Palaeogeography, Palaeoclimatology, Palaeoecology 475 (2017) 154–161

Contents lists available at ScienceDirect

Palaeogeography, Palaeoclimatology, Palaeoecology

journal homepage: www.elsevier.com/locate/palaeo

The Chironomidae diversity based on records from early Eocene Cambay amber, India, with implications on habitats of fossil Diptera

Frauke Stebner [a,b,*], Viktor Baranov [c,d], Marta Zakrzewska [e], Hukam Singh [f], Wojciech Giłka [e]

[a] University of Bonn, Steinmann-Institute, Section Palaeontology, Nussallee 8, 53115 Bonn, Germany
[b] Stuttgart State Museum of Natural History, Rosenstein 1, 70191 Stuttgart, Germany
[c] Leibniz-Institute of Freshwater Ecology and Inland Fisheries, Müggelseedamm 310, 12587 Berlin, Germany
[d] Humboldt University of Berlin, Faculty of Mathematics and Natural Sciences, Geography Department, Rudower Chaussee 16, 12489 Berlin, Germany
[e] University of Gdańsk, Department of Invertebrate Zoology and Parasitology, Wita Stwosza 59, 80-308 Gdańsk, Poland
[f] Birbal Sahni Institute of Palaeosciences, 53 University Road, Lucknow, India

ARTICLE INFO

Article history:
Received 7 March 2016
Received in revised form 9 March 2017
Accepted 20 March 2017
Available online 21 March 2017

Keywords:
Chironomidae
Cambay amber
Early Eocene
India
Palaeoecology

ABSTRACT

A fossil fauna of Chironomidae in early Eocene Cambay amber from India is reported for the first time. The fossil assemblage consists of 192 specimens from five subfamilies. Chironomidae from Cambay amber represent a fauna whose composition in the fossil record is most similar to Dominican amber, with the exception of the presence of Podonominae in Cambay amber. Chironomidae genera recorded from Cambay amber indicate the presence of freshwater habitats and standing water bodies as well as springs. Incorporation of other dipteran groups from Cambay amber adds evidence of diverse aquatic and semi-aquatic habitats in the Cambay amber forest and implies entrapment of the fossils from a wide range of different locally separated areas.

1. Introduction

Chironomidae are diverse and abundant in aquatic and some terrestrial habitats today with the analysis of the community structure being a valuable tool for the assessment of modern as well as past environmental conditions (Matthews-Bird et al., 2016; Armitage et al., 1995). Today, >7000 species of Chironomidae (Pape et al., 2011) are distributed worldwide. The family has also left a rich fossil record dating back to the Upper Triassic (ca. 210 Ma, Krzemiński and Jarzembowski, 1999) with most amber taxa known from the Eocene, mainly from amber from the Baltic region (ca. 48–43 Ma). As in most amber deposits from elsewhere, chironomids are the most abundant dipteran inclusions in amber from India.

Cambay amber deposits are located in the state of Gujarat, India, about 30 km northeastern of Surat (Rust et al., 2010). Amber can be found in several different large opencast active lignite mines. At present the most important localities in terms of amber quantity and inclusion abundance are Vastan and Tadkeshwar mines, although new mines are constantly opening and exposing additional amber layers. Sedimentological studies on the early Eocene Cambay Shale successions depict the setting in Vastan and Tadkeshwar as a nearshore/coastal system (McCann, 2010; Sahni et al., 2006), as implied by layers with abundant marine organisms (e.g., shell -rich beds with mollusks, foraminifers, ostracods, and micro-vertebrates like sharks and rays; see Sahni et al., 2006), as well as plant fossils (e.g., lignite as remains of plant material, pollen, in situ roots systems; see Sahni et al., 2006) and findings of numerous fossil terrestrial mammals (summarized in Rose et al., 2006; Smith et al., 2016). The latter group indicates regular fresh water influx into the system, whereas low-oxygen tolerant foraminifers with dwarfed morphology also suggest shallow waters with brackish conditions (Sahni et al., 2006). This is supported by findings of fish otoliths, which also indicate a shallow marine environment with regular fresh water influx, such as a protected bay with mangrove systems (Nolf et al., 2006). Generally, deposition of the sediments took place under predominantly low-energy conditions with quiet waters, as indicated by articulated shells and the mainly muddy lithologies (McCann, 2010; Sahni et al., 2006), whereas layers containing disarticulated and fragmented shells indicate occasionally higher water energies (McCann, 2010; Sahni et al., 2006).

The age determination of the amber bearing sediments in Vastan is based on findings of benthic foraminifera (Sahni et al., 2006; Punekar and Saraswati, 2010), dinoflagellates (Garg et al., 2008) and most recently data from strontium isotopes and stable carbon isotopes as well as mammal fossils (Clementz et al., 2011). The data suggest an early

* Corresponding author at: University of Bonn, Steinmann-Institute, Section Palaeontology, Nussallee 8, 53115 Bonn, Germany.
E-mail addresses: frauke.stebner@smns-bw.de (F. Stebner), baranov@igb-berlin.de (V. Baranov), marta.zakrzewska@biol.ug.edu.pl (M. Zakrzewska), hukams@gmail.com (H. Singh), wojciech.gilka@biol.ug.edu.pl (W. Giłka).

http://dx.doi.org/10.1016/j.palaeo.2017.03.019
0031-0182/