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Stiletto flies (Diptera: Therevidae) from a xerothermic locality in the Middle Rhine Valley (Rhineland-Palatinate)

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Abstract

Five species of Therevidae (Diptera: Asiliodea) were collected in malaise traps between 06 May – 30 August, 2000, on the Middle Rhine at Roßstein, Rheintaunus Dörscheid. Three specimens of *Thereva strigata* (FABRICIUS, 1794), two specimens of *T. oculata* EGGER, 1859, one specimen of *T. handlirschi* KRÖBER, 1912, and one specimen of *Pandivirilia caesia* (MEIGEN, 1838) were collected; but the majority of the specimens collected (64 of 71 total specimens) were *T. nobilitata* (FABRICIUS, 1775). The occurrence of *T. oculata* at this locality is of particular importance, as this species as rare and local in central Europe.

Kurzfassung

Stilettenfliegen (Diptera: Therevidae) eines xerothermen Standortes im Mittelrheintal (Rheinland-Pfalz)

Zwischen dem 6. Mai und dem 30. August 2000 wurden mit Hilfe von Malaisefallen, die im Mittelrheintal am Roßstein (Rheintaunus, Dörscheid) gesammelt worden

waren, fünf Arten von Stilettfliegen nachgewiesen. Unter den gefangenen Therevidae (Diptera: Asiloidea) waren drei Exemplare von *Thereva strigata* (FABRICIUS, 1794), zwei von *T. oculata* EGGER, 1859, ein Exemplar von *T. handlirschi* KRÖBER, 1912, und eins von *Pandivirilia caesia* (MEIGEN, 1838), die Mehrzahl der Belege (64 von insgesamt 71) gehörte zu *T. nobilitata* (FABRICIUS, 1775). Von besonderem Interesse ist das Vorkommen von *T. oculata* an dieser Lokalität, da diese Art in Europa nur selten und lokal nachgewiesen ist.

1. Introduction

Therevidae are rather inconspicuous flies that are most often collected in dry to arid habitats. Adults have been observed drinking water from small pools and from vegetation, and a few species are known to visit flowers (WINTERTON, WIEGMANN & IRWIN 2001). The larvae are active predators of other fossorial invertebrates in dry, friable substrates and are easily collected in sandy soils and sand dunes, where larvae of Therevidae can be quite abundant. Larvae of Therevidae have been recorded as predators of Coleoptera, Lepidoptera, Hymenoptera, and Diptera larvae (LYNEBORG & SPITZER 1974, LYNEBORG & IRWIN 1981, STUBBS & DRAKE 2001); but the ecological impact of Therevidae populations has not been examined in detail. In habitats where standing water is dramatically reduced in the summer months, collecting for Therevidae in streambeds is often productive, as adults tend to search for and congregate at the remaining pools. Malaise traps placed in and around waterways can provide an effective sampling method for Therevidae in riparian or forest habitats.

The following work on Therevidae is part of a series of papers to present the results of malaise trap sampling at the Mittelrhein (Rheintaunus Dörscheid (Roßstein)). Other papers cover Heteroptera (GÜNTHER & NIEHUIS 2002), Tephritidae (MERZ & NIEHUIS 2001), Tachinidae (TSCHORSNIG & NIEHUIS 2000, 2001), Stratiomyidae and Xylomyidae (HAUSER & NIEHUIS 2001) and several small insect families (GEISSEN & NIEHUIS 2001). These papers (and those in preparation on various families of Diptera, Hymenoptera and Coleoptera) are designed to enumerate and describe the insect fauna of the Middle Rhine and provide a detailed study of this xerothermic habitat, which is rare in Germany.

2. Materials and Methods

Specimens of Therevidae were collected from 06 May to 30 August, 2000, into alcohol using two malaise traps at Roßstein, Rheintaunus Dörscheid, and identified to species with reference to keys in the following works: LYNEBORG & SPITZER

(1974) for species of *Thereva* and LYNEBORG (1986) for the species of *Pandivirilia*. The reader is directed to these works for taxonomic information, including figures of diagnostic characters, concerning the species mentioned in this paper. Voucher specimens collected in this study are in the collection of the senior author, and several specimens collected during this study are providing data for a molecular phylogenetic study of *Thereva* in progress by HOLSTON.

Table 1: Sample abundance totals for the five species of Therevidae collected at Roßstein, Rheintaunus Dörscheid, with numbers of males and females for each species sorted by date of collection.

	Species/Collecting Date	06.V.-18.V.	18.V.-30.V.	30.V.-20.VI.	20.VI.-04.VII.	04.VII.-03.VIII.	03.VIII.-16.VIII.	16.VIII.-30.VIII.	30.VIII.-13.IX.
1)	*Pandivirilia caesia*, ♀			**1**					
	Pandivirilia caesia, ♂								
2)	*Thereva handlirschi*, ♀								
	Thereva handlirschi, ♂			**1**					
3)	*Thereva nobilitata*, ♀			**3**		**3**			
	Thereva nobilitata, ♂		**3**	**16**	**13**	**17**	**7**	**2**	
4)	*Thereva oculata*, ♀								
	Thereva oculata, ♂	**1**	**2**						
5)	*Thereva strigata*, ♀								
	Thereva strigata, ♂					**2**		**1**	

3. Results

3.1. Species List

Five species of Therevidae representing two genera, *Thereva* and *Pandivirilia*, were collected between 06 May – 30 August, 2000. Three specimens of *Thereva strigata* (FABRICIUS), two specimens of *T. oculata* EGGER, one specimen of *T. handlirschi* KRÖBER and one specimen of *Pandivirilia caesia* (MEIGEN) were collected; but the majority of the specimens (64 of 71 total specimens) were *T. nobilitata* (FABRICIUS) (Table 1.).

Comparison of the above list with a recent species checklist of Therevidae for Germany (BARKEMEYER 1999) and distribution summaries for species of Therevidae presented in the Catalogue of Palaearctic Diptera (LYNEBORG 1989) indicates that all five species of Therevidae collected during this study have been previously recorded for Germany.

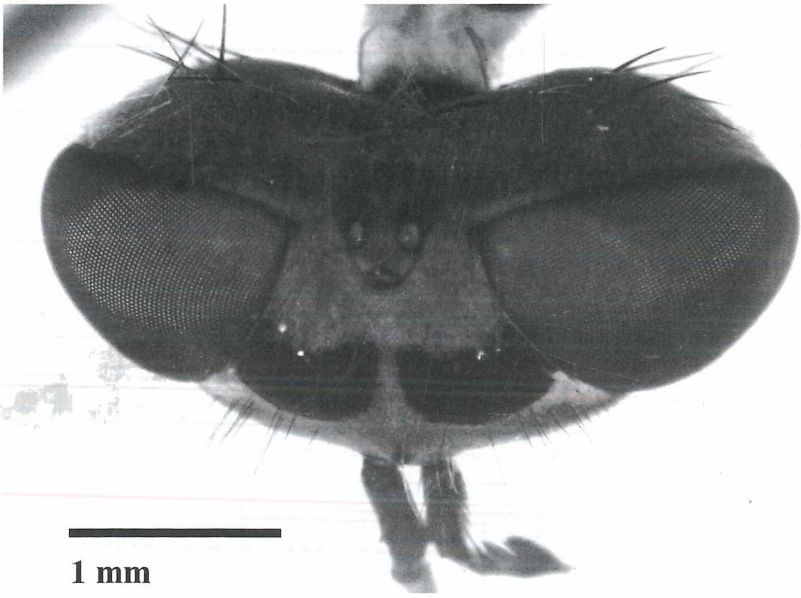

Figure 1. *Thereva oculata*, EGGER, dorsal view of head (female) showing the bipunctate frontal callus. Specimen preserved in alcohol from malaise trap sample collected at Roßstein, 18.V.-30.V.2000, leg. NIEHUIS. Photograph: K. C. HOLSTON.

3.2 Notes for Individual Species

Pandivirilia. – Species of *Pandivirilia* are associated with broadleaf forests of the Palaearctic and Nearctic (IRWIN & LYNEBORG 1981, LYNEBORG 1986), and larvae of *Pandivirilia melaleuca* (LOEW) have been collected from rotting logs in forests in England (STUBBS & DRAKE 2001).

1) *Pandivirilia caesia* (MEIGEN, 1838)

LYNEBORG (1986, 1989) noted that *P. caesia* is widely distributed in central and western Europe, including Germany, and LYNEBORG (1986) reported that this species has been collected from May to June.

Thereva. – All four species of *Thereva* collected during this study (and 15 additional central European *Thereva*) are identifiable using the key to the Czech *Thereva* fauna (LYNEBORG & SPITZER 1974). Species of *Thereva* are found in a variety of habitats, and many species of Palaearctic *Thereva* have distributions in Europe that encompass several biogeographic zones based plant distributions.

2) *Thereva handlirschi* KRÖBER, 1912

LYNEBORG & SPITZER (1974) reported its flight period as "July – September, maximum in August" and considered *T. handlirschi* a "eurytop, common species, widely distributed in Czechoslovakia on various biotops, especially in mixed and coniferous forests." Observational and experimental studies of *T. handlirschi* larvae suggested that larvae have a beneficial effect in forests due to their predatory ecology (LYNEBORG & SPITZER 1974).

3) *Thereva nobilitata* (FABRICIUS, 1775)

LYNEBORG & SPITZER (1974) reported the flight period of *T. nobilitata* as "July – September" and characterized its ecology as follows: "probably a oligotop – eurytop species, ecologically similar to *T. handlirschi* KRÖB., especially as to the bionomics of the predaceous larvae in forest soils." The abundance of *Thereva nobilitata* in the malaise trap samples is consistent with its apparent abundance across northern and central Europe, but the true abundance and distribution of *T. nobilitata* is obscured by misidentifications in collections (LYNEBORG & SPITZER 1974).

4) *Thereva oculata* EGGER, 1859

LYNEBORG & SPITZER (1974) considered *T. oculata* a "rare and very local species" and identify distribution records they were able to verify during their revision of Czech *Thereva*. These authors do not record *T. oculata* for Germany, and LYNEBORG (1989) similarly does not list Germany as part of this distribution in the 'Palaearctic Catalogue of Diptera'. In the recent checklist of Therevidae for Germany, however, *T. oculata* is included, based on published determinations in 1995 of Bavarian specimens by VON DER DUNK (Werner BARKENMEYER, pers. comm.). Six of these Bavarian specimens were examined by HOLSTON; they have been identified as females of *Thereva valida* LOEW, 1847 and have the following locality information: Nürnberg-Birkenlach (Reichswald), 1993 [2 females]; Nürnberg-Sulz (Reichswald), 1992 [2 females]; Nürnberg-Tiergarten (Reichswald), 1990 [1 female]; Hersbruck, 1992 [1 female]. Specimens from Bamburg and Nürnberg-Allersburg determined as *T. oculata* by VON DER DUNK (1995) were not examined. Collecting localities for specimens of *T. oculata* verified by LYNEBORG & SPITZER (1974) and HOLSTON (this study) are restricted, therefore, to localities in Austria, the Czech Republic, France, Germany (excluding Bavaria), Italy (see also LYNEBORG 1998), and Switzerland.

Distribution of *Thereva oculata* EGGER – AUSTRIA: Niederösterreich, Schneeburg (near Vienna)." CZECH REPUBLIC: Bohemia (Severočeský Kraj), Svádov; Moravia, Jílová. FRANCE: Basses-Alpes (Ardennes). GERMANY: Rheintaunus Dörscheid, Roßstein (Mittelrhein). ITALY: Sondrio, Bornio (near Sondrio). SWITZERLAND: Bern, Brünigen ("Voralpen"); Graubünden, Casaccia (Bregaglia); Solothurn, Gempen (Juras).

The single row of antereoventral (**av**) macrosetae on the hind femur is useful in distinguishing *T. oculata* from *T. nobilitata* and *T. unica* (HARRIS) [syn. *bipunctata*

MEIGEN, 1820], which have basal **av** macrosetae. The frontal callus of the female (Figure 1.) may be difficult to use for distinguishing among *Thereva* species due to the intraspecific variation (LYNEBORG & SPITZER 1974), but the two bare, slightly bulging areas of the frons in *T. oculata* are wide, similar to specimens of *T. unica*, but not do not form a narrow transverse band (or weakly separated band) as in *T. valida* or a single chordate (heart-shaped) medial spot as in *T. handlirschi*. Specimens of *T. valida* and *T. handlirschi* are darker in overall coloration than those of *T. oculata*, especially with regard to the abdominal pollinosity and infuscation of the wing membrane. A key to distinguish among these five species is presented below, and the reader is strongly encouraged to use keys of LYNEBORG & SPITZER (1974) for primary determinations of European *Thereva*.

Key for separating *Thereva handlirschi, T. nobilitata, T. oculata, T. valida, T. unica.*

1 Hind femur (f3) with 1-4 pv setae at base 2
– Hind femur (f3) without pv setae at base 3
2 Pile on gena and lower occiput white. Male: distiphallus hooklike (curved and abruptly upturned from wider base). Female: haltere knob brown, dark anterior region of tergites 2-3 not extended posteriorly into triangular medial wedge, wide and distinctly demarcated into bands ***unica* HARRIS**
– Pile on gena and lower occiput yellow. Male: distiphallus sinuate. Female: haltere knob yellow, dark anterior region of tergites 2-3 extended posteriorly into indistinctly demarcated triangular medial wedge . . . . . .***nobilitata* (FABRICIUS)**
3 Male: wing membrane brown infuscated, distiphallus with long tip angled posteriorly. Female: Dark anterior region of tergites 2-4 broad and distinctly demarcated into bands 4
– Male: wing membrane pale grayish-brown hyaline, distiphallus with short sinuate tip. Female: Dark anterior region of tergites 2-4 narrow and indistinctly demarcated into bands ***oculata* EGGER**
4 Abdominal pile pale yellow laterally (sparser than black medial pile). Female: frontal callus narrow transverse and bandlike, not extended toward ocellar triangle . . . . . .***valida* LOEW**
4 Abdominal pile orangish yellow laterally (denser than black medial pile). Female: frontal callus chordate, extending toward ocellar triangle . . . . . .***handlirschi* KRÖBER**

5) *Thereva strigata* (FABRICIUS, 1794)

LYNEBORG & SPITZER (1974) characterized *T. strigata* as an "oligotop species" with a flight period from May to August. They considered the species "widespread throughout Czechoslovakia, chiefly in lowlands, relatively common."

4. Discussion

The relative abundance of *T. nobilitata* among species of *Thereva* at Roßstein is generally consistent with its characterization as one of the most common European species of *Thereva* (LYNEBORG 1965, BARKENMEYER 1993, 1994, STUBBS & DRAKE 2001). Pinned Therevidae from unsorted malaise trap samples collected in the

state of Brandenburg near Eberswalde in a faunistic survey for the Deutsches Entomologisches Institut conducted by Frank BURGER, provide further support for this characterization (for details of this study, see TAEGER, 1995, and TAEGER & BLANK, 1995). From sites in Brandenburg, *Thereva cinifera* (MEIGEN) (n=205; 46 males, 159 females) and *T. valida* (n=90; 6 males, 84 females) were the most numerous species of Therevidae in malaise trap samples collected from July to August, 1994. Specimens of *T. nobilitata* (n=39; 2 males, 37 females), however, were present in numbers comparable to those in Roßstein samples and outnumber specimens of *T. handlirschi* (n=9; 1 male, 8 females), *T. plebeja* (n=16; 0 males, 16 females), *T. fulva* (n=2; 0 males, 2 females), and *T. marginula* (n=1; 0 males, 1 female) in Brandenburg. Sampling results from Roßstein confirm that *T. nobilitata* is a common species of Therevidae in Germany although sampling in Brandenburg suggests that the relative abundance of *T. nobiliata* is likely to be variable among sites in Germany.

Numbers of specimens in malaise trap samples indicate that females of Therevidae were caught in malaise traps more frequently than males. More females (n=58) than males (n=6) of *T. nobilitata* were collected at Roßstein. Similarly, in malaise trap samples from Brandenburg, female specimens of *T. cinifera, T. valida, T. nobilitata, T. handlirschi*, and *T. plebeja* were more numerous than males. A male-skewed bias in sex ratio in malaise traps, however, has been recorded for *Stenogephyra torrida* LYNEBORG, 1987, and *Phycus niger* KRÖBER, 1929, two species of Phycini (Therevidae, Phycinae) collected during a 12-month period in Namibia (IRWIN 2001). Field observations of *T. strigata* in Spain revealed that males formed leks on boulders, from which they intercept passing conspecifics in flight. Similar lekking behavior has been observed for other species of Therevinae (e.g., males of *Acrosathe* on open sand; HOLSTON, unpublished data) and species of Agaophytinae (e.g., males of *Agapophytus* on eucalypt trunks; WINTERTON, WIEGMANN & IRWIN 2001). Species of Phycini, unlike Therevinae and Agapohpytinae, have not been observed forming leks. Males of *S. torrida* and *P. niger* are thought to search actively for females, which could account for the higher numbers of males than females in malaise trap samples (IRWIN 2001). If the sex ratio for *T. nobilitata* at Roßstein is assumed to be 1 to 1, the greater abundance of females in the trap samples may be attributable to female-specific use of habitat near the malaise trap (e.g., for oviposition sites) and/or to trivial movement patterns that cause females to be intercepted more frequently than males.

Due to the low number of specimens collected from Roßstein and few comparative data from other sites in Germany, additional observations are limited to a few remarks. The presence of *T. oculata*, an uncommon species, in these malaise trap samples suggests that the habitat at Roßstein may provide clues to its presence elsewhere in Germany and Europe. Efforts to improve distributional summaries for *T. oculata* by sampling additional sites in Europe should incorporate factors of habitat specificity (e.g., altitude, temperature, rainfall, soil type) similar to those at Roßstein and other locali-

ties in Europe mentioned above. Further study of the *T. oculata* in Europe is necessary, however, before conclusions can be made concerning the distribution and status of this species in Germany. Combining the strategy of long-term malaise trap sampling used during this study with hand netting and, especially, sifting larvae from various microhabitat substrata is suggested for further studies of the taxonomic diversity and ecology of European Therevidae.

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