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The zoogeography of the western Palaearctic Tipulidae (Diptera) X. The Tipulidae of the eastern Mediterranean islands

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Abstract

A discussion is presented about the zoogeography of the Tipulidae known from the eastern Mediterranean islands; 54 non-endemic and 19 endemic species and subspecies are presently known from 25 islands. The non-endemic and endemic Tipulidae fauna of the islands close to Greece and Turkey is very similar to the fauna of the adjacent mainland. Older endemic as well as more widespread but relict species are found especially on the southern Aegean islands and on Cyprus. The Tipulidae fauna of the Kikládhes apparently is at large of quite recent, probably late Pleistocene origin.

Résumé

On discute la zoogéographie des espèces et sous-espèces non-endémiques (54) et endémiques (19) de Tipulidae actuellement connues de 25 îles de la Méditerranée orientale. La faune de Tipulidae non-endémiques et endémiques des îles voisines de la Grèce ou de la Turquie ressemble fort à celle des zones continentales adjacentes. On trouve des paléo-endémites ainsi que des espèces plus largement répandues mais relictes, surtout dans les îles d'Égée méridionale et au Chypre. La faune de Tipulides des Cyclades est, en grandes lignes, apparemment fort récente, probablement d'origine Pléistocène tardive.

Introduction

This paper in our series on the zoogeography of the western Palaearctic Tipulidae (Theowald & Oosterbroek, 1980–1990), deals with the species of the eastern Mediterranean islands. As such it is the first report on the Tipulidae fauna of these islands. It is mainly because of the collecting activities of Prof. Dr. H. Malicky (Lunz, Austria) and a number of other entomologists, that this paper can be presented. During the last ten years more than 2000 crane fly specimens have been collected on the islands discussed. This has brought the number of species to 73, recorded from 25 eastern Mediterranean islands.

Especially well investigated are the islands near to western Greece, the majority of the islands near to western Turkey and some of the southern Aegean islands. Less well known are the Tipulidae faunas of the north and central Aegean islands and of Cyprus, whereas Tipulidae are not yet recorded from several even larger islands (Límnos, Imroz, Skíros, Páros, Kárpathos). Not taken into account here are the species from Evvoia (Euboea). The Tipulidae fauna of this large island, situated close to the Greek mainland, has been discussed by Theowald & Oosterbroek (1986) as part of the fauna of central Greece.

List of species

The species are listed below in alphabetical order according to genera, subgenera and species groups. The names of the islands from which they are known are given according to the Times Atlas of the World (1985, comprehensive ed.). A code, representing the type of distribution of the species is added between brackets, using the following abbreviations:

E Widespread in Europe;
EA Widespread in Europe and Asia Minor;
M Widespread in the Mediterranean region, except Asia Minor;
MA Widespread in the Mediterranean region and Asia Minor;
B Distributed on the Balkan Peninsula;
BA Distributed on the Balkan Peninsula and Asia Minor;
A Distributed in Asia Minor;
e Endemic, followed by the distributional code of its sister species or sister group.

Taxonomic or distributional remarks are given at the end of the list for species marked with an asterisk (*).

Ctenophora Meigen, 1803
elegans Meigen, 1818: Sámos, Samothráki (E)
festiva Meigen, 1804: Kérkira (E)
ornata Wiedemann, 1818: Andros, Kérkira (EA)
Dolichopeza Curtis, 1825
fuscipes Bergroth, 1889: Kefallinía, Kíthira, Kríti, Sámos, Samothráki, Zákinthos (M)
graeca Mannheims, 1954: Thásos (BA)
Nephrotoma Meigen, 1803
analis (Schummel, 1833): Samothráki (EA)
appendiculata appendiculata (Pierre, 1919): Dhílos, Kérkira, Míkonos (EA)
beckeri (Mannheims, 1951): Cyprus (A)
cornicina (Linnaeus, 1758): Andros, Cyprus, Kérkira, Sámos (EA)
cretensis Oosterbroek, 1982: Kríti (eA)
croceiventris lindneri (Mannheims, 1951): Kos (EA)
flavipalpis (Meigen, 1830): Zákinthos (E)
guestfalica guestfalica (Westhoff, 1880): Kérkira (EA)
malickyi Martinovsky, 1979: Kríti (eE)
minuscula (Mannheims, 1951): Cyprus (A)
scalaris scalaris (Meigen, 1818): Andros, Cyprus, Ikaría, Kálamos, Kérkira, Kríti, Náxos, Póros, Ródhos, Zákinthos (EA)
theowaldi Oosterbroek, 1978: Kos, Ródhos (A)
Tipula Linnaeus, 1758, subgenus (*Acutipula*) Alexander, 1924
cretensis Vermoolen, 1983: Kríti (eM)
cypriensis Vermoolen, 1983: Cyprus (eA)*
ismene Mannheims, 1969: Kefallinía (B)
isparta Vermoolen, 1983: Cyprus (A)
maxima balcanica Vermoolen, 1983: Andros, Tínos (B)
transcaucasica latifurca Vermoolen, 1983: Ikaría, Kos, Sámos, Samothráki, Sérifos, Thásos (BA)
Tipula (Lunatipula) Edwards, 1931
acuminata group
artemis artemis Theischinger, 1977: Ikaría, Khíos, Sámos (B)
cypris Mannheims, 1963: Cyprus, Ródhos (A)
dedecor Loew, 1873: Kos, Sámos (eA)*
graeca dufouri Oosterbroek & Vukovic, 1989: Kefallinía, Kérkira, Kíthira (B)
istriana Erhan & Theowald, 1961: Lésvos (BA)
vermooleni Theischinger, 1987: Kos (eBA)*
bimacula group*
bimacula Theowald, 1980: Kefallinía, Kérkira, Lésvos, Zákinthos (M)
kephalos Theischinger, 1979: Kefallinía (eM)
minos Theischinger, 1982: Kríti (eA)
rhodolivida Theowald, 1972: Kos, Ródhos (A)
caudispina group*
simova Theischinger, 1982: Thásos (eB)
clio group
leda Mannheims, 1965: Kefallinía (B)
theia Mannheims, 1963: Kíthira (B)
helvola group
helvola Loew, 1873: Kefallinía, Kérkira, Kríti, Lésvos, Sámos, Samothráki, Zákinthos (EA)
livida group
graecolivida Mannheims, 1954: Kríti, Zákinthos (B)
mendli Martinovsky, 1976: Khíos, Kos, Lésvos, Sámos (A)
pseudowolfi Theischinger, 1979: Sámos (A)
urania Mannheims, 1954: Kíthira, Spétsai (B)
wolfi Mannheims, 1954: Thásos (B)
lunata group
furcula Mannheims, 1954: Khíos, Kos, Míkonos, Ródhos (BA)
soosi Mannheims, 1954: Lésvos, Náxos, Ródhos, Sámos (BA)
macroselene group
cedrophila Mannheims, 1963: Ródhos (A)
christophi Theischinger, 1982: Sámos (A)
cretis Mannheims, 1965: Dhílos, Kérkira, Kríti, Levkás, Síros (M)
imbecilla Loew, 1869: Ródhos (eB)
kykladon Theischinger, 1987: Sérifos (eM)
macroselene macroselene Strobl, 1893: Kefallinía (B)
macroselene pan Mannheims, 1965: Kíthira (B)
selenis Loew, 1873: Ródhos (eM)
tibonella Theischinger, 1977: Lésvos (BA)
peliostigma group
dorica Mannheims, 1965: Kríti (eEA)
peliostigma peliostigma Schummel, 1833: Náxos, Sámos, Síros, Thásos (EA)
phaidra group
circe Mannheims, 1954: Kríti (eBA)
cressa Mannheims, 1965: Kríti, Ródhos (eBA)
phaidra Mannheims, 1965: Kríti (eBA)
truncata group
beieri Mannheims, 1954: Kefallinía, Levkás (eB)
caudatula Loew, 1862: Kíthira, Síros (B)
tyche Mannheims, 1966: Kérkira (B)
verrucosa (= *brunneinervis*) group
dracula Theischinger, 1977: Khíos, Kos (A)
quinquespinis Theischinger, 1980: Lésvos (A)
teunisseni Theischinger, 1979: Ródhos (eA)
Tipula (Mediotipula) Pierre, 1924
stigmatella Schummel, 1833: Kefallinía (EA)
Tipula (Savtshenkia) Alexander, 1966
aster Theischinger, 1983: Thásos (eM)

jeekeli Mannheims & Theowald, 1959: Lésvos, Náxos, Ródhos (M)
odontostyla Savtshenko, 1961: Thásos (A)
rufina rufina Meigen, 1818: Cyprus, Kefallinía, Náxos (EA)
Tipula (Tipula) Linnaeus, 1758
italica errans Theowald, 1984: Lésvos (BA)
oleracea Linnaeus, 1758: Dhílos, Kríti, Ródhos (E)
orientalis Lackschewitz, 1930: Andros, Cyprus, Dhílos, Kefallinía, Kérkira, Kíthira, Kos, Kríti, Lésvos, Levkás, Náxos, Ródhos, Sérifos, Síros, Zákinthos (BA)
Tipula (Yamatotipula) Matsumura, 1916
lateralis lateralis Meigen, 1818: Andros, Ikaría, Kefallinía, Kérkira, Kos, Kríti, Levkás, Náxos, Ródhos, Sámos, Sérifos, Síros, Zákinthos (EA)

Annotations. – *T. (A.) cypriensis* apparently forms a species group together with *isparta* (Turkey, Cyprus), and *macra* Savtshenko, 1961 (Transcaucasus, northern Iran). *T. (A.) macra* is not a member of the *corsica* subgroup sensu Vermoolen, 1983, because it does not possess a tridental apex of the intromittent organ.

The type-locality Kérkira of *T. (L.) dedecor* is considered questionable. The holotype (Zool. Mus. Berlin) was collected in the middle of the 19th century by the insect trader Erber from Vienna, and is labelled "Corfu" (Kérkira). The species has never been collected again on Kérkira and more recent material is all from Kos and Sámos. The species is closely related to *T. (L.) osmana* Mannheims, 1963 from northern Turkey.

T. (L.) vermooleni is described by Theischinger, 1987, as a species closely related to *pachyprocta* Loew, 1873, from Yugoslavia. The latter species, however, is the sister species of the species pair *graeca* and *heros* Egger, 1863. *T. (L.) vermooleni* is considered to form a species group with *savtshenkoi* Simova, 1960 (Bulgaria and southern Yugoslavia), and *decolor* Mannheims, 1963 (western Roumania, northwestern Turkey) (Oosterbroek & Vukovic, 1989).

The four species of the *T. (L.) bimacula* group represent a distinct species group (Theischinger, 1979). The only record of *bimacula* from Turkey (Mannheims, 1968, 308: Antalya) apparently refers to *rhodolivida*. *T. (L.) minos*, described as a subspecies of *bimacula*, is given specific rank because *minos* and *rhodolivida* are probably sister species, as well as *bimacula* and *kephalos*.

The *T. (L.) caudispina* group, separated here from the *T. (L.) fascingulata* group, comprises the species *animula* Mannheims, 1967, *capra* Theischinger, 1980, *capreola* Mannheims, 1966, *caudispina caudispina* Pierre, 1921, *caudispina parnonensis* Theischinger, 1979, *forcipula* Mannheims, 1966, *hera* Theischinger, 1979, *rauschorum* Theischinger, 1977, *sigma* Theischinger, 1979, *simova* Theischinger, 1982, and *thais* Mannheims, 1963. The *caudispina* group is distributed in Italy and the Balkan only.

Zoogeographical remarks

In order to present a more detailed account of the faunal composition of the Tipulidae of the eastern Mediterranean islands, the islands are assigned to six island groups (see table I).

(1) The islands close to western Greece and northern Pelopónnisos (Kérkira, Levkás, Kálamos, Kefallinía, Zákinthos, Spétsai, Póros)

Of the 24 species of these islands 22 are also known from the adjacent mainland. Of the two endemic species, *beieri* (Levkás, Kefallinía) is closely related to *trunca* Mannheims, 1954, and *subtrunca* Mannheims, 1966, both from Greece. *T. (L.) kephalos* (Kefallinía) apparently is the sister-species of *bimacula*, also known from Greece, as well as from Kefallinía (Theischinger, 1979).

It can be concluded that the Tipulidae fauna of these islands is very similar to the fauna of the adjacent mainland. The majority of the species (15 out of 24) is widely distributed in Europe or the Mediterranean and about one third is limited to the Balkan Peninsula (table I).

(2) The islands close to northeastern Greece (Thásos, Samothráki)

The Tipulidae fauna of northeastern Greece and the European part of Turkey is poorly known. Which species known from the islands Thásos and Samothráki occur on the adjacent mainland, therefore, can only be estimated and seems likely for seven of the eleven species, namely those species with larger distributions in Europe, the Balkan Peninsula and Asia Minor (table I: EA, E, BA, B).

Table I. Number of species of Tipulidae on the eastern Mediterranean islands according to island groups and type of distribution. Species endemic to island groups are given in parentheses (3(1) = 3 species, one of which is endemic) and are assigned according to the distributional code as added in the species list.

Island group	E	M	B	EA	BA	A	Total
1 Kérkira	1	2	2	7	1	–	13
Levkás	–	1	1(1)	1	1	–	4(1)
Kálamos	–	–	–	1	–	–	1
Kefallinía	–	3(1)	5(1)	4	1	–	13(2)
Zákinthos	1	2	1	3	1	–	8
Spétsai	–	–	1	–	–	–	1
Póros	–	–	–	1	–	–	1
Total	2	4(1)	8(1)	9	1	0	24(2)
2 Thásos	–	1(1)	2(1)	1	2	1	7(2)
Samothráki	1	1	–	2	1	–	5
Total	1	2(1)	2(1)	3	2	1	11(2)
3 Lésvos	–	2	–	1	5	2	10
Khíos	–	–	1	–	1	2	4
Sámos	1	1	1	4	2	4(1)	13(1)
Ikaría	–	–	1	2	1	–	4
Kos	–	–	–	2	4(1)	5(1)	11(2)
Total	1	3	1	6	8(1)	8(1)	27(2)
4 Kíthira	–	1	5	–	1	–	7
Kríti	2(1)	3(1)	1	4(1)	4(3)	2(2)	16(8)
Ródhos	1	2(1)	1(1)	2	4(1)	5(1)	15(4)
Total	2(1)	5(2)	7(1)	4(1)	6(3)	7(3)	31(11)
5 Andros	–	–	1	4	1	–	6
Tínos	–	–	1	–	–	–	1
Síros	–	1	1	2	1	–	5
Míkonos	–	–	–	1	1	–	2
Dhílos	1	1	–	1	1	–	4
Sérifos	–	1(1)	–	1	2	–	4(1)
Náxos	–	1	–	4	2	–	7
Total	1	3(1)	2	7	4	0	17(1)
6 Cyprus	0	0	0	3	2	4(1)	9(1)
Total of all islands	5(1)	9(5)	16(3)	13(1)	12(4)	18(5)	73(19)

Although Thásos and Samothráki are relatively close to Turkey, no Turkish species are known from the islands.

The endemic *simova* (Thásos) belongs to the *caudispina* group with ten species distributed in Italy and the Balkan only. The species *aster* (Thásos) and *odontostyla* (Thásos, Crimea, northern Caucasus) belong to the subgenus *Savtshenkia*. The distribution of most Mediterranean *Savtshenkia* species is not well known. Many species fly in autumn, a season in which there has been only very few collecting in the Mediterranean with exception of Corsica and Sardinia (Theowald, Dufour & Oosterbroek, 1982). *D. fuscipes* (Samothráki) is distributed throughout the Mediterranean, from Algeria and Mallorca to central Greece, Kríti and Sámos, but is

Table II. Distribution of the non-endemic species of Kíthira, Kríti and Ródhos

	Greece	Kíthira	Kríti	Ródhos	Western Turkey	Kikládhes
Group A						
T. (L.) graeca dufouri (B)	+	+	–	–	–	–
T. (L.) theia (B)	+	+	–	–	–	–
T. (L.) urania (B)	+	+	–	–	–	–
T. (L.) macroselene pan (B)	+	+	–	–	–	–
T. (L.) caudatula (B)	+	+	–	–	–	–
T. (L.) graecolivida (B)	+	–	+	–	–	–
Group B						
D. fuscipes (M)	+	+	+	–	–	–
T. (L.) cretis (M)	+	–	+	–	–	+
T. (T.) oleracea (E)	+	–	+	+	–	+
T. (S.) jeekeli (M)	+	–	–	+	–	+
Group C						
N. theowaldi (A)	–	–	–	+	+	–
T. (L.) credrophila (A)	–	–	–	+	+	–
T. (L.) rhodolivida (A)	–	–	–	+	+	–
T. (L.) cypris (A)	–	–	–	+	(Cyprus)	–
Group D						
T. (T.) orientalis (BA)	+	+	+	+	+	+
T. (Y.) lateralis lateralis (EA)	+	–	+	+	+	+
N. scalaris scalaris (EA)	+	–	+	+	+	+
T. (L.) helvola (EA)	+	–	+	–	+	–
T. (L.) soosi (BA)	+	–	–	+	+	+
T. (L.) furcula (BA)	+	–	–	+	+	+

not known from northeastern Greece and Turkey.

(3) The islands close to western Turkey (Lésvos, Khíos, Sámos, Ikaría, Kos)

The Tipulidae fauna of these islands is, as can be expected, predominantly Turkish; 20 of the 27 taxa are known from nearby Turkey, and 3 others are related to Turkish (sub)species (*T. (L.) artemis artemis* to *T. (L.) artemis asiaeminoris* Theischinger, 1982; *T. (L.) dedecor* to *T. (L.) osmana*; *T. (L.) vermooleni* to *T. (L.) decolor)*. The four species not known from the nearby mainland are widely distributed in Europe (*C. elegans*) or the Mediterranean (*D. fuscipes*, *T. (L.) bimacula* and *T. (S.) jeekeli*).

(4) The southern Aegean islands (Kíthira, Kríti, Ródhos)

(4A) Geological history

The South Aegean or Hellenic island arc comprises the islands Kíthira, Andikíthira, Kríti, Kásos, Kárpathos and Ródhos. The Tertiary history of the arc is associated with the northward subduction of the African plate under the Aegean (Hall et al., 1984). During the Oligocene the islands formed a mountain ridge, situated along the southern edge of the Aegean plate, and connecting the mountainous areas of Greece and southern Turkey. Mid Miocene marine transgressions separated this southern part from the rest of the Aegean plate. Local subsidence and uplifting resulted in a chain of islands although Ródhos remained connected with Turkey until the Pliocene (Meulenkamp, 1985). Local submergence occurred on all islands (Meulenkamp, 1985; Sondaar et al., 1986: Kíthira: Early to Mid Pliocene, Kríti: Mid Miocene into the Pliocene, Kárpathos: Messinian, Ródhos: Late Pliocene to Early Pleistocene). The present configuration of Kríti is con-

sidered to date back to uplifting at the end of the Pliocene. During the Pleistocene at least Ródhos and probably also Kíthira were temporarily connected to the mainland.

(4B) The non-endemic species (see table II)

Tipulidae are known from Kíthira, Kríti and Ródhos only, with in total 31 species. The non-endemic species occurring on the southern Aegean islands are listed in table II. They are assigned to four groups based on distributional characters. Groups A and B include ten species, known from Greece, but not from western Turkey. Their distribution across the South Aegean island arc shows a decline in number towards the east (Kíthira 6, Kríti 4, Ródhos 2). The majority of these species is restricted to the Balkan, three species are distributed throughout the Mediterranean, and one species *T. (T.) oleracea*) is widely distributed in Europe. Group C consists of four species from western Turkey or Cyprus which do not occur further to the west than Ródhos. Group D consists of six species occurring in Greece and western Turkey. They show a decline in number from east to west (Ródhos 5, Kríti 4, Kíthira 1).

The species of group A apparently extended their range from the Balkan southward to Kíthira, whereas the species of group C reached Ródhos from Turkey. These range extensions probably occurred by way of Pleistocene land connections because in both instances the species were not able to reach Kríti, *T. (L.) graecolivida* excepted, or the Kikládhes. The other non-endemic species (group B and D) are either older relict species distributed throughout the Mediterranean (*D. fuscipes*, *T. (L.) cretis*, *T. (S.) jeekeli*) or species widely distributed in Europe or the Balkan and Asia Minor. Especially the species of group B and D are distributed also on the Kikládhes.

(4C) Endemic species (see table III)

The distribution of the species groups with endemic species on the southern Aegean islands is given in table III together with the other species which belong to these monophyletic species groups. No endemic species are known from Kíthira. It is of interest to note that only three of all species listed in table III are distributed on the Kikládhes as well (the widespread *T. (L.) peliostigma*, the Mediterranean *T. (L.) cretis*, and *T. (L.) kykladon* endemic to Sérifos). So the endemic fauna of the South Aegean island arc appears distinctly separated and different from the fauna of the Kikládhes.

The first four species groups of table III are distributed in Greece and western Turkey. Six of the eleven endemics belong to these groups (Kríti 4, Kríti and Ródhos 1, Ródhos 1). The *T. (L.) phaidra* group is strictly limited to the southern Balkan and western Turkey. Of the *T. (L.) bimacula* group, *bimacula* is distributed throughout the Mediterranean (northern and eastern Spain, central and southern Italy, Sicily, southern Balkan). The *T. (L.) verrucosa* and *T. (L.) peliostigma* groups are more widely distributed. The next four groups of table III have no representatives in western Turkey or other parts of Asia Minor. The *N. beckeri* group is the only Asia Minor group.

In six groups the distribution is either limited to the region (the *T. (L.) phaidra*, *T. (L.) pelidne*, and *N. beckeri* groups) or show disjunctions towards the western Mediterranean (the *T. (L.) bimacula*, *T. (L.) macciana*, and *T. (A.) corsica* groups). More detailed phylogenetic and distributional research is necessary with respect to the species groups of table III. It is almost certain, however, that we are dealing here at least in part with older species groups in which a once continuous distribution across the southern Aegean became fragmented, apparently in association with the origin of the separate islands.

(5) The islands of the Kikládhes (Andros, Tínos, Síros, Míkonos, Dhílos, Sérifos, Náxos) (see table IV)

Until the Mid Miocene the Aegean plate formed a continuous landmass connecting the Balkan with Turkey. Marine transgressions, first separating it from the south Aegean, led to gradual drowning. This resulted in isolation from the Balkan and Turkey from the Pliocene onward. Of the landmass itself only the higher peaks remained above sea level (De Vries, 1985). During the Pleistocene connections between the islands of the Kikládhes were restored but not between this central part of the Aegean and the Balkan or Turkey.

Our knowledge of the Tipulidae fauna of the Kikládhes (table IV) is still fragmentary. Tipulidae

Table III. Distribution of the species groups with endemic species on the South Aegean islands

	Greece	Kíthira	Kríti	Ródhos	western Turkey	Kikládhes
phaidra group						
T. (L.) bulbosa (B)	+	–	–	–	–	–
T. (L.) lyrion (B)	+	–	–	–	–	–
T. (L.) circe (eBA)	–	–	+	–	–	–
T. (L.) phaidra (eBA)	–	–	+	–	–	–
T. (L.) cressa (eBA)	–	–	+	+	–	–
T. (L.) sciurus (A)	–	–	–	–	+	–
bimacula group						
T. (L.) bimacula (M)	+	–	–	–	–	–
T. (L.) kephalos (eM)	(Kefallinía)	–	–	–	–	–
T. (L.) minos (eA)	–	–	+	–	–	–
T. (L.) rhodolivida (A)	–	–	–	+	+	–
verrucosa group						
T. (L.) verrucosa verrucosa (E)	+	–	–	–	–	–
T. (L.) teunisseni (eA)	–	–	–	+	–	–
T. (L.) quinquespinis (A)	–	–	–	–	+	–
T. (L.) verrucosa sinedente (A)	–	–	–	–	+	–
T. (L.) dracula (A)	–	–	–	–	+	–
T. (L.) neutra (A)	–	–	–	–	+	–
peliostigma group						
T. (L.) pel. peliostigma (EA)	+	–	–	–	+	+
T. (L.) dorica (eEA)	–	–	+	–	–	–
T. (L.) pel. burdurafyonensis (A)	–	–	–	–	+	–
macciana group						
T. (L.) macciana (Corsica, Sardinia)	–	–	–	–	–	–
T. (L.) kykladon (Serifos) (eM)	–	–	–	–	–	+
T. (L.) cretis (M)	+	–	+	–	–	+
T. (L.) selenis (eM)	–	–	–	+	–	–
pelidne group						
T. (L.) pelidne (B)	+	–	–	–	–	–
T. (L.) imbecilla (eB)	–	–	+	–	–	–
flavipalpis group						
N. flavipalpis (E)	+	–	–	–	–	–
N. malickyi (eE)	–	–	+	–	–	–
corsica group						
T. (A.) rifensis (Morocco)	–	–	–	–	–	–
T. (A.) corsica (Corsica, Sardinia)	–	–	–	–	–	–
T. (A.) cretensis (eM)	–	–	+	–	–	–
beckeri group						
N. cretensis (eA)	–	–	+	–	–	–
N. beckeri (A)	–	–	–	–	+	–

are known from seven islands only, and for example, only one species is known from Tínos against four from the much smaller island of Dhílos. As far as we know at present none of the species shows connections with Asia Minor only, whereas five are distributed towards the west. The majority of the 17 species, however, is widespread. This, together with the almost complete absence of endemic spe-

Table IV. Distribution of the species of the Kikládhes

	Andros	Tínos	Míkonos	Dhílos	Náxos	Síros	Serífos
C. ornata (EA)	+	–	–	–	–	–	–
N. append. appendiculata (EA)	–	–	+	+	–	–	–
N. cornicina (EA)	+	–	–	–	–	–	–
N. scalaris scalaris (EA)	+	–	–	–	+	–	–
T. (L.) pel. peliostigma (EA)	–	–	–	–	+	+	–
T. (S.) rufina rufina (EA)	–	–	–	–	+	–	–
T. (Y.) lateralis lateralis (EA)	+	–	–	–	+	+	+
T. (A.) transc. latifurca (BA)	–	–	–	–	–	–	+
T. (L.) furcula (BA)	–	–	+	–	–	–	–
T. (L.) soosi (BA)	–	–	–	–	+	–	–
T. (T.) orientalis (BA)	+	–	–	+	+	+	+
T. (T.) oleracea (E)	–	–	–	+	–	–	–
T. (L.) cretis (M)	–	–	–	+	–	+	–
T. (L.) kykladon (eM)	–	–	–	–	–	–	+
T. (S.) jeekeli (M)	–	–	–	–	+	–	–
T. (A.) maxima balcanica (B)	+	+	–	–	–	–	–
T. (L.) caudatula (B)	–	–	–	–	–	+	–

cies, indicates that the Tipulidae fauna of the Kikládhes is at large quite recent, probably of late Pleistocene origin. The only endemic species, *kykladon* of Sérifos, might, together with *cretis* and *jeekeli* represent elements of an older fauna in connection with the South Aegean island arc.

(6) Cyprus

Only nine species of Tipulidae are known from Cyprus. Of these nine species, seven also occur on the opposite mainland and the one species endemic to Cyprus, *cypriensis*, is closely related with *isparta* from Cyprus and the opposite mainland. Five species are also known from other eastern Mediterranean islands. From this it can be concluded that the Tipulidae fauna of Cyprus does not show a high amount of isolation. Therefore, the low number of species is apparently not due to the relatively large distance from the mainland, even during glacial periods of the Pleistocene. It is much more likely that Cyprus is largely undercollected compared to other Mediterranean islands. Curiously enough, this undercollecting especially refers to the subgenus *Lunatipula*. Of the 60 Tipulidae species known from the opposite mainland, 41 belong to this subgenus. None of these species is known from Cyprus, the only *Lunatipula* being *cypris*, endemic to Cyprus and Ródhos. Of the 19 species from the opposite mainland and belonging to other genera and subgenera seven are found on Cyprus as well.

Of the eight non-endemic species four are widespread (*N. cornicina* EA, *N. scalaris* EA, *T. (T.) orientalis* BA, *T. (S.) rufina* EA). The other four are Asia Minor species. Each of them, however, shows a connection towards the South Aegean island arc: *T. (L.) cypris* is endemic to Cyprus and Ródhos. *N. beckeri* (Cyprus, southeastern Turkey, Lebanon and Israel) is the sister species of *cretensis* (endemic to Kríti). *N. minuscula* (distribution as in *beckeri*) is the sister species of *theowaldi* (southwestern Turkey, Kos and Ródhos). *T. (A.) isparta* (southern Turkey, Cyprus) and *cypriensis* (Cyprus) form a species group with *macra* Savtshenko, 1961 (Transcaucasus, northern Iran). The sister group of these species includes *doriae* Pierre, 1926 (Mallorca, Corsica, Sardinia, northern Algeria), *rifensis* Theowald & Oosterbroek, 1980 (northern Morocco), *corsica* Pierre, 1921 (Corsica, Sardinia) and *cretensis* (Kríti). This faunal connection between Cyprus, southwestern Turkey, Ródhos, and Kríti could well be linked with the Miocene evolution of the Aegean and Tauric Arcs (Poisson, 1984). Such Miocene land connections are considered also by Kinzelbach (1975) to explain distribution patterns among scorpions.

Table V. Percentage of species of each distributional type on all islands and on the respective island groups except Cyprus. Numbers outlined indicate a higher percentage on an island group in comparison to all islands (indicated only for percentages higher than 10).

Distributional code	E	M	B	EA	BA	A
Total of all islands	7	13	23	19	18	20
Islands close to W. Greece and N. Pelopónnisos	8	17	33	38	4	0
Islands close to N.E. Greece	9	18	18	28	18	9
Islands close to W. Turkey	4	10	4	22	30	30
South Aegean islands	6	17	23	13	18	23
Kikládhes	6	18	12	41	23	0

Faunal composition

The faunal composition of the island groups, Cyprus excepted, is given in table V. The Mediterranean (M) and widespread Europe-Asia Minor (EA) species are usually not limited to one island group and show a higher percentage on most island groups than on all islands together. The EA species show a lower percentage only on the southern Aegean islands. Species from the Balkan (B) are found especially on the islands close to western Greece and the northern Pelopónnisos, whereas the species distributed on both sides of the Aegean Sea (BA) show a higher percentage on the islands close to western Turkey and the Kikládhes. On the Kikládhes species from the Balkan and from Asia Minor show a low or zero percentage. The faunal composition of these islands is largely determinated by widespread EA species (41%). Our incomplete knowledge of the fauna of these islands does not allow for definite conclusions, but the present predominance of this presumably quite recent faunal component might indicate that most of the original prepleistocene species are no longer present on the Kikládhes.

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