where water sources are scarce. Mud-puddling is predominantly observed in male butterflies, who gather sodium to transfer to females during copulation through spermatophores. This transfer can enhance egg production and fitness of offspring. The presence of sodium ion receptors on the tarsi of many adult Lepidoptera further highlights the importance of sodium in their physiology.

Puddling sites and behaviour

Mud-puddling primarily occurs on wet soil, but butterflies may also seek out human perspiration, blood, tears and other unconventional sources for nutrients. This behaviour is not limited to Lepidoptera; certain bee species, known as sweat bees, also exhibit similar behaviours.

Butterflies often form large congregations at puddling sites, attracting more individuals to join. These sites are typically rich in salts, minerals and amino acids, which are essential for their physiological and reproductive functions.

Importance of sodium

Sodium plays a crucial role in various physiological functions of butterflies, including digestion, excretion, reproduction and flight. Since adult diets mainly consist of nectar and fruits, which lack sufficient sodium, mud-puddling becomes essential for supplementing this mineral, especially for males, who require higher energy and metabolism levels for locating and courting females.

During mud-puddling, butterflies consume dissolved salts and nutrients, which are stored in their sperm. When males transfer these nutrients to females during mating, it enhances the chances of successful egg development, acting as a beneficial gesture during courtship for both the female and the offspring. Essential proteins from carrion and bird droppings contribute to female egg yolk formation and male flight muscle development, providing them with a competitive advantage.

Duration and fluid ejection

The duration of mud-puddling can vary from a few seconds to over an hour. Butterflies use their proboscis to suck nutrient-rich fluids and filter them to extract essential chemicals. Excess fluid is often ejected in sudden, regular spurts from the abdomen.

During mud-puddling, butterflies and moths can process fluids up to 600 times their body mass, resulting in frequent fluid ejections. This behaviour helps in depositing adhered pollen grains and is facilitated by the longer ileum found in puddling males.

Influencing factors of puddling behaviour

Several factors trigger puddling in butterflies, including genetic makeup, age, mating status and sensory cues from the environment. Pierids and papilionids rely heavily on visual cues, while nymphalids, hesperiids and lycaenids use olfactory signals. Young male butterflies, needing high activity levels to find females, are typically the most frequent puddlers. Environmental conditions such as temperature and pollution also significantly affect puddling behaviour.

Conservation and research implications

Understanding butterfly puddling behaviour is crucial for conserving endangered species and facilitating their breeding in controlled environments. Puddling sites also hold significance for palynological research, which can track butterfly migration and provide insights into historical climate conditions.

Conclusion

Mud-puddling is essential for butterflies to get rare nutrients and improve their reproductive success. Despite being unglamorous, this behaviour provides important ecological and behavioural insights. It is crucial for butterfly research and conservation, helping us understand how butterflies thrive in their environments and guiding efforts to protect them.



Purple emperor puddling on dung



Julia Butterfly puddling on tears



Common baron puddling on guava fruit



Drury's jewel puddling on bird droppings