

Higher taxon diversity, abundance and community structure of Empididae, Hybotidae and Brachystomatidae (Diptera: Empidoidea) in tropical forests – results of mass-sampling in Thailand

[Diversität, Abundanz und Gemeinschaftsstruktur höherer Taxa der Empididae, Hybotidae und Brachystomatidae (Diptera: Empidoidea) in tropischen Wäldern – Ergebnisse einer Massenbeprobung in Thailand]

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Abstract

An overview of Empididae, Hybotidae and Brachystomatidae (Diptera: Empidoidea) in Thailand is presented using data from mass trapping of more than 35,000 specimens collected throughout the country supplemented with reference to the literature. Quantitative analyses were restricted to 18,675 specimens with associated numerical data and a subset of 16,805 collected using standardised trapping protocols. The diversity, abundance, distribution, habitat and biogeography of 21 genera of Hybotidae, 12 Empididae and 2 Brachystomatidae occurring in Thailand was assessed. Hybotidae were generally more abundant than Empididae, especially in the east and coastal peninsula and both families were more frequent at higher elevations. Brachystomatidae were rare and confined to northern mountains. Hybotidae were dominated by Tachydromiinae and Empididae by Empidinae and Hemerodromiinae although regional and altitudinal variations occurred. The Empididae subfamilies Clinocerinae and Hemerodromiinae were rare or absent in the east and coastal peninsula and did not occur below an altitude threshold at ca. 400 m. Seasonal phenology of subfamilies varied with region and altitude but maximal abundance coincided generally with the start and end of the wet seasons and was lowest during dry seasons. Diversity and abundance at generic level was investigated at a northern site and found to be positively correlated with the wet season. Cluster analysis of altitude and subfamily abundance tentatively identified 12 communities with distinct habitat, regional, altitudinal and phenological characteristics. Northern montane wet evergreen forests were particularly rich in Empidoidea and many genera occurring there have Palearctic affinities consistent with a model (PLANT et al. 2012) in which historical climate changes drove immigration from the north. Unlike many of the Palearctic elements, taxa with Oriental affinities have often successfully colonised the lowlands where they dominate genus-level assemblages in highly seasonal habitats.

Key words

Empididae, Hybotidae, Brachystomatidae, Oriental Region, Thailand, diversity, abundance, altitude, seasonality

Zusammenfassung

Auf der Grundlage von Daten aus dem Massenfang von mehr als 35.000 Exemplaren wird ein Überblick über die in Thailand vorkommenden Empididae, Hybotidae und Brachystomatidae (Diptera: Empidoidea) gegeben, ergänzt durch Angaben aus der Literatur. Quantitative Analysen wurden für 18.675 Exemplare durchgeführt, von denen numerische Daten vorlagen. Gleiches gilt für 16.805 Exemplare, die mit standardisierten Fangmethoden gesammelt wurden. Diversität, Abundanz, Verbreitung, Habitat und Biogeografie von 21 Gattungen der Hybotidae, 12 Gattungen der Empididae und 2 Gattungen der Brachystomatidae in Thailand wurden ermittelt. Hybotidae waren allgemein häufiger als Empididae, besonders im Osten und an den Küsten der Halbinsel, und beide Familien waren häufiger in größeren Höhen. Brachystomatidae waren selten und auf die nördlichen Bergregionen beschränkt. Unter den Hybotidae dominierten die Tachydromiinae und unter den Empididae die Empidinae und Hemerodromiinae, obwohl regionale und höhenabhängige Variationen auftraten. Clinocerinae (Empididae) und Hemerodromiinae waren im Osten und an den Küsten der Halbinsel selten oder fehlten. Sie traten unter ca. 400 m Meereshöhe gar nicht auf. Das saisonale Auftreten der Unterfamilien variierte in Abhängigkeit von Region und

Höhe, aber die maximale Abundanz fiel im allgemeinen mit dem Beginn und dem Ende der Regenzeiten zusammen und war in den Trockenzeiten am niedrigsten. Die Diversität und Abundanz auf Gattungsniveau, die an einem nördlichen Fundort untersucht wurden, waren positiv korreliert mit der Regenzeit. Eine Clusteranalyse der Unterfamilien-Abundanz in Abhängigkeit von der Meereshöhe identifizierte 12 vorläufige Gemeinschaften mit jeweils verschiedenen Eigenschaften bezüglich Habitat, Region, Höhe und Phänologie. Die nördlichen immergrünen Bergregenwälder erwiesen sich als besonders reich an Empidoidea, wobei viele der dort vorkommenden Gattungen Beziehungen zur Paläarktis zeigen – ein Ergebnis, das mit dem Modell von PLANT et al. (2012) übereinstimmt, wonach historische Klimaveränderungen die Einwanderung von Norden vorantrieben. Im Gegensatz zu vielen paläarktischen Elementen haben orientalische Taxa häufig erfolgreich die Tiefländer besiedelt, wo sie innerhalb der Gattungsgemeinschaften in saisonbeeinflussten Habitaten dominieren.

Stichwörter Empididae, Hybotidae, Brachystomatidae, orientalische Region, Thailand, Diversität, Abundanz, Höhe, Saisonalität

Introduction

Thailand is situated within both the Indo-Burma and Sundaland biodiversity mega-hotspots identified by MYERS et al. (2000) as globally significant. In common with most, if not all tropical countries, Thailand's biodiversity is poorly known with estimates of taxon richness and abundance based largely on relatively well studied vertebrates and higher plants. There are for example ~ 10,000 named species of higher plants out of an estimated 12,000–18,000 and inventories of ~ 320 reptiles, ~ 550 fish and ~ 1,000 birds are likely to be reasonable approximations of the correct figures. Quantification of invertebrate diversity in Thailand, even to order of magnitude, is however unrealistic at present, as with the exception of a few groups such as butterflies (Lepidoptera) with 1,130 species (EK-AMNUAY 2006), they remain largely unknown. HUTACHARERN et al. (2007) catalogued 10,191 species of insects and mites from the country, but this is undoubtedly far short of the actual total. Knowledge of Thailand's Diptera is very incomplete; the Oriental Catalogue (DELFINADO & HARDY 1973, 1975, 1977) listed 974 described species in 56 families while HUTACHARERN et al. (2007) reported 996 named species in 40 families. PAPP et al. (2006) reviewed the literature and recent collections in Thailand, concluding that 99 families were present, albeit with many represented only by undescribed species. Although the Empidoidea families Empididae and Hybotidae are numerous in collections from Thailand (e. g. PAPP et al. 2006) only 23 species of Empididae and 32 Hybotidae were listed by YANG et al. (2007) and a likely rich fauna of Dolichopodidae (not discussed further in the present work) is similarly under-recorded (YANG et al. 2006). Recent publications on the taxonomy and systematics of Empidoidea in Thailand include: – Empididae: BARTÁK & KUBÍK (2008); DAUGERON & GROOTAERT (2003, 2005b); DAUGERON et al. (2011); GROOTAERT & KIATSOONTHORN (2001); HORVAT (2002); PLANT (2009a, 2009b, 2010). – Hybotidae: GROOTAERT & SHAMSHEV (2003, 2006, 2009, 2012); SHAMSHEV & GROOTAERT (2004, 2005, 2007, 2008); SHAMSHEV et al. (2006). Brachystomatidae: PLANT (2009c, 2010a). Currently 44 named species of Hybotidae, 43 Empididae and 3 species of Brachystomatidae have been reported from Thailand. Twelve genera of Empididae, 21 Hybotidae and 2 Brachystomatidae are now known from the country, although many of these have been recorded merely as present in wider faunistic or phylogeographic studies (GROOTAERT & SHAMSHEV 2009, GROOTAERT & SHAMSHEV 2012, PAPP et al. 2006, PLANT et al. 2012, SHAMSHEV & GROOTAERT 2007) and in the absence of detailed revisionary work, some generic assignments should be regarded as provisional.