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Publisher: Taylor & Francis

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Journal of Natural History

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/tnah20>

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Published online: 21 Feb 2007.

To cite this article: Henri M. André (2005) In search of the true Tydeus (Acari, Tydeidae), Journal of Natural History, 39:13, 975-1001, DOI: [10.1080/00222930400002838](https://doi.org/10.1080/00222930400002838)

To link to this article: <http://dx.doi.org/10.1080/00222930400002838>

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In search of the true *Tydeus* (Acari, Tydeidae)

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(Accepted 6 April 2004)

Abstract

The early history of the genus *Tydeus*, the type genus of the family Tydeidae, is complex and convoluted and, subsequently, even the identity of the type species of the family remains unclear. First, the literature is thoroughly analysed and morphological characters of some species are reappraised. After studying Oudemans' types, two *species inquirendae*, *Tydeus croceus* and *T. cruciatus*, are redescribed and a third, *T. spathulatus*, removed from synonymy and reinstated as a valid species. A fourth species, confused with *T. spathulatus*, is described. A lectotype is designated for *T. spathulatus* and a neotype for *T. croceus*. After discussion, the genus *Lorryia* Oudemans, 1925 is re-established in its pristine state. As the redescribed species were designated as type species by Oudemans, the following new generic synonymies are proposed: *Raphitydeus* Thor, 1933 and *Lorryia* Oudemans, 1925 *sensu* Kaźmierski (1989, 1998) are junior synonyms of *Brachytydeus* Thor, 1931; *Homeotydeus* André, 1980 (*partim*) and *Pseudolorryia* Kaźmierski, 1989 are junior synonyms of *Calotydeus* Oudemans, 1937; *Brachytydeus* Thor, 1933 (*partim*), *Calotydeus* Oudemans, 1937 (*partim*), *Tydeus* Koch, 1836 *sensu* Oudemans, 1937 (*partim*), *Orthotydeus* André, 1980, and *Tydeus* Koch, 1836 *sensu* Kaźmierski, 1989 are junior synonyms of *Tydeus* Koch, 1836. To stabilize the usage of the names, especially that of the genus type of the family Tydeidae, the International Commission of Zoological Nomenclature will be asked to set aside all previous type species designations for *Tydeus* and to designate *Tydeus spathulatus* as the type species, with Oudemans' specimens from Italy as primary type material.

Keywords: *Acari*, *Tydeus*, *Lectotype*, *neotype*, *redescription*, *species inquirenda*, *species nova*, *synonymy*, *taxonomy*, *type species*

Introduction

The early history of the genus *Tydeus*, the type genus of the family Tydeidae, is complex and convoluted. It is probably no coincidence that the few monographs devoted to the entire family did not mention a type species (Thor 1933; André 1980) or cited a “wrong” species (Vitzthum 1941; Baker 1965). The genus *Lorryia*, often said to be “mysterious”, has also had several avatars. The type specimens of no less than four type species have been lost: *Tydeus mutabilis* Koch, the type species of the genus designated by Koch (1842); Koch's *Tydeus croceus*, renamed by Oudemans *Tydeus kochi* and considered to be, according to the rules of the Code of Zoological Nomenclature, the type species of the genus; *Acarus*

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ISSN 0022-2933 print/ISSN 1464-5262 online © 2005 Taylor & Francis Ltd

DOI: 10.1080/00222930400002838

croceus L., the type species of *Calotydeus* designated by Oudemans (1937); and last, *Lorryia superba* Oudemans, the type species of the genus by original designation. The genus *Ereynetes* Berlese, the type genus of the sister family Ereynetidae, experienced a similar history until Fain (1964) studied the Berlese collection in detail.

Furthermore, two nomenclatural systems coexist, my own (André 1980) and that of Kaźmierski (1989), which generates nomenclatural “instability” (Momen and Lundqvist 1995, p 42). Many people are disconcerted by the current confusion in species nomenclature and do not know when to use generic names as familiar as *Lorryia* and *Tydeus* (e.g. O'Donnell 1999; Lundqvist 1999; Lee 2001). A thorough analysis of the past literature and the study of key species from the Oudemans' collection housed in the National Museum of Natural History, Leiden, were a prerequisite to resolve some of these problems and to fix the identity of the type genus of the family Tydeidae.

Material and methods

Material

Oldest available type species and specimens were sought and requested on loan. Some specimens from the Oudemans' collection were selected and redescribed. As summarized by Eynhoven (1944), Oudemans described two new tydeine genera, *Calotydeus* with *Acarus croceus* L. as type species and *Tectotydeus* with *T. demeyeri* as type species, as well as eight new species assigned to the genus *Tydeus*. The scope of this study will be restricted to the available species listed in Table I.

Oudemans' collection includes four slides of *Tydeus croceus* Linnaeus. They all bear a small white label with the printed data “Museum Leiden/Verz. A. C. Oudemans/Cat. No.” followed by a handwritten number varying from one to four. This number will serve as an identification number in the following comments. The first slide bore two handwritten labels “*Tydeus croceus*/(L. 1758)/Nymphae; ♀/dors. Vent./neotype/Glyc. gel. 3637” and “*Salix/viminalis*/21 Juni 1927/Arnhem/Oudemans.” The three other slides bore red labels, also with handwritten comments. The left labels indicated the name of the species, the stase (nymph or female) and the note “Faure 3897”. The right labels read “op roggearen/Nerderoostenrijk/Sept. 1928/Dr. Fulmek” (with variants of the locality name). The last three slides corresponded to the material described by Oudemans (1928b, p 377).

The first slide of *Tydeus croceus*, designated as neotype, contained seven specimens collected on willow, among which were two adults (based on size). All were mounted in dorsal view, except for a female, and were full of opaque granules which made it difficult to observe the striation pattern and to study the dorsal and ventral faces of specimens using transmitted light. Slides nos 3 and 4 contained, each, four specimens. They were unfortunately difficult to study due to air inclusions under the coverslip, the presence of granules or the fact they were quite shrivelled. It was, however, possible to infer the striation pattern and to see the two eyespots in specimens of slide no. 4. Slide no. 2 contained tens of specimens, again quite shrivelled. It was decided, with the curator's permission, to remount slide nos 1 and 2, after study in a concavity slide. Prior to study, specimens were swollen in warm lactic acid as advised by Oudemans (1929c, p 19). This way, a total of 53 specimens from ears of *Secale cereale* (rye) and the seven specimens from willow were remounted separately (from rye: three males, two females, one tritonymph and 47 deutonymphs; from willow: one adult, too opaque to determine the sex, one female, and five deutonymphs).

Table I. Synoptic presentation of the discussed species with their successive generic assignments (type species designated in publications are underlined and marked with an asterisk; the numbers between brackets refer to homonymous species).

Authors	Species with successive generic assignments									
Linnaeus, 1758				<u>Acarus croceus</u> n.sp. on Salix						<u>Tetranychus</u> <u>caudatus</u> n.sp.
Dugès, 1834										
Koch, 1836 1838 1842					<u>Tydeus</u> n.g. <u>croceus</u>		<u>velox</u> n.sp.	<u>cruciatus</u> n.sp.	<u>mutabilis</u> n.sp. <u>mutabilis</u> *	
Oudemans, 1914 1928b 1929b	<u>Tydeus</u>	(1) <u>croceus</u>	(2) <u>croceus</u>	(3) <u>kochi</u> n. sp.						
Thor, 1931								<u>Brachytydeus</u> n.g. <u>cruciatus</u> *		
Thor, 1933	<u>Tydeus</u> <u>demeyerei</u>		<u>croceus</u>	<u>kochi</u>		<u>velox</u>		<u>Brachytydeus</u> <u>cruciatus</u> *	<u>mutabilis</u>	<u>caudatus</u> j.syn. <u>croceus</u> j.syn. <u>spathulatus</u>
Oudemans, 1937	<u>Tectotydeus</u> n.g. <u>demeyerei</u> *			<u>Calotydeus</u> n.g. <u>croceus</u> *	<u>kochi</u>	<u>velox</u>		<u>Tydeus</u> <u>cruciatus</u>	<u>mutabilis</u> *	<u>caudatus</u>
Vitzthum, 1941				<u>Tydeus</u> <u>kochi</u> *				<u>Brachytydeus</u> <u>cruciatus</u> *		
Baker & Wharton, 1952	<u>Tydeus</u> <u>demeyerei</u>		<u>croceus</u>	(1) <u>kochi</u> *		<u>velox</u>		<u>cruciatus</u>	<u>mutabilis</u>	<u>caudatus</u>
Baker, 1970	<u>Tydeus</u> (<u>Tydeus</u>)			(2) <u>kochi</u> *						<u>caudatus</u> j.syn. <u>croceus</u>
Castagnoli, 1984					<u>Orthotydeus</u> <u>kochi</u>					
Recent assignments										
André's system	-	<u>Orthotydeus</u>	<u>Orthotydeus</u> ?	<u>Homeotydeus</u>	<u>Orthotydeus</u> ?	<u>Orthotydeus</u>	?	<u>Tydeus</u>	?	<u>Orthotydeus</u>
Kazmierki's system	-	<u>Tydeus</u>	<u>Tydeus</u> ?	<u>Pseudoloryia</u>	<u>Tydeus</u> ?	<u>Tydeus</u>	?	<u>Lorryia</u>	?	<u>Tydeus</u>
This work	Not a Tydeinae	<u>Tydeus</u>	<u>Tydeus</u> ?	<u>Calotydeus</u>	<u>Tydeus</u> ?	<u>Tydeus</u>	?	<u>Brachytydeus</u>	?	<u>Tydeus</u>
Types	available	available	lost	available	lost	available	lost	available	lost	lost
Current status	valid	valid	j. synonym?	valid	valid	n. sp.	?	valid	?	valid
Clublike setae	?	6	3	0	≥ 2	0	0	0	0	3

The only slide of *Tydeus demeyeri* bore two handwritten labels. The left one indicated “Tydeus/demeyerei/Oudemans. 1929./♀/Faure” and the right one “Plecotus/auritus/Bodegraven/VIII.1892/J. C. H. de Meyere”.

Oudemans’ collection included only a single slide of *Tydeus cruciatus*. It was labelled on the left slide “Tydeus/cruciatu/s/ C. L.Koch 1838./Faure 2951” and on the right side “In mos/Arnhem/10.II.1904/K. W. Dam-/merman”, all data are handwritten. The label data correspond to that published by Oudemans (1929b, p 477). Although legs were quite shrivelled, it was however possible to describe the chaetotaxy.

Oudemans’ collection included three slides of *Tydeus spathulatus*. The type slide bore two handwritten labels, on the left: “Tydeus/spathulatus/Oudms 1928/dors. Vent/typen/3898” and on the right: “op bladeren/Padova/1883/Prof. Dr. A./Berlese”. These labels correspond to data given in the original description. The type slide included 12 specimens in bad state that were remounted for study. The second slide with two specimens bore also two handwritten labels, on the left: “Tydeus/spathulatus/Oudemans. 1928/♀ dors. vent./Faure”, and on the right: “Fagus/silvatica/Renkum./8.VIII.1930/Oudemans.” The third slide with five specimens bore also two handwritten labels, on the left: “Tydeus/spathulatus/Oudemans. 1928”, and on the right: “Castanea/sativa/Renkum bij/Arnhem/9.VIII.1930/Oudemans.” The five specimens, again shrivelled, were remounted separately.

Methods

Important information published in the first half of the last century or earlier has been overlooked and/or misinterpreted in recent literature. Misidentifications and synonymies proposed without revising the type material have made the situation still more puzzling. Therefore, an extensive overview of the literature was undertaken and all papers cited were read and cross-referenced.

For the (re)descriptions of Oudemans’ slides, I used photographs taken with a Leica TC200 digital camera mounted on a Leica DM LB microscope equipped with phase contrast. Some photographs were combined with the Auto-montage program (version 3.03.0103 by Synoptics Ltd) as explained in André and Ducarme (2003). This program automatically combines the in-focus regions from a series of source images each at a different point of focus, to generate a single montaged image, which tends to be completely in focus.

The history of the genus *Tydeus*

The genus *Tydeus* was created by Koch (1836) for two species, *T. velox* and *T. croceus*. The former species was attributed to Linnaeus (1758) while the latter was new. The type species was subsequently designated in 1842 when Koch selected *T. mutabilis* Koch, 1838 as the type species of the genus (see Table I for a synoptic presentation). Whatever the uncertainty as for the publication dates, it is clear that (1) Koch did not designate a type species in his original description of the genus *Tydeus*, (2) his designation of a type species is posterior to his description of the genus, and (3) his subsequent designation of a type species is not valid according the International Code of Zoological Nomenclature. Indeed, this designation does not conform to article 69, which stipulates that only originally included nominal species are eligible for subsequent fixation as type species. As *T. mutabilis* was not part of the originally included nominal species, it is not a valid type species for the genus *Tydeus*.

Oudemans' publications required a thorough analysis as he referred to three species under the name *croceus* and changed his interpretation of Linnaeus' species. Oudemans (1914, p 122–123) described first a *Tydeus croceus* collected from a mole's nest. This first *croceus* had spatulate setae (Oudemans 1914, Plate XII, Figures 7–10). Subsequently, Oudemans (1926, p 122) admitted that Koch's *croceus* was the same species as that proposed by Linnaeus ("blijkbaar dezelfde"). However, Oudemans (1928b) changed his mind later when he rediscovered a second *croceus* on the same host tree (a willow) as that recorded by Linnaeus. He then observed that Linnaeus' species had no spatulate setae and thus differed from his own *croceus* described in 1914 and from Koch's *croceus* (the third *croceus* treated by Oudemans) that were both described as having short spatulate setae at the tip of the opisthosoma. Accordingly, he renamed the last species, *Tydeus kochi* (Oudemans 1928b, p 378). The second *croceus*, that found by Oudemans on *Salix* and supposed to be the real *croceus*, was redescribed in detail by Thor (1932) while the first one, that collected from a mole's nest, was synonymized with *caudatus* by Thor (1933, p 38).

Thor (1933), in the only comprehensive review of Tydeidae preceding that of Baker (1965), listed a type species for all the tydeid genera, but the genus *Tydeus*. This omission is probably explained by his transfer of the species *mutabilis*—the type species of *Tydeus* then recognized—to the genus *Brachytydeus* Thor, 1931, the type of which was *Tydeus cruciatus* Koch, 1838. The difference between the two genera, *Tydeus* and *Brachytydeus*, was tenuous: the latter genus was just characterized by a short and large body, with short and relatively thick legs.

The confusion was removed by Oudemans (1937, p 922) in his "Kritisch historisch Overzicht der Acarologie". Oudemans correctly observed that, if *mutabilis* belonged to the genus *Brachytydeus*, then *Brachytydeus* was a junior synonym of *Tydeus*. The latter genus comprised then the type species *mutabilis*, plus some others such as *cruciatus* and *caudatus*. As for the species erroneously included in the genus *Tydeus* by Thor (1933), Oudemans (1937) proposed to keep them together in a new genus named *Calotydeus*. Except on a minor point, Oudemans did not question the classification and diagnostic characters proposed by his predecessor but merely corrected the names he had misused. So renamed, the new genus was thus characterized by having a short body, with short and relatively thick legs. The new genus is valid as it satisfies Article 13 of the code, specifically Article 13a(ii) (bibliographic reference to a published statement with differentiating characters) and 13b (designation of a type species). The single classification difference between the two authors was the creation by Oudemans of a new genus, *Tectotydeus*, with a single species, *demeyeri*.

Strictly speaking, Vitzthum (1941) did not review the Tydeidae. He merely proposed a list of genera with type species, with neither comment nor explanation. Of the above-mentioned genera, he retained only two names: *Tydeus* and *Brachytydeus*. For the latter genus, he followed Thor (1933) and cited his *cruciatus* as type species. In contrast, Vitzthum proposed, with no explanation, a new type for the former genus and, for the first time, Koch's *croceus* (*non* *Acarus croceus* Linnaeus, 1758), was considered to be the type species of the genus *Tydeus*.

Baker and Wharton (1952, p 192) found that the Tydeidae had "been divided in the past into too many genera" and proposed a new classification "believed to be more correct and simpler". They first synonymized, with no explanation, a batch of genera (*Microtydeus* Thor, 1931; *Brachytydeus* Thor, 1931; *Melanotydaeus* Berlese, 1910; *Stylotydeus* Thor, 1933; *Lasiotydaeus* Berlese, 1908; *Calotydeus* Oudemans, 1937, and *Tectotydeus* Oudemans, 1937) with *Tydeus* Koch. Let us note that the genus *Brachytydeus* had already been considered a synonym of *Tydeus* by Oudemans (1937), and that the genera *Lasiotydaeus*

and *Microtydeus* are so different from *Tydeus* that they were subsequently placed in a family different from Tydeidae (André and Fain 2000). Next, Baker and Wharton (1952) designated, again with no explanation or reference to Vitzthum (1941), a type species for *Tydeus*, namely *Tydeus kochi* Oudemans, 1928 (= *Tydeus croceus* Koch, 1836 (*non* *Acarus croceus* Linnaeus, 1758)).

In his monograph on Tydeidae, Baker (1965) restored the genera *Lasiotydaeus* and *Microtydeus* but kept the other synonymies proposed previously by Baker and Wharton (1952), as well as *Tydeus kochi* as the type species of the genus. Disregarding Koch's (1842) designation and Oudemans' (1937, p 922) comments, Baker (1965, p 100) explained that the type was originally designated as *Tydeus croceus* (Linnaeus). He also added that Oudemans, in his *Kritisch Historisch*, had argued that *croceus* of Linnaeus was not a tydeid, and renamed the type *Tydeus kochi*. I have been unable to locate such statements in Oudemans' opus. *Acarus croceus* L. 1758 was recognized first as a *Tydeus* by Oudemans (1914, p 122; 1926, p 122; 1929a, p 252) then as a *Calotydeus* by Oudemans (1937, p 931). Lastly, as already reported, Oudemans (1937, p 922) clearly recognized *T. mutabilis* as the type species of the genus *Tydeus* while *Acarus croceus* L. 1758 was designated as type species of his new genus *Calotydeus*. Eynhoven (1944, p 49) confirmed the latter designation.

For the first time, Baker (1965) gave a description of the genus *Tydeus* including the leg chaetotaxy. His description was however based on a new species, *Tydeus tuttlei*, collected from grass in Arizona. There is no evidence that the chaetotaxy specified by Baker (1965) corresponds to that of the type species or any other *Tydeus* species described by Oudemans.

In his revision of the genus *Tydeus*, Baker (1970) explained for the first time the choice of *T. kochi* as the type species and implicitly referred to the International Code of Zoological Nomenclature governing the eligibility of species for type fixation (especially Article 69 of the current edition). He repeated his previous history of Oudemans' arguments and even added that Thor (1933) listed *croceus* as the type species, which is incorrect (see above). Again, Baker (1970) defined the genus by its leg chaetotaxy. Furthermore, he divided the genus into three subgenera based on the number of genital setae, six pairs in the nominotypical subgenus, five pairs in *Pertydeus* André and Naudo, and four pairs in a new subgenus, *Afrotydeus*.

Lastly, Baker (1970, p 173), subsequently followed by Kuznetsov and Livshitz (1973, p 47) and Castagnoli (1984, p 309), published the two synonymies already proposed by Thor (1933, p 38): Oudemans' (1914) *croceus* and *T. spathulatus* Oudemans, 1928 were both junior synonyms of Dugès' (1834) *caudatus*. Of course, the first synonym did not pertain to the other Oudemans' *croceus*, namely the type species of *Calotydeus*, which was mentioned neither by Baker (1970) nor by Kuznetsov and Livshitz (1973). This indistinctness is probably the source of the statement that the real *T. croceus* L. mentioned by Oudemans was identified by Baker (1970) as Dugès' *Tydeus caudatus* (Kaźmierski, 1989, p 290).

In the absence of any evidence on the identity of the type species, André (1980) did not refer to *Tydeus* Koch, but rather to *Tydeus* Koch *sensu* Baker, and accordingly refrained from mentioning a type species. However, he made two errors. Indeed, his leg chaetotaxy differed in two points from that given by Baker (1965, 1970). First, he mentioned four setae on tibia I versus three in Baker's publications. This difference is not an error and is explained by the fact that Baker had not seen the small famulus, *k''*, present on that podomere. The second discrepancy is more serious as he cited three setae on femur II versus two in Baker's publications. The last error made by André is the omission of the

subgenus *Afrotydeus*. To be consistent, he should have raised this subgenus to the generic rank as done with *Eotydeus* and *Pertydeus*.

Kaźmierski (1989) aimed at redefining precisely the identity of the genus *Tydeus*. Unfortunately, he did not revise Oudemans' types and at the same time perpetuated several errors made in or originating from Baker's (1965, 1970) revisions. Indeed, Kaźmierski (1989, p 290) referring to Baker (1965) stated that the femoral pattern (3-2-1-1) was given as typical for *Tydeus* and the type species, *Tydeus kochi* Oudemans. As already mentioned, Baker's description was based on an American species and there is no evidence that the chaetotaxy specified by Baker corresponded to that of the type species or any other *Tydeus* described by Oudemans.

More serious, the specimens identified as *kochi* by Baker (1970) surely belong to another species. Indeed, Oudemans (1928b, p 377), quoting Koch, wrote about *T. croceus* L.: "En nu blijkt mij, dat deze niet identiek is aan *Tydeus croceus* C. L. KOCH 1836, 4, 12., die 'an der Stelle der Hinterrandswinkel eine etwas kolbige kurze Borste' besitzt" ("And now, it appears to me that it is not identical to *Tydeus croceus* C. L. KOCH 1836, 4, 12., which has 'a short and somewhat clubbed setae at the corner of the posterior edge'"). The presence of clavate setae in *T. kochi* was illustrated in Koch's drawing reproduced by Oudemans (1937, p 933, Figure 447) and was confirmed by Thor (1933, p 19) who stated "...indem sowohl die Schulterhaare als auch die beide Haarpaare des hinteren Korperrandes kurz und kolbig (oder spatelförmig) verdickt sind" ("...while the shoulder setae as well as the two pairs of setae at the posterior edge of the body thicken and are short and clubbed (or spatulate)"). There are no clavate setae in species identified as *T. kochi* by Baker (1970, p 170-171, Figure 26), Castagnoli (1984, p 308), and Momen and Sinha (1991, p 1227, Figure 1) and the character has not been mentioned in recent identification keys (Kaźmierski 1998, p 342-343). The misidentification of *kochi* is the second error in Kaźmierski's (1989) revision.

A third misinterpretation in Kaźmierski's (1989, p 290) analysis arose from confusion between the first two Oudemans' *croceus*. If Oudemans' (1914) *croceus* is indeed a junior synonym of Dugès' *caudatus* (Thor 1933, p 38; Baker 1970, p 173), then the one commented upon by Oudemans (1928) and illustrated by Thor (1932) is quite distinct and should not be confused with Dugès' species which has spatulate setae and a different femoral formula.

The history of the genus *Lorryia*

The genus *Lorryia* was created by Oudemans (1925) with *L. superba* as the type species. The description of the genus took only one line: "*Lorryia*=*Tydeus* met ééne klauw aan elken poot !" which means "*Lorryia*=*Tydeus* with one claw to each leg".

The description of the type species was slightly longer: "*Tijdeus*-vormig; scheidlinslijn en oogen zeer duidelijk; huid netvormig geteekend; haren ongeveer zoo lang als femur I, zeer dun, nauwelijks knotsvorming eindigend. Pooten als bij *Bdella* fijn dwarsgestreept. Op *Viverra* sp. (stellig daarop verdwaald). Ambon; III. 1923". The translation is: "*Tijdeus*-like; suture line and eyes very evident; skin with a reticulation pattern; setae about as long as femur I, very thin, slightly expanded distally. Legs thinly and transversally striated as in *Bdella*. On *Viverra* sp. (definitely lost). Ambon; III. 1923".

Oudemans (1928a, p 229-232) confirmed that the genus *Lorryia* was unique in having only one claw whereas all the other related species had two claws. He gave a detailed description of *Lorryia superba* (two pages with nine figures), and illustrated the presence of

the empodium in a special drawing (his Figure 102). Figure 102 has never subsequently been reproduced in contrast to his Figure 96, which represented a dorsal view of the entire animal and was reproduced later by Thor (1933, p 55). Figure 96 is critical in the sense that only one claw is visible on each leg. The leg chaetotaxy was partly described in the text: I(3-1-2-1-?), II(2-1-2-1-?), III (1-1-1-1-?), IV(1-1-1-?-?). Apparently, Oudemans wanted more to describe the shape of some characteristic setae than to enumerate them. The chaetotaxy represented on the drawings was slightly richer: I(5-3-3-3-1), II(5-2-2-3-0), III(3-2-1-2-1), IV(3-1-1-1-0). The formula is obtained by adding the setae drawn on two figures, Figures 96 (dorsal view) and 98 (ventral view). This supposes that Oudemans was able to distinguish between dorsal and ventral setae, which is not necessarily true since he was unable to distinguish the two claws on each leg (see below). Lastly, there are some discrepancies between the text and the figures: for instance, Oudemans wrote specifically “tibiae III en IV en tarsi III en IV ieder met een borstel” (“tibiae III and IV and tarsi III and IV each with one seta”) while he drew two on tibia III, only one on tibia IV, and three on tarsi III and IV.

In his description of *Tydeus reticulatus*, Oudemans (1928b, p 380) confirmed the presence of only one claw in *Lorryia superba*: “*Tydeus reticulatus* nov. spec. Gelijkt sprekend op *Lorryia superba*, door mij beschreven in Ent. Ber. v. 7. n. 146. 1925. p. 33, maar alle tarsen met 2 klauwen”. The translation is: “*Tydeus reticulatus* nov. spec. closely related to *Lorryia superba*, described by me in Ent. Ber. v. 7. n. 146. 1925. p. 33, but all tarsi with two claws”.

After various observations, Oudemans (1929a, p 481) became aware that he might have confused two adjacent structures and changed his mind. He was then convinced that the two claws were compressed against each other during the mounting process and wrote: “En ik ben er nu van overtuigd, dat *Lorryia superba* twee klauwen heeft, al kan ik dat niet bewijzen; daartoe zou het preparaat geopend en een der pooten sterk gecompriimeerd moeten worden”. The translation is: “I am now convinced that *Lorryia superba* has two claws but I cannot prove it; to do so, I should open the preparation, and one of the legs should be strongly compressed”. Oudemans (1929a, p 481) concluded “Op die gronden wensch ik de diagnose van het genus *Lorryia* te wijzingen als volgt : als *Tydeus*, maar dorsaal met geheel, of gedeeltelijk netvormige structuur. Type blijft *superba* OUDMS. 1925. Voeg daarbij: *reticulatus* OUDMS. 1928, *pulcher* OUDMS. 1929, *mali* OUDMS. 1929, *concinus* OUDMS. 1929.” The translation is: “On this basis, I wish to modify the diagnosis of the genus *Lorryia* as follows: as *Tydeus*, but dorsally with entirely or partly reticulated pattern. The type remains *superba* OUDMS. 1925. Are added: *reticulatus* OUDMS. 1928, *pulcher* OUDMS. 1929, *mali* OUDMS. 1929, *concinus* OUDMS. 1929.” This correction has apparently been overlooked in all subsequent publications but that of Thor (1933).

Thor (1933, p 53–54) followed the new definition of the genus published by Oudemans (1929a, p 481) but stated “Beine (Fig. 8) mittellang, quergestreift, in Präparat anscheinend nur mit je einer Krallen”. The translation is: “Legs of middle length, transversally striated, in preparation apparently with only one claw”. Thor reproduced Oudemans’s figure (with only one claw) but, unfortunately, did not include his discussion, hence the importance of the word “anscheinend” (apparently). Subsequent acarologists who did not master German and had only Figure 1 at their disposal have probably overlooked this word. Finally, Thor divided the genus into two subgenera: *Raphitydeus*, with double striae, trichobothridia distally blunt and no eyes visible, and *Lorryia* with simple striae, simple trichobothridia and eyes easily visible.

Baker (1944) noted that some *Lorryia* species shared characters belonging to both subgenera and decided to synonymize them. Later, he introduced the use of chaetotaxy in the family, especially that of legs (Baker 1965). He maintained the past definition of the genus *Lorryia* based on the integument reticulation and proposed three informal groups of species based on the leg chaetotaxy.

In his revision of the genus *Lorryia*, Baker (1968, p 986) commented on Oudemans' figure and the presence of only one claw in the type species and even speculated what would happen if Oudemans' figure was correct. Apparently, Baker was unaware of Oudemans' (1929a) discussion, or more probably did not understand Dutch. As the type species of the genus remained enigmatic, Baker (1968) decided to interpret the genus on the basis of his 1965 revision.

André (1980) observed that most *Lorryia* species had the same chaetotaxy as the genus *Tydeus*, as it was defined by Baker (1965). Accordingly, he decided to synonymize *Lorryia* with *Tydeus* and created new genera for the few species that had a different chaetotaxy.

Kaźmierski (1989) again commented on the apparent point that *Lorryia superba* was a "mysterious" species due to the presence of one claw only on each apotele. He however added that the leg chaetotaxy was "perfectly shown in the drawing by Oudemans (1928a)" and concluded that it was the same as in *Tydeus* Koch *sensu* André. This conclusion is surprising as the chaetotaxy of Oudemans' figure is obviously incomplete: I have never seen a tydeoid specimen with only three setae on tarsi III and IV, even in the most specialized parasitic species such as the Speleognathinae. Last, the chaetotaxy given by Oudemans (1928a, Figures 96, 98; text on p 231) does not correspond to that of *Tydeus* as published by Baker (1965) and accepted by André (1980): tibia IV bears two setae in *Tydeus* but only one according to the drawings and text published on *Lorryia superba* by Oudemans (1928a).

Species characters

A discussion of diagnostic characters useful for recognizing tydeid genera was recently published by André and Fain (2000). Other characters are used at the species level (e.g. the size, shape and length of setae), some of them are briefly discussed later.

Double or simple striation

The striation type, simple versus double, was proposed by Thor (1933, p 53) to separate the two subgenera: *Raphitydeus* with double striae ("doppelte Linien") and *Lorryia* with simple striae ("einfachen Linien"). Surprisingly, this character has never been discussed since, either to be rejected, or to be adopted.

Double versus simple striae are also observed in Tydeinae without the reticulation pattern found in the two above-mentioned subgenera. However, this difference results from an artifact due to differential pressure exerted on specimens during the mounting process. The stronger the pressure, the flatter the specimen and the striae which appear to be double. The two types may be seen in the same species (Figure 1) and sometimes on the same individual depending on the relief of the specimen. Therefore, this character must be rejected for species identification.

Figure 1. Prodorsum of two specimens of *Tydeus goetzi* showing the two types of striae, simple (A) and double (B). In both specimens, the number of striae between setae (vi) amounts to 23. Note that the circular bases around the setae are not taken into account to estimate $NS(vi)$.

Striation pattern on genital lips

The striation pattern (aside from reticulation) as a diagnostic feature was first proposed by Baker (1965) to separate tydeid genera. For instance, the genus *Paralorryia* created by Baker (1965) was unique in having the striae between the second pair of opisthosomal setae transverse and not longitudinal. The genus was later synonymized but it is still customary to refer to a *Paralorryia*-type striation. The system was refined by Kaźmierski (1998, Figure 5). Later, the ventral striation pattern has been occasionally used to recognize species. However, the striation pattern on genital lips has never been considered, although it is similar in some ways to a fingerprint (Figure 2). Even if some intraspecific variability seems to exist, the character might be useful to discriminate between species. Basically, two patterns have been found in females. In the extended type, the striae perpendicular to the genital aperture extend from the aperture to the aggenital area, thus well beyond the genital setae (Figure 2A, B). In the compact type, the transverse striae are much shorter and do not extend beyond the genital setae (Figure 2C, D). This distinction does not apply to males which have longitudinal striae on genital lips.

Striae density

The striation pattern is often homogeneous within a given genus. However, two species with the same striation pattern may have different striae density. The number of striae between the two anterior prodorsal setae, $NS(vi)$, may provide an estimate of striation density that is easy to evaluate (Figure 3). In the species illustrated in Figure 1, this number is 23 in both specimens. Depending on the species, $NS(vi)$ may vary from 12 to 29.

Figure 2. The two types of genital striation pattern, extended (A, B) and compact (C, D). (A) *Tydeus croceus*; (B) *T. cruciatus*; (C) *T. spathulatus*; (D) *T. nieuwerkerkeni*. Scale bar: 10 μm .

The striae density on the ventral face may be estimated through the number of striae between epimeral setae at the level of coxae III. In this area, striae are often longitudinal and more or less dense (Figure 4; see also the drawings by Kaźmierski 1989, 1998). Depending on species, $\text{NS}(\text{ep})$ was found to vary from 18 to 36.

Figure 3. Striae density on prodorsum in *Tydeus croceus* (A), *T. cruciatus* (B), *T. nieuwerkerkeni* (C) and *T. spathulatus* (D). NS(vi)=28, 22, 27 and 26, respectively. Scale bar: 10 μ m.

Shape of setae

The shape of setae, especially those at the posterior margin of the body, may vary between species but the terminology is very confusing. Terminal setae in *Tydeus caudatus* were said to be spatulate by Baker (1970, p 173) and Castagnoli (1984, p 309). Kaźmierski (1998, p 343) distinguished several subtypes, such as spatulate clavate or simply spatulate setae.

Here, I will refer to serrate setae (the usual shape) and to spatulate, clavate and lanceolate setae. Smooth (Figure 5B) and serrate (Figure 5A) setae present a radial symmetry while the others have a bilateral symmetry.

Figure 4. Striae density on the 3rd intercoxal area in *Tydeus spathulatus* (A), *T. cruciatus* (B) and *T. spathulatus* (C). NS(ep)=36, 18, 32, respectively. Scale bar: 10 μ m.

Figure 5. Shape of terminal dorsal setae, serrate (A), smooth (B), spatulate (C), and lanceolate (D, E). (A) *Tydeus croceus*; (B) *T. cruciatus*; (C) *T. nieuwerkerkeni*; (D, E) *T. spathulatus*. Scale bar: 10 μm .

Clavate setae gradually thicken near the distal end whereas spatulate setae (Figure 5C) are shaped like a spatula, with a long, narrow, linear base (Webster's Revised Unabridged Dictionary). Lanceolate setae (Figure 5E) are rather narrow, tapering to a point at the apex (ibidem). Depending on the orientation, lanceolate setae may appear to be clavate and seem shorter than they really are. Indeed in several species, terminal setae scroll and the apex passes unnoticed (compare Figure 5D to E). However, real clavate setae were observed by Castagnoli (1984, scanning electron micrograph, Figure III, 2).

Although clavate setae are often said to be club-shaped or clubbed, I reserve these two adjectives for trichobothridial setae having the end thickened and with their original radial symmetry.

Shape of coxal organs

Karg (1973, 1975) proposed to use coxal organs—or Claparède organs of other authors—to discriminate tydeine species. Depending on the species, the outline of this structure may be circular, oval, figure-of-eight-shaped or reniform (Figure 6). As the coxal organ lies in the groove separating coxa I from coxa II, its real shape may be difficult to assess depending on the orientation of the mite.

Redescriptions of Oudemans' material

All specimens studied, but one, were Tydeinae. Typical features of the (sub)family which are constantly present (supracoxal setae, number of opisthosomal setae, etc.) are omitted from the following descriptions.

Figure 6. Outline of the coxal organ in *Tydeus croceus* (A), *T. spathulatus* (B), *T. nieuwerkerkeni* (C), and *T. cruciatus* (D). Depending on the orientation or state of specimens, the outline may be deformed due to perspective (C) or difficult to see (D).

***Tydeus croceus* (L.) sensu Oudemans (1928b)**
(Figures 2A, 3A, 4A, 5A, 6A, 7, 8)

The oldest illustration of the species was given by Oudemans (1914, p 122, Figures 7–10 in Plate XII). However, as already mentioned by Thor (1933, p 17), Oudemans' (1914) species was not the real *croceus*. Indeed, the species illustrated in his Plate XII (surprisingly entitled "*T. foliorum*") exhibits distinctive spatulate setae at the posterior tip of the abdomen.

As already commented upon, the identity of the species was established by Oudemans (1928b, p 377) who collected the mite from the same tree genus (*Salix*) as Linnaeus. The description was, however, issued later by Thor (1932) who reproduced Oudemans' original drawings (his Figures 1–20). The first 11 figures were again published by Thor (1933, p 17 Figures 18–28). The description is nevertheless imprecise on several points, e.g. the leg chaetotaxy. Consequently, the species was listed as an "ancient species" not identifiable by Kaźmierski (1998). Therefore, a detailed description is given, illustrated by Figures 7, 8.

Prodorsum

Prodorsum recurved with two eyespots (Figure 8A).

Leg chaetotaxy in adults

I(8-4-3-3-1), II(6-2-2-3-0), III(5-2-1-1-1), and IV(5-2-1-1-0). Oudemans' figures (Figures 1, 2 in Thor 1932; Figures 18, 19 in Thor 1933) contain thus three errors: the famulus is not drawn, the trochanteral III is omitted, and tarsi III and IV bear only four setae. Eupathidia on tarsus I: *ft''*, (*tc*) and (*p*). Solenidiotaxy: 2. The leg phanerotaxy (eupathidia included) does not vary from the deutonymph to the adult.

Figure 7. Dorsal view of *Tydeus croceus*. Scale bar: 80 μm .

Palp chaetotaxy

Ad-DN(6-2-2) plus a tarsal solenidion and with a double terminal eupathidium on the distal segment (Figure 8E). Stylet-like movable digit (Figure 8F).

Epimeral formula

Ad-DN(3-1-4-2). Vertition and bisynthesis has been observed on podosoma IV. Coxal organ simple and oval (Figure 6A).

Genital chaetotaxy

Ad(0,4-6-4), TN(4-4) and DN(1-2). In some adults, there are only five pairs of genitals (as in Oudemans' drawings) but the presence of a single pair of genitals has been observed in all deutonymphs. Extended striation pattern (Figure 8C).

Specimens from willow and rye are similar in morphology and size. Dorsal setae (except the trichobothridia) are not smooth as in Oudemans' drawings, but serrate (Figure 8B). Long posterior setae are particularly fragile and, once broken, may give the impression that they are truncate.

Legs ornamented with ventral semi-annular thickenings similar to those described in some Ereyneidae (Figure 8D). Such ornamentation was not drawn by Oudemans and has not been reported in other tydeid species. Dorsal setae on genua tapered (Figure 8G).

Figure 8. *Tydeus croceus*. Prothorax with eyespots (A), terminal dorsal setae (B), striation of genital area (C), ornamentation of femur I (D), palp (E), stylet-like movable digit of chelicera (F), dorsal seta of genu III (G). Scale bar: 10 μ m.

Length of the idiosoma (in μ m)

Specimens from willow: undetermined adult: 416; ♀: 346; DN: 269 ± 12 ($n=5$). Specimens from rye, ♂: 380 ± 36 ($n=2$); ♀: 335 ± 2 ($n=2$); TN: 286; DN: 263 ± 12 ($n=6$). Usually, males are smaller than females. NS(*vi*)=25–27, NS(*ep*)=32.

***Tydeus cruciatus* Koch**
(Figures 2B, 3B, 4B, 5B, 6D)

The species was also listed as an “ancient species” not identifiable by Kaźmierski (1998). The single illustration of the species was given by Koch (1838). Although they both provided further description of the species, neither Oudemans (1929b), nor Thor (1931, 1933) published additional figures.

Leg chaetotaxy

I(8-4-3-3-1), II(6-2-2-3-0), III(5-2-1-2-1), and IV(5-2-1-1-0). Eupathidia on tarsus I: *ft'*, (*tc*) and (*p*). Solenidiotaxy: 2.

Genital chaetotaxy

(0,?-6-4). Extended striation pattern (Figure 2B). Palp and chelicera apparently similar to those of *croceus*.

The single female in Oudemans' collection exhibits the typical *Tydeus* striation pattern defined by Baker (1965). Striation unique in having circular striae around (*vi*) similar to those usually observed around the trichobothridia (Figure 3B). Dorsal setae smooth (Figure 5B). The species is probably small as the idiosoma length was only 235 μm , but this measure is only indicative due to the state of the specimen. The total length published by Oudemans (1929b, p 477) was 247 μm . Koch (1838) had already indicated that the species was exceedingly small ("ungemein klein"). $\text{NS}(\text{vi})=22$, $\text{NS}(\text{ep})=19$.

Tydeus demeyeri Oudemans

The only illustration of the species (Figure 29 in Thor 1933) is a dorsal view of the gnathosoma. In his original description, Oudemans (1929b, p 478) wrote: "Seta verticales internae achter het niveau der pseudostigmata verplaatst" ("Verticales internae setae displaced behind the level of pseudostigmata"). This particular position of prodorsal setae *vi* (p_1 in Baker's terminology) behind the trichobothridia means that the prodorsum is procurved, which implies that *demeyeri* belongs neither to Tydeinae, nor to Tydeidae as recently redefined by André and Fain (2000). The presence of at least 10 (probably 12) setae on tarsus I confirms that *demeyeri* is not a Tydeidae. Due to the bad state of the specimen, it was not possible to get further information on the species.

Figure 9. Dorsal view of *Tydeus spathulatus*. Scale bar: 80 μm .

***Tydeus spathulatus* Oudemans**
(Figures 2C, 3D, 4C, 4B, 5D, 6B, 9, 10)

The species was described by Oudemans (1928b, p 380) and synonymized with *caudatus* by Thor (1933, p 38). Oudemans (1937, p 925) owned that his *spathulatus* was a junior synonym of Dugès' *caudatus* as proposed by Thor. However, no illustration of the species has ever been published. The major feature reported by Oudemans (1928b) is the presence of six spatulate ("langspatelvormig") posterior setae.

The three slides in Oudemans' collection contain different species. The description of this section refers to the type specimens that Oudemans purchased from Berlese and collected from Padova in Italy. Specimens differ from Oudemans' description in two points. The posterior opisthosomal setae are not spatulate but rather lanceolate. Depending on the orientation, they sometimes seem to be clavate, but never spatulate (see Figure 3D, E). The number of lanceolate setae amounts to five pairs (Figure 10A), and not three as written by Oudemans. Other dorsal opisthosomal setae are serrate.

Leg chaetotaxy in adults

I(8-4-3-3-1), II(6-2-2-2-0), III(5-2-1-1-1), and IV(5-2-1-1-0). Eupathidia on tarsus I: *ft'*, (*tc*) and (*p*). Solenidiotaxy: 2. Dorsal setae on genua I and II tapered (Figure 10B), on genua III and IV blunt (Figure 10C, D)

Palp and chelicera

Palp and chelicera apparently similar to those of *croceus*.

Genital chaetotaxy

(0,?-6-4). Compact striation pattern (Figure 2C). The species exhibits the typical *Tydeus* striation pattern defined by Baker (1965) as well as two eyespots on the prodorsum.

Figure 10. *Tydeus spathulatus*. The five lanceolate terminal dorsal setae (A), dorsal setae of genu I (B) and IV (C), with a detail of the tip of the former (D). Scale bar: 10 μ m.

Length of the idiosoma (in μm)

Length is 368 ± 16 ($n=4$) in females and 331 ± 7 ($n=3$) in males. $\text{NS}(\text{vi})=26$, $\text{NS}(\text{ep})=36$.

Designation of a lectotype

As explained in the Material and Methods section, the 12 specimens of this species were remounted separately. Therefore, I hereby designate as lectotype the female remounted in the slide with the original label handwritten by Oudemans. The other slides with new labels contain the paralectotypes.

***Tydeus nieuwerkerkeni* n. sp.**
(Figures 2D, 3C, 4C, 5C, 6C, 11)

This description refers to the two other slides of Oudemans' collection bearing the label "*Tydeus spathulatus*", that contain specimens from Renkum in the Netherlands. The habitus, leg chaetotaxy and other generic characters are similar to those of *Tydeus spathulatus*. However, the species is undescribed and is characterized by three pairs of short, spatulate setae (Figure 11A). These setae are shorter than homologous setae in *spathulatus* (compare Figure 5C and E). Dorsal setae on genua are similar to those of *spathulatus* but more serrate (Figure 11C, D).

The length of the idiosoma (in μm) is 344 ± 74 ($n=3$) in females. $\text{NS}(\text{vi})=27$, $\text{NS}(\text{ep})=18$.

Another specimen of the species was collected in Samrée (Belgium), from the bark of *Fraxinus excelsior* along a road.

Designation of types

The five specimens from the slide with the data "*Castanea sativa*, Renkum bij Arnhem" were remounted separately and form the type-series. The slide with the original label contains the female holotype, the other four slides with new labels contain paratypes.

Figure 11. *Tydeus nieuwerkerkeni* n. sp. The three spatulate terminal dorsal setae (A), serrate seta of the opisthosoma (B), dorsal setae of genu II (C) and III (D). Scale bar: 10 μm .

Discussion and synonymies

Keeping the genus Lorryia Oudemans, 1925

The type of *Lorryia superba* Oudemans, 1925, the type species of the genus, has been lost. Its provenance is unique. Some Tydeidae have been found associated with or phoretic on insects: *Melissotydeus macrosolenus* André, 1985; *Tydeus olivaceus* Koch, 1838; *Tydeus reticulatus* Oudemans, 1928; *Calotydeus xylocopae* Oudemans, 1926; and an undetermined *Tydeus* recorded on the tympanic membrane of Noctuidae by Treat (1969). But *superba* is the single tydeid species recorded on a mammal. We might suspect that, like *demeyeri*, *superba* would not be a Tydeidae. However unlike *demeyeri*, Oudemans (1928a, Figures 95–103) published illustrations of the habitus and details of *superba* that are typical of Tydeidae.

The type locality is “Ambon”, one of the Moluccan Islands, in the Banda Sea (Malay Archipelago, East Indonesia). Very few Tydeidae have been described or recorded from Indonesia: *Prelorryia indoniensis*, *Pretydeus panitae*, *Tydeus xylocopae*, *Lorryia turrialbensis*. Due to the uniqueness of the habitat and the rarity of the provenance, we may not exclude that *L. superba* belongs to a genus which has never been recaptured.

We may also question the presence of a single claw on apoteles. As already said, Oudemans was concerned with this feature and came back several times on that point before concluding he was wrong in his original description; he probably studied the specimen several times. Is the presence of a single claw on apoteles so unrealistic? The question is partly a matter of quality of observation, and partly of biological significance. First of all, let us note that the presence of a single claw was observed on all legs. Is it

Figure 12. Scanning electron micrograph of the apotele in a Tydeinae (species undetermined). Courtesy of University of Basel.

realistic to expect that the claws would be so close to each other that it was impossible for Oudemans to distinguish them on any of the eight legs? Is it realistic to expect to see claws quite compressed together when we remember that (1) an empodium separates them, (2) claws diverge from each side of the empodium (Figure 12), and (3) claws are not movable (they are fixed on the apotele, this podomere only being capable of down and upward movements, see Figure 1 in André 1981). Next, the quality of Oudemans' (1928a) observation seems to be excellent in the light of his Figure 102, that has never been reproduced subsequently: the empodium is clearly visible and appended close to the single claw. Lastly, the recent discovery of a new tydaeoline mite deprived of empodium makes more plausible the loss of a claw in *Lorryia* (H. M. André and X. Ducarme, in preparation).

Nevertheless even if it had two claws, Oudemans' *Lorryia* is unique due to its leg chaetotaxy. We are again facing Baker's (1968, p 986) conclusion: if Oudemans' figure and description (i.e. his chaetotaxy) are correct, *Lorryia* will stand with a single species, the others falling into other genera.

Therefore, I propose to maintain the genus as Oudemans described it. The loss of a claw is clearly an autapomorphic character separating the genus from all other tydeid genera. Were the species recaptured from the same habitat and origin and have a chaetotaxy similar to that published, the situation would remain unchanged. If the chaetotaxy was different from that published, at worst a simple new synonym would ensue. The situation might be much more complex and the nomenclatorial stability compromised if we decided not to respect the original description.

Brachytydeus as senior synonym of *Lorryia* sensu Kaźmierski

As noted by Baker (1968), if *Lorryia* stands with a single species, the others have to fall into a different genus. Baker (1968) suggested the subgenus *Raphitydeus* Thor, 1933. However, the true identity of the subgenus remains unclear and, moreover, it is invalid since Thor (1933) did not designate a species type among the two species he assigned to his new subgenus. In contrast, the species which are currently assigned to the genus *Lorryia* by Kaźmierski (1989, 1998) display the same chaetotaxy as *Tydeus cruciatus* which was designated as the type species of the genus *Brachytydeus* by Thor (1931). As *Brachytydeus* has precedence, the following synonymies ensue:

Brachytydeus Thor, 1931

Raphitydeus Thor, 1933 **n. syn.**

Lorryia Oudemans, 1925 *sensu* Kaźmierski (1989, 1998) **n. syn.**

The genus *Brachytydeus* includes more than 170 extant species and the type specimen of the type species is available at the National Museum of Natural History, Leiden.

Calotydeus as senior synonym of *Pseudolorryia*

With the exception of the presence of a single pair of genitals in deutonymphs, the chaetotaxy of *Calotydeus* corresponds to that of the genera *Homeotydeus* published by André (1980) and *Pseudolorryia* proposed by Kaźmierski (1989). As *Tydeus croceus* was designated as the type species of the genus *Calotydeus* by Oudemans (1937), the following synonymies result from the application of the Code of Zoological Nomenclature:

Calotydeus Oudemans, 1937

Homeotydeus André, 1980 **n. syn.** (*partim*)

Pseudolorryia Kaźmierski, 1989 **n. syn.**

The genus *Calotydeus* includes eight extant species. The type species is *Acarus croceus* L. 1758 as designated by Oudemans (1937).

Designation of neotypes for T. croceus L.

Linnaeus' original types have been lost. However, Oudemans (1937) recaptured the species from the same tree genus (*Salix*) and designated neotypes housed in the National Museum of Natural History, Leiden (this designation was apparently not published by Oudemans). That Oudemans' specimens really belong to Linnaeus' species remains speculative: on the one hand, a tydeid species may be found on many host plants (see Ripka and Kaźmierski 1998, Table I), on the other, several tydeid species may coexist on the same tree species. At least eight tydeid species have been recorded from *Salix*, among which five were collected in Sweden. The identity of Linnaeus species remains thus unclear. To avoid further problems in the tydeid systematics and to secure stability of the nomenclature, I nevertheless propose to follow Oudemans' suggestion and so designate as neotype the female specimen mounted in ventral view in the slide selected by Oudemans. The slide with the neotype bears the original label handwritten by Oudemans, including the word "Neotype". The six other slides bear new labels.

The genus Tydeus Koch, 1836

Koch's (1842) designation of *T. mutabilis* as type species for the genus *Tydeus* is not valid. Koch's (1836) *croceus*, the species renamed *kochi* by Oudemans (1928b), was designated later as the type species by Baker and Wharton (1952)—thus before the publication of the first edition of the Code of Zoological Nomenclature—and by Baker (1970) in accordance with the code. Koch's drawing, as well as the text, clearly indicate the presence of clavate setae at the posterior margin of the idiosoma. This species characteristic was acknowledged by Oudemans (1928b) and Thor (1933). However, the type is lost and specimens identified as *kochi* by Baker (1970) and subsequent authors belong to another species since they have no clavate setae.

Fortunately, the few *Tydeus*-like species exhibiting clavate or spatulate setae at the posterior margin of the idiosoma all belong to the same genus, *Orthotydeus* proposed by André (1980) or *Tydeus sensu* Kaźmierski (1989). As the type specimens of *spathulatus* and all species displaying clavate or spatulate setae share the same leg chaetotaxy, we may reasonably assume that the species renamed *kochi* by Oudemans (1928b) had the same leg chaetotaxy. Based on other grounds, I then agree with Kaźmierski's proposal that the genus *Tydeus* is characterized by the following formula: I(8-4-3-3-1), II(6-2-2-2-0), III(5-2-1-1-1), and IV(5-2-1-1-0).

The following synonymies result from the application of the Code of Zoological Nomenclature:

Tydeus Koch, 1836

Brachytydeus Thor, 1933 **n. syn.** (*partim*)

Calotydeus Oudemans, 1937 **n. syn.** (*partim*)

Tydeus Koch, 1836 *sensu* Oudemans 1937 (*partim*)

Orthotydeus André, 1980 **n. syn.**

Tydeus Koch, 1836 *sensu* Kaźmierski 1989

The genus *Tydeus* includes 40 extant species, many of which (28) have been recorded on plants.

Reinstatement of T. spathulatus Oudemans

The type of *spathulatus* with its five pairs of lanceolate setae is clearly distinct from other tydeid species with only three pairs of clavate or spatulate setae, Thor's (1933) *caudatus* included. Oudemans' *spathulatus* is thus removed from synonymy and reinstated as a valid species.

Proposed designation of T. spathulatus as type species of Tydeus

The type specimens of the type species designated by Baker (1970) for *Tydeus* are lost. The second oldest species is Dugès' *caudatus*, as redescribed by Thor (1933), which belongs also to the genus *Tydeus* as redefined here. Again, types are lost. The oldest type specimens available for the genus are thus those of the species *spathulatus* described by Oudemans (1928b) from Italy. To stabilize the usage of the names, especially that of the genus type of the family Tydeidae, the International Commission of Zoological Nomenclature will be asked to set aside all previous type species fixation for *Tydeus* and to designate *Tydeus spathulatus* as the type species, with Oudemans' specimens from Italy designated as primary type material. The specimen is in a good state, properly housed in a well-known museum, and easily available for study. It not only represents the oldest type specimen likely to be the primary type material of the family, but it is the single one from Oudemans' collection which agrees with the original genus description.

Other alternatives

Are there other alternatives to this proposal that might be either simpler or more favourable to name stability? It is not possible to rely on the two originally included species described by Koch (1836): (1) types of both species are lost, (2) *velox* has never been recorded since and turns out to be a *species inquirenda*, and (3) Koch's *croceus*, renamed *kochi* by Oudemans (1928b), is also a *species inquirenda* as, already commented on, authors' *kochi* belong to another species.

Then why not designate a new neotype specimen for the true *croceus*, i.e. for the material representing *T. croceus* L. *sensu* Oudemans ex willow in agreement with Thor (1933)? This alternative (see Table II) suggested by E. E. Lindquist (personal communication) poses several problems. The first is that, surprisingly, the true *croceus* has never been proposed as type species of the genus *Tydeus* (and subsequently of the family Tydeidae). Actually, it was designated as the type species of the genus, *Calotydeus*. This alternative entails the rejection of a valid genus since *Calotydeus* would become a junior synonym of *Tydeus*. Next, the genus *Tydeus* so redefined would not correspond to usage and would disagree with both generic definitions, that by Andre (1980) as well as that by Kaźmierski (1989). This would certainly add to the current confusion in species nomenclature. Last, it would be necessary to maintain the recent genus *Orthytydeus* to include the species with clavate or lanceolate setae such as *kochi*.

A second alternative consists in selecting *cruciatus* as type species of the genus *Tydeus* and the family Tydeidae. This alternative (2 in Table II) brings us back to a situation similar to that proposed by Oudemans (1937). The disadvantages are similar to those of alternative 1. The species *cruciatus* has never been proposed as type species of the genus *Tydeus* (and subsequently of the family Tydeidae). Actually, it was designated as the type species of the genus, *Brachytydeus*. This alternative also would entail the rejection of a valid genus since *Brachytydeus* would become a junior synonym of *Tydeus*. Again, it would be necessary to

maintain the recent genus *Orthotydeus* to include the species with clavate or lanceolate setae such as *kochi*. However, the genus *Tydeus* so redefined presents the advantage of being congruent with André's (1980) system.

As stated in the introduction, the aim of the International Code of Zoological Nomenclature "is to provide the maximum universality and continuity in scientific names of animals" (ICZN 2000, p xix). Especially, the principle of priority operates to determine which from among the synonyms is the valid name. However, the code recognizes that the rigid application of the principle of priority may, in certain cases, upset a long-accepted name and is then destructive of stability. The two criteria, respect of the priority law and agreement with a current nomenclatural system, were used to evaluate the different proposals. As summarized in Table II, alternative 1 is the worst of all (no respect of the priority law, no congruence with any of current nomenclatural system). In contrast, the proposal advanced in this paper respects the priority principle and is congruent with one of the two systems proposed so far.

Conclusions

The Tydeidae were first considered as pests (e.g. Tapley 1953; Smirnov 1957; Maltshenkova 1967; Dellei and Szendrey 1991). While their status is being reconsidered and they are about to be seen as beneficial organisms either as alternate prey (Molnár 1990) or as biological control agents (English-Loeb et al. 1999), it is of paramount importance to have precise species descriptions and identifications. This is currently not the case in many publications of agronomic interest. The density of striae and the shape of setae are difficult to draw and many descriptions do not allow field biologists to determine the species precisely. The use of scanning electron micrographs is still rare and gives pictures that are very different from the usual sight obtained with light microscopy. The photographs presented in this study offer good pictures of structures difficult to draw. However, they require specimens in good state and expensive diagnostic equipment (microscope, camera, software). A detailed discussion of pros and cons of digital imaging used for mite species description is given by André and Ducarme (2003).

The history of the genus *Tydeus* is complex and convoluted. After three series of revisions (Baker 1965, 1970; André 1980, 1981; Kaźmierski 1989, 1998), most problems have arisen from the disregard for old type specimens that were yet preserved in a well-known museum. Identified problems include misidentifications and species confusion: *croceus* (three species named this way), *kochi* (two species) and *spatulatus* (two species),

Table II. Comparison between alternative nomenclatural acts; optimal values at the bottom (no law violation, high congruency) are in bold.

Species	Previous assignments	New assignments		
		This proposal	Alternative 1	Alternative 2
<i>kochi</i> , <i>spatulatus</i>	<i>Orthotydeus</i> , <i>Tydeus</i>	<i>Tydeus</i>	<i>Orthotydeus</i>	<i>Orthotydeus</i>
<i>croceus</i>	<i>Tydeus</i> , <i>Calotydeus</i> , <i>Homeotydeus</i> , <i>Pseudolorryia</i>	<i>Calotydeus</i>	<i>Tydeus</i>	<i>Calotydeus</i>
<i>cruciatus</i>	<i>Tydeus</i> , <i>Brachytydeus</i> , <i>Lorryia</i>	<i>Brachytydeus</i>	<i>Brachytydeus</i>	<i>Tydeus</i>
Number of priority law violations		0	1	1
Congruency with previous systems		1	0	1

designation of types and numerous synonymies repeatedly published without prior study of type specimens. Of special interest is the chain reaction of misidentifications such as those affecting Linnaeus' species. After studying Oudemans' collection, two "ancient" species, supposedly impossible to identify according to Kaźmierski (1998), are here redescribed and a third removed from synonymy and reinstated as a valid species. With this paper, I hope to have clarified some of the most frustrating problems in tydeid mite systematics and contributed to the stability of the nomenclature.

Acknowledgements

I thank X. Ducarme, R. Jocqué, G. W. Krantz, and E. E. Lindquist for remarks and suggestions on early drafts of the manuscript. I am deeply indebted to E. J. van Nieuwerkerken for the loan of Oudemans' specimens and permission to remount them. Thanks also to M. Judson for providing me with copies of Koch's publications and Daniel Mathys for permission to reproduce Figure 12.

References

- My own copy of Koch's (1836) work does not indicate the publication date. There are possibly considerable problems with this very rare work (Brignoli 1985; Judson 2000). The publication date usually reported is 1836 as proposed by Sherborn (1923). It bears two numbers, either "heft 4" (the reference given by Koch 1842) and "heft 137" depending on the numbering system adopted, either that of Koch or that of Panzer's *Faunae Insectorum Germaniae* of which Koch's booklets formed part.
- The number enclosed in brackets after Oudemans' articles refers to the list of Oudemans' publications numbered by G. L. van Eyndhoven in 1944.
- André HM. 1980. A generic revision of the family Tydeidae (Acari: Actinedida). IV. Generic descriptions, keys and conclusions. *Bulletin et Annales de la Société royale belge d'Entomologie* 116:103–130, 139–168.
- André HM. 1981. A generic revision of the family Tydeidae (Acari: Actinedida). III. Organotoaxy of the legs. *Acarologia* 22:165–178.
- André HM, Ducarme X. 2003. Rediscovery of the genus *Pseudotydeus* (Acari: Tydeoidea), with description of the adult using digital imaging. *Insect Systematics and Evolution* 34:373–380.
- André HM, Fain A. 2000. Phylogeny, ontogeny and adaptive radiation in the superfamily Tydeoidea (Acari: Actinedida), with a reappraisal of morphological characters. *Zoological Journal of the Linnean Society* 130:405–448.
- Baker EW. 1944. Seis especies de *Lorryia* (Acarina, Tydeidae). *Anales del Instituto de Biología de México* 15:215–222.
- Baker EW. 1965. A review of the genera of the family Tydeidae (Acarina). In: Naegele JA, editor. *Advances in acarology* 2. Ithaca (NY): Cornell University Press. p 96–133.
- Baker EW. 1968. The genus *Lorryia*. *Annals of the Entomological Society of America* 61:986–1008.
- Baker EW. 1970. The genus *Tydeus*: subgenera and species group with descriptions of new species (Acarina: Tydeidae). *Annals of the Entomological Society of America* 63:163–177.
- Baker EW, Wharton GW. 1952. *An introduction to acarology*. New York: The MacMillan Co. 465 p.
- Berlese A. 1883. Acari, Myriapoda et Scorpiones hucusque in Italia reperta 5. Padova.
- Berlese A. 1908. Elenco di generi e specie nuove di Acari. *Redia* 5:1–15.
- Berlese A. 1910. Acari nuovi. *Redia* 6:199–234.
- Brignoli PM. 1985. On the correct dates of publication of the arachnid taxa described in some works by C. W. Hahn and C. L. Koch (Arachnidae). *Bulletin of the British Arachnological Society* 6:414–416.
- Castagnoli M. 1984. Contributo alla conoscenza dei Tideidi (Acarina: Tydeidae) delle piante coltivate in Italia. *Redia* 67:307–322.
- Dellei A, Szendrey L. 1991. New data to the mite fauna of the vineyards in Heves county. *Növényvédelem* 27:124–128. (Hun with Eng summary).
- Dugès A. 1834. Recherches sur l'ordre des Acariens en général et la famille des Trombidiés en particulier. *Annales des Sciences Naturelles (Sér. 2, Zool.)* 1:5–46 + 1 plate.

- English-Loeb G, Norton AP, Gadoury D, Seem RC, Wilcox W. 1999. Control of powdery mildew in wild and cultivated grapes by a tydeid mite. *Biological Control* 14:97–103.
- Eyndhoven GL van. 1944 (1943). In memoriam Dr. A. C. Oudemans. *Tijdschrift voor Entomologie* 86:1–56.
- Fain A. 1964. Les Ereyinetidae de la collection Berlese à Florence. Désignation d'une espèce type pour le genre *Ereynetes* Berlese. *Redia* 49:87–111.
- ICZN. 2000. International code of zoological nomenclature. 4th ed, London: International Trust for Zoological Nomenclature. 306 p.
- Judson M. 2000. Nomenclatural problems associated with the names Alycidae Canestrini & Fanzago, 1877 and Pachygnathidae Kramer, 1877 (Acari). *Memorie della Società Entomologica Italiana* 78:535–540.
- Karg W. 1973. Drei neue Tydeinarten der Gattung *Lorryia* Oudemans, 1925 (Acarina, Trombidiformes). *Zoologischer Anzeiger* 191:218–229.
- Karg W. 1975. Zur Kenntnis der Tydeiden (Acarina, Trombidiformes) aus Apfelanlagen. *Zoologischer Anzeiger* 194:91–110.
- Kaźmierski A. 1989. Revision of the genus *Tydeus* Koch sensu André, *Homeotydeus* André and *Orthotydeus* André with description of a new genus and our new species of Tydeinae (Acari: Actinedida: Tydeidae). *Mitteilungen aus dem Hamburgischen Zoologischen Museum und Institut* 86:289–314.
- Kaźmierski A. 1998. Tydeinae of the world: generic relationships, new and redescribed taxa and keys to all species. A revision of the subfamilies Prettydeinae and Tydeinae (Acari: Actinedida: Tydeidae)—Part IV. *Acta Zoologica Cracoviensis* 41:283–455.
- Koch CL. 1836. Deutschlands Crustaceen, Myriapoden und Arachniden. Ein Beitrag zur deutschen Fauna, Heft 137. Regensburg: Herrich-Schäffer.
- Koch CL. 1838. Deutschlands Crustaceen, Myriapoden und Arachniden. Ein Beitrag zur deutschen Fauna, Heft 160. Regensburg: Herrich-Schäffer.
- Koch CL. 1842. Übersicht des Arachnidensystems. Volume 3(2). Nürnberg: C. H. Zeh'schen Buchhandlung.
- Kuznetsov NN, Livshitz IZ. 1973. Genus *Tydeus* (Acariformes, Tydeidae) from the Crimea. *Zoologicheskii Zhurnal* 52:45–53.
- Lee J.-H. 2001. *Lorryia formosa* or *Tydeus formosa*? [online]. http://www.nhm.ac.uk/hosted_sites/acarology/archive/2001/al0102.html.
- Linnaeus C. 1758. *Systema Naturae per Regna Tria Naturae, Secundum Classes, Ordines, Genera, Species, cum Characteribus, Differentiis, Synonymis, Locis*. 10th ed. 4 + 824 p.
- Lundqvist L. 1999. Tydeidae [online]. http://www.nhm.ac.uk/hosted_sites/acarology/archive/1999/al9905.html.
- Maltshenkova NI. 1967. Mite of the genus *Tydeus* (Acariformes, Tydeidae), the pest of grapes in Moldavia. *Entomologicheskoe Obozrenie* 46:117–121. (Rus with Eng summary).
- Molnár J. 1990. The study of *Tydeus caudatus* in vineyards. *Növényvédelem* 26:109–111. (Hun with Eng).
- Momen F, Lundqvist L. 1995. The genus *Tydeus* (Acari: Prostigmata: Tydeidae) in southern Sweden; six new species. *Acarologia* 36:41–56.
- Momen F, Lundqvist L. 1996a. Corticolous mites: new and unrecorded species of the genus *Tydeus* (Acari: Prostigmata: Tydeidae) and a key to species of southern Sweden. *Acarologia* 37:83–89.
- Momen F, Lundqvist L. 1996b. A new genus, *Quadrottydeus*, and three new species of the family Tydeidae (Acari: Prostigmata) from southern Sweden. *International Journal of Acarology* 22:3–10.
- Momen F, Lundqvist L. 1996c. Taxonomy of non-*Tydeus* of the mite family Tydeidae (Acari: Prostigmata) from moss, lichens and trees in southern Sweden. *Acarologia* 37:281–297.
- Momen F, Sinha R. 1991. Tydeid mites associated with stored grain and oilseeds in Canada, with description of a new genus and five new species (Acari: Tydeidae). *Canadian Journal of Zoology* 69:1226–1254.
- O'Donnell M. 1999. Tydeidae [online]. http://www.nhm.ac.uk/hosted_sites/acarology/archive/1999/al9905.html.
- Oudemans AC. 1914 (1913). Acarologisches aus Maulwurfsnerten. *Archiv für Naturgeschichte* 79:68–136. [330].
- Oudemans AC. 1925. Acarologische aantekeningen LXXIX. *Entomologische Berichten* 7:26–34 [481].
- Oudemans AC. 1926. Kritisch historisch Overzicht der Acarologie. Eerste Gedeelte. *Tijdschifte voor Entomologie* 69 (Suppl.):I–VIII, 1–500 [492].
- Oudemans AC. 1928a (1927). Acari uit Ambon. *Zoologische Mededelingen* 10:185–237. [508].
- Oudemans AC. 1928b. Acarologische aantekeningen XCIV. *Entomologische Berichten* 7:374–382. [516].
- Oudemans AC. 1929a. Kritisch historisch Overzicht der Acarologie. Tweede Gedeelte. *Tijdschifte voor Entomologie* 72 (Suppl.):I–XVII, 1–1097. [522].
- Oudemans AC. 1929b. Acarologische aantekeningen XCVIII. *Entomologische Berichten* 7:476–485. [525].
- Oudemans AC. 1929c. Acarologische aantekeningen XCIX. *Entomologische Berichten* 8:11–20. [527].
- Oudemans AC. 1937. Kritisch historisch Overzicht der Acarologie. Derde Gedeelte, Band C. Leiden: E. J. Brill. p I–XXIII, 799–1348. [566].

- Ripka G, Kazzmierski A. 1998. New data to the knowledge on the tydeid fauna in Hungary (Acari: Prostigmata). *Acta Phytopathologica et Entomologica Hungarica* 33:407–418.
- Sherborn CD. 1923. On the dates of C. L. Koch, “Deutschlands Crustaceen, Myriapoden und Arachniden,” 1835–1844. *Annals and Magazine of Natural History* 9 (11):568.
- Smirnoff WA. 1957. An undescribed species of *Lorryia* (Acarina, Tydeidae) causing injury to Citrus trees in Morocco. *Journal of Economic Entomology* 50:361–362.
- Tapley RG. 1953. A note on mites as new pest of *Coffea Arabica* in Tanganyika. *East African Agricultural and Forestry Journal* 18:191–192.
- Thor S. 1931. Norwegische Tydeidae. I–VII. Mit Kennzeichnung vier neuer Gattungen. *Zoologischer Anzeiger* 94:89–104.
- Thor S. 1932. Die erstbenannte *Tydeus*-Art, *T. croceus* (C. Linné) 1758, nach Dr. A. C. Oudemans’ Identifizierung und Originalfiguren. *Zoologischer Anzeiger* 99:58–63.
- Thor S. 1933. Tydeidae, Ereynetidae. *Das Tierreich* 60:1–84.
- Treat AE. 1969. Behavioral aspects of the association of mites with noctuid moths. *Proceedings of the 2nd International Congress of Acarology*; 1967 July 19–25; Sutton Bonington, UK, Budapest: Akademia Kiado. p 275–286.
- Vitzthum HG. 1941. Acarina. 5 Lieferung. Dr H.G. Bronns Klassen und Ordnungen des Tierreichs 5:641–800.