

The subgenus *Rusticoidus* of genus *Aedes* (Diptera: Culicidae) in Europe and Asia

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Introduction

In 1973, Shevchenko & Prudkina described the new subgenus *Rusticoidus* in genus *Aedes* Meigen and based the subgenus on structures of the male genitalia and the larval siphon. The following discussion and description is from their paper and is based on a translation from Russian to English by SCITRAN, Santa Barbara, California, USA. My comments are included in square brackets. The authors indicated [page 41] that in subgenus *Ochlerotatus*, among all species they investigated [see their table], only *Ae. refiki* should be singled out. It is distinguished from the remaining species of the subgenus by the structure of the sternite and claspettes, by the presence (only in it and in other species of the group) of lanceolate scales on the basal verruca [lobe] of the coxite, and by a few other characteristics. In addition, in contrast to other species, there are additional hairs on the siphon of the larvae. Evidently, it is expedient to single out *Ae. refiki*, as well as all the other species of the *rusticus* group, into a special subgenus *Rusticoidus* Shevchenko & Prudkina. For precisely this reason [their] table presents ten and not eleven species. [On page 46 Shevchenko & Prudkina presented the following characteristics of the male genitalia for subgenus *Rusticoidus*.] The wing [claspette filament] of the claspette is spindle-shaped and has cross-striations. The length of the trunk [claspette stem] of the claspette is 285.6 microns, at the base and apex the trunk is widened, at the apex it is claviform. Sk = 3.1. Three spines are arranged one after another along the basal part of the trunk. Sb = 3.9. The central and lateral-proximal parts of the IXth tergite are wide with a concave anterior margin, the lateral-distal part is narrowed with a weakly widened margin. The depression between the projections is wide and deep, and on the projections there are an average of 8 bristles (7-10). St = 0.9. The IXth sternite is elongated and has the shape of a small boat with a convex central part, and it has five bristles. Sc = 4.8. The phallosome is greatly constricted in the middle, the apical part is expanded, and the posterior margin has a projection. The posterior margins of the wall contact each other in the first half. [Their] Figure 2 shows IXth sternite, IXth tergite, phallosome, and claspette of *Ae. refiki*.

Based on the information, in the above paragraph, provided by Shevchenko & Prudkina (1973) for their new subgenus (*Rusticoidus*) only one species is specifically named (i.e., *Ae. refiki* Medschid) which, therefore, becomes the haplotype of the subgenus. However, on page 41 they indicated that not only is *Ae. refiki* included in the subgenus *Rusticoidus* but also all other species of the *rusticus* group.

Confusion has existed as to which species should be included in the subgenus *Rusticoidus* since, unfortunately, Shevchenko & Prudkina (1973) did not specify which species they considered as belonging to the *rusticus* group. In order to clarify this a brief review of the *rusticus* group of *Ochlerotatus* and the subgenus *Rusticoidus* follows.

Edwards (1921:296) placed *Ae. rusticus* (Rossi) and *Ae. lepidonotus* Edwards in the Communis Group of subgenus *Ochlerotatus* but stated "The structure of the male hypopygium shows the isolated position of *A. rusticus* and *A. lepidonotus*..." Martini (1931:264), within the genus *Aedes*, listed four "Globi" in the subgenus *Ochlerotatus*. One of these was his new globus, *Feltianus*, for which he listed four species (i.e., *Ae. diversus* Theobald, *Ae. subdiversus* Martini, *Ae. refiki*, and *Ae. lepidonotus*). Martini's "globus" apparently utilized the Latin meaning for the word (i.e., globe of things collected together) and appears to include an assemblage of similar species within a subgenus (i.e., species group). Edwards (1932:137, 147), in his treatment of the world fauna of the family Culicidae, designated Group H (*rusticus*-group: *Feltianus*) in subgenus *Ochlerotatus* of genus *Aedes* and included the following species: *Ae. lepidonotus*, *Ae. refiki*, *Ae. rusticus*, *Ae. stampari* Apfelbeck, *Ae. subdiversus* Martini and *Ae. trichurus* (Dyar). He included the following synonyms for these species: *Ae. lepidonotus* (= *albescens* Edwards); *Ae. rusticus* (= *diversus* Theobald, ?? *maculatus* Meigen, ? *musicus* Leach, *memorosus* var. *luteovittatus* Theobald, *pungens* Robineau-Desvoidy, *quadratimaculatus* Macquart, *rusticus* var. *subtrichurus* Martini); *Ae. stampari* (= ? *subdiversus*); and *Ae. trichurus* (= *cinereoborealis* Felt and Young, *pagetonotum* Dyar and Knab, and *poliochros* Dyar). Edwards (1932:137) defined his Group H as follows: "Tarsi without pale rings. Lower mesepimeral bristles present, and general ornamentation similar to last group, but posterior pronotal

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scales mostly broad and flat. Male coxite with strong apical lobe; basal lobe usually with a number of flattened hairs; claspette unusually large, with stout stem. Larva (except in *A. stampari*) with several hairs on siphon in addition to the usual pair of tufts." Most subsequent authors followed Edwards' (1932) group classification including Natvig (1948:381) and Gutsevich *et al.* 1970 (English translation, 1974). Stone *et al.* (1959) included within *Ochlerotatus* the species listed by Edwards (1932) without a segregation by group and they included *Ae. pseudorusticus* Callot as a synonym of *Ae. refiki*. Stone (1963) listed *Ae. stampari* in synonymy with *Ae. refiki*. Mohrig (1969:95) follows the *rusticus* group classification of Edwards (1932) while treating the two species (i.e. *Ae. refiki* and *Ae. rusticus*) occurring in Germany. His studies were focused on an investigation comparing the female genitalia of subgenera in the genus *Aedes* occurring in that country and showed these two species (*rusticus* group) occupied a certain unusual position within the subgenus *Ochlerotatus*. Knight & Stone (1977), in the current "Catalog of the Mosquitoes of the World," listed subgenus *Rusticoidus* and included only *Ae. refiki* with the synonym *Ae. pseudorusticus*, however, the other species of Edwards' (1932) *rusticus*-group were retained in *Ochlerotatus*. Dahl & White (1978:393) again synonymized *Ae. stampari* with *Ae. refiki*, following Martini (1931); this was also reported by Ward (1984:269). Ward (1987:94) stated "One species, *Ae. refiki* Medschid, was transferred to the monotypic subgenus *Rusticoidus* by Shevchenko and Prudkina (1973). Although this subgenus is well recognized (Knight & Stone 1977), no mention was made of the current status of *Ae. refiki*." Alekseev (1989) described the new species, *Aedes (Rusticoidus) krymmontanus*, and provided on page 177 the following information. The subgenus *Rusticoidus* at present in the USSR and adjacent countries comprised 5 species (Gutsevich *et al.*, 1970, Gutsevich & Pendikova, 1972). On the basis of our material, as well as on the figures and descriptions of the larvae and adults of species of the subgenus (Gutsevich *et al.*, 1970; Dubitzky, 1970; Martini, 1931; Medschid, 1928; Rioux, 1965; Roman, 1958; Gilot, 1968; Gilot *et al.*, 1971; Mohrig, 1969) a table of characters diagnostic for the species has been constructed. Because of insufficient description and figures, as well as citation of range *Ae. (R.) albescens* has been omitted. Alekseev (page 176) provided a table of diagnostic characters of comparable species of subgenus *Rusticoidus* (i.e. *Ae. krymmontanus*, *Ae. rusticus*, *Ae. refiki*, *Ae. lepidonotus* and *Ae. subdiversus*). This table included one male genitalic and 12 larval characters. A translation from Russian to English of the article was provided by the late George C. Steyskal, Gainesville, Florida. Ward (1992:189), for subgenus *Rusticoidus*, included citations of *Ae. krymmontanus* and *Ae. refiki*. Schaffner (1992:80, 188) raised the question whether *Ae. rusticus* and the other members of Edwards' (1932) *rusticus*-group should be included in the subgenus *Rusticoidus* along with *Ae. refiki*. Later, Schaffner (1998:4) stated "The sub-genus *Rusticoidus* was described by Shevchenko & Prudkina (1973) following a study of the male genitalia in the genus *Aedes*. They proposed *Ae. refiki* as haplotype, and included in the sub-genus the related species previously incorporated in the *rusticus* group. Even though the catalogue of mosquitoes (Knight & Stone, 1977 and its additions) classifies *Ae. refiki* as being the only European species in this sub-genus, we share the opinion of other authors (Shevchenko & Prudkina, 1973; Encinas Grandes, 1982) that *Ae. rusticus* is also a member of that subgenus." In a series of articles Stojanovich & Scott (1993:16; 1995a:17; 1995b:15; 1995c:14; 1995d:19; 1996:6; 1997:18) included *Ae. refiki*, *Ae. rusticus* and *Ae. subdiversus* (one or more species per article) in subgenus *Rusticoidus* but indicated that some authors placed *Ae. rusticus* and *Ae. subdiversus* in subgenus *Ochlerotatus*. Snow & Ramsdale (1999:16) provided a chart giving the distribution for the species *Ae. krymmontanus*, *Ae. lepidonotus*, *Ae. quasirusticus*, *Ae. refiki*, *Ae. rusticus* and *Ae. subdiversus*, and even though it was not stated that the species belonged to the same subgenus, they were grouped together in the chart.

Because of the uncertainty of which species were assigned to subgenus *Rusticoidus* by Shevchenko & Prudkina (1973), several articles published since have retained one or more of the species of the "rusticus group" in subgenus *Ochlerotatus*.

From the above chronology, and my examination of specimens and species descriptions, I concur with Alekseev (1989) in the inclusion of the following European species in the subgenus *Rusticoidus*: *Ae. krymmontanus*, *Ae. lepidonotus*, *Ae. refiki*, *Ae. rusticus*, and *Ae. subdiversus*. *Aedes quasirusticus* Torres Canamares (1951) also should be included in *Rusticoidus*.

The western Asian *Aedes albescens* should be questionably included in the subgenus pending a redescription and illustrations of the species to include adults, male genitalia, pupa and larva. Gutsevich & Pendikova (1972) and Gutsevich & Dubitzky (1981; 1987) should be examined for supplemental information concerning Edwards' (1921) description of *Ae. albescens* and its separation from *Ae. subdiversus*. The related North American species will be treated by the author in a separate article.

The following is an expanded definition of subgenus *Rusticoidus* and is provided for comparison with the other subgenera of *Aedes*, especially subgenus *Ochlerotatus*. This definition is based on the examination of specimens of *Ae. lepidonotus* (♀, ♀g, ♂, ♂g, L), *Ae. refiki* (♀, ♀g, ♂, ♂g, L), *Ae. rusticus* (♀, ♀g, ♂, ♂g, P, L), *Ae. quasirusticus* (♀, ♀g, ♂, ♂g, P, L) and *Ae. subdiversus* (♂, ♂g), and the published descriptions and illustrations of all included species. Symbols and abbreviations used above are: ♀ = female, ♂ = male, P = pupa, L = fourth-instar larva, and g = genitalia. Nomenclature used follows Harbach & Knight (1980).

Subgenus *Rusticoidus*

Adults. Relatively large-sized mosquitoes with somewhat shaggy appearance. *Head:* Eyes separated in front; vertex and occiput covered with curved narrow scales; numerous erect forked scales on occiput and lateral areas of vertex; ocular line with curved narrow scales and numerous well developed setae; maxillary palpus of female brown with scattered pale scales; maxillary palpus of male noticeably longer than proboscis, palpomere 3 long with distal portion somewhat swollen, upturned, with numerous long (longer than palpomere 4 length), forward-directed setae lateroventrally, palpomeres 4,5 somewhat downturned, palpomere 4 with numerous moderately long setae ventrolaterally, palpomere 5 with several short to moderately long setae lateroventrally and more numerous on proximal portion (maxillary palpus developed similar to many *Ochlerotatus*). *Antenna:* Pedicel of female with 2 large patches of partly overlapping broad scales, one covering mesal surface and other covering lateral surface, patches maybe contiguous dorsally in some species. *Thorax:* Scutum covered with narrow scales, including most of prescutal area, 1-6 on parascutellar area, antealear and supraalar areas usually with curved narrow scales somewhat broader, no broad scales present; scutal setae (most on anterior half relatively short)--few anterior promontory, numerous anterior and posterior dorsocentral and acrostichal, scutal fossal (anterior, lateral, median and posterior), few posterior medial scutal, several prescutellar, several antealear, numerous supraalar, and 1-3 parascutellar; scutellum with curved narrow scales and numerous long setae on all lobes; pleural areas with scales broad and relatively long (occasionally few narrow scales on paratergite, hypostigmal and lower metepisternal areas in some species), most pale, occurring on following areas--large patch on antepronotum, large patch on upper proepisternum, large patch covering postpronotum, large elongate patch on subspiracular area, patch on hypostigmal area, patch on postspiracular area, elongate patch on lateral and ventral margins of paratergite, large patch covering upper and posterior areas of mesokatepisternum, patch on lower prealar area and often extending onto upper area, large patch covering mesepimeron from near ventral margin dorsally to anterodorsal setal patch and also posterodorsally to setae, patch covering metamerom, patch on membrane posteromesad of metapostnotum; most pleural setae long, and as follow--numerous (30+) antepronotal, numerous (40+) upper proepisternal, several posterior postpronotal, few postspiracular, few upper and several posterior mesokatepisternal, numerous (25+) prealar, numerous upper and 1-9 (usually 2-5) long lower mesepimeral; mesomerom with dorsal margin well above base of hindcoxa. *Legs:* Patches of broad scales on both antecoxal and postcoxal membranes of foreleg; posttarsi I-III of female and male each toothed, larger unguis of I,II with 2 teeth in male. *Wing:* Costa with pale scales at base; remigium with 1-6 (usually 2,3) long setae. *Abdomen:* Terga with brown scales but with extensive pale-scaled areas.

Female genitalia. *Tergum VIII:* With basal 0.4-0.5 retracted into segment VII; base slightly concave; apex straight and wide; numerous setae and usually numerous moderately broad scales on most of area; 4-8 moderately long setae on apical margin. *Sternum VIII:* Base slightly convex to straight; apex with very small median indentation and broadly rounded lobe on each side of midline; numerous short and moderately long setae and moderately broad scales on most of area; apical margin with row of setae, short mesally and increasing in length to moderately long laterally. *Tergum IX:* Moderately wide; apex with moderately deep median indentation; several setae apically. *Insula:* Liplike; with several moderately long setae. *Lower vaginal lip:* Covered with short to moderately long spicules; narrow; lightly pigmented; lower vaginal sclerite absent. *Upper vaginal lip:* Covered with short to moderately long spicules; narrow; moderately to heavily pigmented; caudal margin curved; upper vaginal sclerite absent. *Spermathecal eminence:* Membranous; nonpigmented; ill-defined; large patch of short thin simple spicules on basomesal area. *Postgenital lobe:* Moderately long; moderately wide; with small median apical indentation; ventral surface narrowly attached to upper vaginal lip; with number of setae. *Cercus:* Moderately long; moderately wide; apex sharply rounded with few long stout setae; dorsal surface with number of short and few moderately long setae and numerous moderately broad scales; ventral surface with number of short setae on apical and lateral areas. *Spermathecal capsules:* 1 large- and 2 medium-sized ones; heavily pigmented; spherical.

Male genitalia. Prerotation position. *Tergum IX:* With narrow lobe on each side of midline bearing several short, stout, flattened setae apically. *Gonocoxite:* Long; moderately broad; dorsal surface with basal lobe bearing specialized setae mesally. *Gonostylus:* Long; narrow; curved mesally; with 2-4 short setae subapically on lateral margin; gonostylar claw moderately long, narrow, heavily pigmented, with apex truncate. *Claspette:* With long, moderately thick, curved stem, distal portion somewhat broader; filament short, with transverse annulations. *Phallosome:* Aedeagus simple, more or less troughlike, relatively long, narrow, median area narrower than basal and apical portions, base with more or less circular opening (bearing short triangular flap laterally on each side in some species), apex with median small lobe separating short flattened area with few tiny, stout spicules on each side; paramere moderately long to long, narrow; basal piece moderately long. *Proctiger:* Moderately long; shorter than aedeagus; paraproct heavily pigmented, apex curved into blunt point; few short cercal setae. *Sternum IX:* Relatively short; with heavily pigmented, median, caudal, small, rounded area bearing few long and short setae; heavily pigmented, short, triangular strip laterally on each side.

Pupae. *Cephalothorax:* Setae 4,5-CT with short thin branches, approximately equally developed; 7-CT with moderately long thin branches; 11-CT moderately stout, closer to 10-CT than to 12-CT. *Trumpet:* Moderately long; pinna moderately wide. *Abdomen:* Seta 1-II-VII with thin branches, 1-II, III moderately long, 1-IV-VII moderately long to long; 2-II, VII laterad of 1-II, VII; 2-III-VI mesad of 1-III-VI; 5-IV-VI very long, stout; 6-VII with short fine branches; 9-VII, VIII relatively short, with moderately stout branches, 9-VII noticeably cephalad and slightly laterad of 6-VII, 9-VIII very lightly aciculate. *Paddle:* Outer width from midrib greater than inner width; length noticeably longer than width; basal portion of outer margin with minute serrations, apical portions of outer and inner margins with minute spicules; seta 1-Pa short, usually single (occasionally 2-forked or branched).

Fourth-instar larvae. *Head:* Seta 1-C long, stout, curved mesad, simple; 4-C short, with fine branches, mesad and slightly cephalad of 6-C; 5-C long, stout, aciculate, caudad of 4,6-C, slightly mesad of 6-C and slightly laterad of 4-C; 6-C long, stout, aciculate; 7-C moderately long to long, stout, fanlike, with multiple aciculate branches, laterad of 4-6-C and slightly cephalad of 4,6-C, shorter than 5,6-C; 8-10-C moderately long, fine; 11,12-C short, with multiple fine branches; 13-C long, single; 14-C short, relatively stout; 15-C short, with thin branches. *Antenna:* Relatively short, heavily pigmented, shaft with numerous short stout spicules over entire length; seta 1-A short, stout, with aciculate branches; 2-6-A inserted at apex of shaft. *Thorax:* Seta 1-P long, aciculate; 12-P very long, aciculate, single. *Abdomen:* Seta 12-I short; 1-VII long, stout, aciculate; 1,3,5-VIII with multiple, stout, aciculate branches, 1-VIII noticeably shorter than 3,5-VIII; 4-VIII shorter than 3-VIII; comb on segment VIII consisting of several stout scales in 1 or 2 irregular rows, scales with long stout median spine and few short denticles basolaterally; saddle incompletely rings segment X, without acus, without stout posterior spines; 1-X long, stout, aciculate; 4-X consisting of several long, multiple-branched setae on well developed grid and at least 2 short, branched, precratal setae. *Siphon:* With well developed attached acus; seta 1-S long, stout, with multiple aciculate branches; 1 accessory seta laterally before midlength of siphon, inserted slightly above pecten proximally to 1-S, short, usually branched; at least 1 additional accessory seta (often several accessory setae that are stout and aciculate) inserted dorsally or slightly subdorsally on siphon; 6-S long, single; 8-S short, branched; 9-S developed as moderately stout hook; pecten consisting of several spines with at least 1 distal spine wider spaced than the remainder.

Eggs. The following are pertinent features that I feel may be of subgeneric importance and are extracted from the description of the egg of *Ae. rusticus* given by Service *et al.* (1997). *Shape:* Short but very wide; in profile almost subtriangular with rounded corners; ventral surface arched in middle; about equally rounded at both ends. *Outer chorion:* Dorsal, lateral, ventral, anterior and posterior areas more or less similarly developed; chorionic cells mainly roundish or elliptical, few quadrilateral or pentagonal with straighter sides; each cell encloses single variously sized, but usually large, tubercle with finely granular sloping sides and domed tuberculate top. *Micropyle:* Collar not very prominent; orifice not obvious.

Discussion.

Adults of the subgenus *Rusticoides* are similar to some Holarctic species of *Ochlerotatus* in habitus but are distinguished from all (?) species of this subgenus and the other subgenera of *Aedes* by possessing the following combination of six characters (1) both antecoxal and postcoxal membranes of foreleg have a patch of broad white scales, (2) antennal pedicel of female has two large patches of partially overlapping broad white scales, one patch covering the mesal surface and the other covering the lateral surface (patches maybe contiguous dorsally in some species), (3) postpronotum is covered with only broad flat scales, (4) parascutellar area has 1-6 scales in addition to 1-3 long setae, (5) hypostigmal area has a patch of broad scales, and (6) membrane posteromesad of metapostnotum has a patch of broad scales. Some species of *Ochlerotatus* possess one or more of the above characters but not all six. Other adult features that are useful in separating *Rusticoides* from the other subgenera of *Aedes* are (1) scutum and scutellum having only narrow scales, (2) antepronotum, upper proepisternum and prealar area each has a large number of long setae, (3) metameron is covered with broad scales, (4) mesepimeron has 1-9 long setae on anteroventral area, (5) subspiracular area has an elongate patch of broad scales, and (6) male posttarsi having each unguis with a tooth and the larger unguis of posttarsi I and II has two teeth.

Adults of *Ae. lepidonotus* are interesting in that they possess a patch of golden narrow scales and 2 short golden or white setae on the median caudal area of the mesopostnotum. Species of the subgenus have 1-7 scales on the lower portion of the metepisternum (seen in specimens of *Ae. lepidonotus*, *Ae. quasirusticus* and *Ae. rusticus* but these scales may have been rubbed off in other species of the subgenus).

Male genitalia of *Rusticoidus* are distinctive in the development of the aedeagus (see above) and the claspette being moderately thick and having a short, transversely annulated filament. Other features, used in combination, that are useful in separating *Rusticoidus* from many other subgenera of *Aedes* are: tergum IX having a narrow lobe on each side of the midline and bearing several short, stout, flattened setae; sternum IX relatively short, having heavily pigmented areas restricted to a small, median, caudal, rounded area bearing a few long and a few short setae, and narrow basal strip connected to the lateral margins that have a short, triangular strip; and the gonocoxite with a basomesal lobe on the dorsal surface bearing specialized setae. Each species of the subgenus has distinctive features of the male genitalia (e.g., *Ae. rusticus* having the gonocoxite with the dorsal surface expanded into a narrow lobe bearing several moderately long, broad, fusiform scales ventrally, and the gonostylar claw is sinuous).

The pupal stage of *Rusticoidus* is known only for *Ae. quasirusticus* and *Ae. rusticus* and is imperfectly described and illustrated. Unfortunately, the specimens of these two species available for examination were in poor condition and no features of subgeneric rank could be observed for this stage.

Fourth-instar larvae of *Rusticoidus* are generally similar to many species of *Ochlerotatus* but are easily distinguished from these and all subgenera of *Aedes* by having the siphon with a short (usually branched) accessory seta laterally before the midlength and inserted slightly above the pecten and proximal to seta 1-S. Other features that are useful in separating *Rusticoidus* larvae from those of other subgenera of *Aedes* are (1) seta 12-P is very long, stout, aciculate and single, (2) siphon has at least a second accessory seta (often with several setae that are stout and aciculate) inserted dorsally or slightly subdorsally, (3) positions and development of setae 4-7-C are as described above, (4) saddle does not ring segment X, is incomplete ventrally and is without an acus or stout spines on the posterior margin, (5) seta 9-S is developed as a moderately stout hook, and (6) antenna is relatively short, heavily pigmented, and with numerous stout spicules over the entire length of the shaft.

Larvae with accessory setae on the siphon also are found in the subgenus *Aedes* and a few species of subgenus *Ochlerotatus* (e.g., *Ae. crinifer* (Theobald) (see Arnell 1976); *Ae. hexodontus* Dyar, *Ae. hexodontus hokkaidensis* Tanaka, Mizusawa & Saugstad and *Ae. punctor* (Kirby) (see Tanaka *et al.* 1979) but none of these species have an accessory seta inserted laterally on the siphon before midlength, slightly above the pecten and proximal to seta 1-S. Seta 12-P developed as a very long, aciculate, single seta is also infrequently found in some *Ochlerotatus* species (e.g., *Ae. punctor*). Other features mentioned above also are found in some species of *Ochlerotatus*.

In subgenus *Rusticoidus* the egg of the European *Ae. rusticus* has been described and/or illustrated (e.g., Marshall, 1938:85; Natvig, 1948:39; Hinton, 1981:425; Service *et al.*, 1997:61). Service *et al.* (1997) provided a detailed description of this species and included several scanning electron microphotographs of the entire egg and other features. This article should be consulted for details of the egg. The chorionic pattern of *Ae. rusticus* eggs is similar to several species of *Ochlerotatus* (e.g., *Ae. cantans* (Meigen), *Ae. punctor*, *Ae. vittiger* (Skuse)) and, even though the shape is characteristic, it also resembles some species of *Ochlerotatus* (e.g., *Ae. aculeatus* (Theobald), *Ae. vittiger*).

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References

- Alekseev, E.V. (1989) Bloodsucking mosquito *Aedes (Rusticoidus) krymmontanus* sp. n., a relic of the entomofauna of the Crimea. *Parazitologija* 23, 173-178 (in Russian).
- Arnell, J.H. (1976) Mosquito studies (Diptera, Culicidae) XXXIII. A revision of the Scapularis Group of *Aedes* (*Ochlerotatus*). *Contributions of the American Entomological Institute* 13 (3), 1-144.
- Dahl, C. & White, G.B. (1978) Culicidae. In: Illies, J. ed., *Limnofauna Europaea*, G. Fischer Verlag, Stuttgart, pp. 390-395.
- Dubitzky, A.M. (1970) The bloodsucking mosquitoes of Kazakhstan. *Alma-Ata, Nauk Kazakh. SSR*, 222 pp. (in Russian).
- Edwards, F.W. (1921) A revision of the mosquitoes of the Palaearctic Region. *Bulletin of Entomological Research* 12, 263-351.

- Edwards, F.W. (1932) Diptera, Fam. Culicidae. In: P. Wytzman, *Genera Insectorum*. Desmet-Verteneui, Brussels, Fasc. 194, 258 pp.
- Encinas Grandes, A. (1982) *Taxonomia y biologia de los mosquitos del area Salmantina (Diptera, Culicidae)*. Consejo Superior de Investigaciones Cientificas Centro de Edafologia y Biologia Aplicada Ediciones Universidad de Salamanca, 437 pp. (in Spanish).
- Gilot, B. (1968) Presence d'*Aedes refiki* Med., 1928, dans la region Grenoblois (Diptera, Culicidae). *Bulletin de la Société entomologique de France* 73, 169-173 (in French).
- Gilot, B., Ain, G., Pautou, G. & Vigny, F. (1971) Repartition d'*Aedes refiki* Med., 1928 (Dipt. Culicidae). Ecologie de cette espece dans la region Rhone-Alpes. *Cahiers O.R.S.T.O.M., serie Entomologie medicale et Parasitologie* 9, 183-186. (in French).
- Gutsevich, A.V. & Dubitzky, A.M. (1981) New species of mosquitoes in the fauna of the USSR. *Parazitologicheskii Sbornik (Akademi Nauk SSSR, Leningrad, Nauka)* 30, 97-165 (in Russian).
- Gutsevich, A.V. & Dubitskiy (sic), A.M. (1987) New species of mosquitoes in the fauna of the USSR. *Mosquito Systematics* 19, 1-92 (English translation of preceding article).
- Gutsevich, A.V. & Pendikova, Y.G. (1972) The bloodsucking mosquito *Aedes (Ochlerotatus) albescens* Edw. (Diptera, Culicidae) as a species in its own right. *Entomological Review* 51, 241-242.
- Gutsevich, A.V., Monchadskii, A.S. & Shtakel'berg, A.A. (1970) *Fauna of the U.S.S.R. Vol. 3, No. 4, Mosquitoes Family Culicidae*. 408 pp. Nasekomye Dvukrylye, Leningrad (in Russian).
- Gutsevich, A.V., Monchadskii, A.S. & Shtakel'berg, A.A. (1974) *Fauna of the U.S.S.R. Diptera, Vol.3, No.4, Mosquitoes Family Culicidae*. 408 pp. Keter Press, Jerusalem (English translation from Russian).
- Harbach, R.E. & Knight, K.L. (1980) *Taxonomists' glossary of mosquito anatomy*. Plexus Publishing, Incorporated, Marlton, NJ, 415 pp.
- Hinton, H.E. (1981) *Biology of insect eggs*. Pergamon Press, Oxford, Vol. I, 473 pp.
- Knight, K.L. & Stone, A. (1977) *A catalog of the mosquitoes of the world (Diptera: Culicidae)*. The Thomas Say Foundation, Vol. VI, 611 pp.
- Marshall, J.F. (1938) *The British mosquitoes*. British Museum (Natural History). London, 341 pp.
- Martini, E. (1931) *Culicidae*. In: Lindner, E., *Die Fliegen der palaearktischen Region*. Stuttgart, 3, 1-144 (1929), 145-320 (1930), 321-398 (1931) (in German).
- Medtschid, E. (1928) Uber *Aedes lepidonotus* Edw. und *Aedes refiki* n. sp. *Archiv für Schiffs- und Tropfen Hygiene, Leipzig* 32, 306-315 (in German).
- Mohrig, W. (1969) The Culicidae of Germany, studies of the taxonomy, biology and ecology of the domestic mosquitoes. *Parasitologische Schriftenreihe* 18. Gustav Fischer Verlag, Jena, 260 pp. (in German).
- Natvig, L.R. (1948) *Contributions to the knowledge of the Danish and Fennoscandian mosquitoes, Culicini*. Suppl. I, *Norsk Entomologisk Tidsskrift*, 567 pp.
- Rioux, J.A. (1965) Presence d'*Aedes (Ochlerotatus) refiki* Med., 1928, dans le Midi de la France. *Annales de Parasitologie humaine et comparée* 40, 125-128 (in French).
- Roman, E. (1958) Contribution a la repartition en France des Dipteres de la famille des Culicidae. *Annales de Parasitologie humaine et comparée* 33, 115-130 (in French).
- Schaffner, F. (1992) *Les moustiques de Haute-Alsace. I. Systematique*. Retirage de these D.R.S., Conseil General du haut-Rhin, 295 pp. (in French).
- Schaffner, F. (1998) A revised checklist of the French Culicidae. *European Mosquito Bulletin* 2, 1-9.
- Service, M.W., Duzak, D. & Linley, J.R. (1997) SEM examination of the eggs of five British *Aedes* species. *Journal of the American Mosquito Control Association* 13, 47-65.
- Shevchenko, A.K. & Prudkina, N.S. (1973) Morphology of genitalia of mosquito males Report I. Study of genitalia of mosquito males of the genus *Aedes*. *Vestnik Zoologii* 6, 40-47 (in Russian).
- Snow, K. & Ramsdale, C. (1999) Distribution chart for European mosquitoes. *European Mosquito Bulletin* 3, 14-31.
- Stone, A. (1963) A synoptic catalog of the mosquitoes of the world, supplement II (Diptera: Culicidae). *Proceedings of the Entomological Society of Washington* 65, 117-140.
- Stone, A., Knight K.L. & Starcke, H. (1959) *A synoptic catalog of the mosquitoes of the world (Diptera, Culicidae)*. The Thomas Say Foundation Vol. VI, 358 pp.
- Stojanovich, C.J. & Scott, H.G. (1993) *Mosquitoes of the Republics of the Former Yugoslavia*. Published by the authors. 81 pp.
- Stojanovich, C.J. & Scott, H.G. (1995a) *Mosquitoes of European Russia*. Published by the authors. 106 pp.
- Stojanovich, C.J. & Scott, H.G. (1995b) *Mosquitoes of Asiatic Russia*. Published by the authors. 112 pp.

- Stojanovich, C.J. & Scott, H.G. (1995c) Illustrated key to the mosquitoes of Fennoscandia-Finland, Sweden, Denmark, Norway. Published by the authors. 132 pp.
- Stojanovich, C.J. & Scott, H.G. (1995d) Mosquitoes of Kazakhstan. Published by the authors. 144 pp.
- Stojanovich, C.J. & Scott, H.G. (1996) Illustrated key to the adult male mosquitoes of Russia. Published by the authors. 56 pp.
- Stojanovich, C.J. & Scott, H.G. (1997) Mosquitoes of Italy. Mosquitoes of the Italian biogeographical area which includes the Republic of Malta, the French island of Corsica and all of Italy except the far-northern provinces. Published by the authors. 200 pp.
- Tanaka, K., Mizusawa, K. & Saugstad, E.S. (1979) A revision of the adult and larval mosquitoes of Japan (including the Ryukyu Archipelago and the Ogasawara Islands) and Korea (Diptera: Culicidae). *Contributions of the American Entomological Institute* 16, 1-987.
- Torres Canamares, F. (1951) Una nueva especie de *Aedes* (Dipt. Cul.). *EOS, Madrid* 27, 79-92 (in Spanish).
- Ward, R.A. (1984) Second supplement to "A catalog of the mosquitoes of the world" (Diptera: Culicidae). *Mosquito Systematics* 16, 227-270.
- Ward, R.A. (1987) Nomenclatural status and some additions to the species listed in the publication, *New species of mosquitoes in the fauna of the USSR* by A.V. Gutsevich and A.M. Dubitskiy (sic) (1981) (Diptera: Culicidae). *Mosquito Systematics* 19, 93-99.
- Ward, R.A. (1992) Third supplement to "A catalog of the mosquitoes of the world" (Diptera: Culicidae). *Mosquito Systematics* 24, 177-230.

The identity of *Culex perexiguus* Theobald versus *Cx. univittatus* Theobald in southern Europe

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The purpose of this note is to clarify the specific name of the species of *Culex* in southern Europe commonly known as *Culex univittatus*. It appears that continued use of the name *univittatus* Theobald, 1901 for this species stems from Minar (1991), who listed *perexiguus* Theobald, 1903 as a junior synonym of this epithet. Contrary to the evidence, I am surprised that *univittatus* is still in use for this taxon. It is obvious that Minar (1991) prepared his contribution to the Catalogue of Palaearctic Diptera without knowledge of my monograph on the subgenus *Culex* in southwestern Asia (Harbach, 1988). It seems he only had access to literature that was 10-12 years out of date, and simply repeated what was listed in the world catalogue of mosquitoes by Knight & Stone (1977), which he incorrectly cited as 1978. He did not reference the supplement to the world catalogue by Knight (1978) which listed *Cx. perexiguus* as a valid species (after White, 1975). Furthermore, Minar apparently had no knowledge of the crossmating experiments performed by Jupp (1971) (*Cx. univittatus* x *Cx. neavei* Theobald) and Jupp & Harbach (1990) (*Cx. perexiguus* x *Cx. neavei*). The available data indicate that *Cx. univittatus* is restricted to the temperate highlands in the East African Subregion of the Afrotropical Region, while *Cx. perexiguus* inhabits more arid areas in eastern Africa and the Mediterranean Subregion of the Palaearctic. I have examined only a few specimens from southern Europe (Greece, Italy and Turkey), but these appear to be *Cx. perexiguus* based on characters of the male genitalia and larvae. Hence, based on the available evidence, the species of the *Univittatus* Complex that occurs in southern Europe should be regarded as *Cx. perexiguus* rather than *Cx. univittatus*.

References

- Harbach, R.E. (1988.) The mosquitoes of the subgenus *Culex* in southwestern Asia and Egypt (Diptera: Culicidae). *Contributions of the American Entomological Institute (Gainesville)* 24(1), vi + 1-240.
- Jupp, P.G. (1971) The taxonomic status of *Culex* (*Culex*) *univittatus* Theobald (Diptera: Culicidae) in South Africa. *Journal of the Entomological Society of Southern Africa* 34, 339-357.
- Jupp, P.G. & Harbach, R.E. (1990) Crossmating and morphological studies of *Culex neavei* and *Culex perexiguus* (Diptera: Culicidae) to elucidate their taxonomic status. *Mosquito Systematics* 22, 1-10.
- Knight, K.L. (1978) Supplement to a catalog of the mosquitoes of the world (Diptera: Culicidae). *Thomas Say Foundation* 6 (supplement), 1-107.
- Knight, K.L. & Stone, A. (1977) A catalog of the mosquitoes of the world (Diptera: Culicidae). Second edition. *Thomas Say Foundation* 6, ix + 1-611.
- Minar, J. (1991) Family Culicidae. *Catalogue of Palaearctic Diptera. Volume 2. Psychodidae—Chironomidae* (ed. by A. Soos and L. Papp), pp. 74-113. Elsevier Science Publishing Co., New York.
- White, G.B. (1975) Notes on a catalogue of Culicidae of the Ethiopian Region. *Mosquito Systematics* 7, 303-338.