

Larval Food Analysis and Qualitative Determination of Exoenzyme-Producing Gut Bacteria in Adult Ceratopogonid Midges (Diptera)

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ABSTRACT

Biting midges are small nematocerosus Diptera. *Culicoides* and *Dasyhelea* are two important genera of the family Ceratopogonidae. Larvae of *Culicoides innoxius* and *Dasyhelea aprojecta* are found in the semiaquatic moist habitat. The larvae feed on the small debris and habitat substrata. The materials consumed by these larvae aid in their development to become adult. The nutritional evaluation of the food material of larvae of *C. innoxius* and *D. aprojecta* was carried out to know the essential elements for their development. In the case of adult *Culicoides*, many species are hematophagous. However, the adult midges of the genus *Dasyhelea* are dependent on nectar and honeydew. Along with their digestive enzymes, exoenzyme-producing gut associated bacteria have also an important role in the digestion of these food materials. Digestion and metabolism of these food materials aid in insect maturation, immunity, reproduction, maintaining diapause, etc. Qualitative determination of the gut associated bacteria of adult *C. innoxius* and *D. flava* was accomplished to infer the role of bacteria supplementing the digestive enzymes.

Keywords: *Culicoides*, *Dasyhelea*, Larval food material, Proximate composition, Exoenzyme-producing gut bacteria, Qualitative determination.

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INTRODUCTION

Family Ceratopogonidae is an enormously diverse group of small nematocerosus midges, usually known as biting midges. In this family along with some other genera *Culicoides* Latreille [1], and *Dasyhelea* Kieffer [2], are important in having medico-veterinary and economic significance respectively. Many species of *Culicoides* are vectors of pathogenic protozoans, viruses, and filarial nematodes [3-5] causing Akabane, Blue Tongue disease, etc. [6, 7]. Some members of the genus *Dasyhelea* are pollinators of cocoa and rubber trees [8, 9]. In the case of female *Culicoides*, the adult stage is hematophagous, feeding on vertebrate blood, though there is report of natural sugar feeding habit also [10]. The larvae of some species of

Culicoides are trophic generalists [11]. Adult stages of both the sexes belonging to the genus *Dasyhelea* rely on nutrition from the honeydew and nectar [12], larval stages of this genus are primarily herbivorous actively feeding upon the plant and animal debris [13-15]. However, there is also evidence of carnivorous feeding habit of *D. pseudoincisurata* Waugh and Wirth, [16, 17]. Insects harbor a broad variety of microorganisms in their gut which help in numerous physiological functions [18]. There is also role of autochthonous bacteria in production of digestive enzymes for plant-derived polymers [19]. Digestion of lipid and protein may also be contributed by these microorganisms [20].

This article aims to evaluate the composition of food materials ingested by the larvae during