

QUINQUEFASCIATUS OR FATIGANS FOR THE TROPICAL (SOUTHERN) HOUSE MOSQUITO (DIPTERA: CULICIDAE)

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ABSTRACT—Towards an objective resolution of the controversy regarding the use of *quinquefasciatus* or *fatigans* as the specific-group name for the Tropical (Southern) House Mosquito, initiated by Alan Stone in 1957, an analysis is made of the type-material at the Naturhistorisches Museum in Vienna, examined in 1966, and the original descriptions of *crucians*, *ferruginosus*, *pungens* and *fatigans* by Wiedemann, and the original descriptions of *punctipennis* and *quinquefasciatus* by Say. It is suggested that the following actions be taken: designation of a neotype for *quinquefasciatus* and an application to the International Commission on Zoological Nomenclature for suppression of *ferruginosus*.

For over 50 years, two different specific-group names (*quinquefasciatus* Say, 1823 and *fatigans* Wiedemann, 1828) have been used for the same ubiquitous, economically and medically important species, popularly known as the Tropical (Southern) House Mosquito. In 1957 Alan Stone, in preparation for a catalog of the mosquitoes of the world, reviewed this vexing problem, came to the conclusion that it was zoological rather than nomenclatorial, and on this basis adopted *quinquefasciatus* as the name to be used in the catalog (Stone, Knight and Starcke, 1959) with the hope that this would result in the solution of the problem and in uniform usage. Unfortunately this has not been the case; *fatigans* continued to be widely used in the Old World and was adopted by the World Health Organization in its reports and publications. A concerted effort is being made at the present time to reach an agreement for the rejection of one of the names and the uniform acceptance of the other.

During the summer of 1966, I had the opportunity of examining the Wiedemann material at the Naturhistorisches Museum in Vienna (NMW) through the courtesy of Dr. Max Beier. This material contains some specimens obtained from Thomas Say which are critical to the resolution of the controversy regarding *quinquefasciatus* and *fatigans*. The manuscript on my findings and analysis was prepared in the fall of 1966 and was circulated to Alan Stone, Kenneth L. Knight and Peter F. Mattingly. However, the only published information on this study (Belkin, 1968b:9, 19, 55, 57) deals with the designation of lectotypes for *Anopheles crucians*, *An. ferruginosus* and *Culex pungens*, all described by Wiedemann, 1828, and statements regarding the type-material of Wiedemann's species and their presence in NMW (Belkin, 1968b:9, 19, 55, 57), and the rejection of *ferruginosus* as a *nomen oblitum* and the retention of *atropos* Dyar and Knab, 1906 as the valid

specific name for a well known taxon (Belkin, Heinemann and Page, 1970:27).

To expedite the resolution of the controversy, the problem is re-examined here with due consideration of the original descriptions of Say and Wiedemann and the material examined at NMW in the summer of 1966. Since the nominal species *Anopheles crucians*, *An. ferruginosus*, *An. punctipennis* and *Culex pungens* are intimately involved in the problem, they are also considered.

Wiedemann Types and Descriptions

crucians. There are five females in NMW collection with *crucians* labels which are probably all part of the type-series. The specimen bearing the following labels was designated as the lectotype (Belkin, 1968b:9): // [small square red label] // Coll. Winthem [printed] // *crucians* [ink] / det. Wiedem. [printed] // *crucians* W/N Orleans [ink] //. All specimens agree quite well with the description except in the statement: "in der Ruhe, wo die Flügel auf einander liegen, sieht man jenseits der Mitte eine blasse Binde, die an den einzelnen Flügeln wenig oder gar nicht bemerkbar ist", which seems to be a rewording of part of Say's description and comments on *punctipennis*: "When the insect is at rest, the wings being incumbent one on the other, the pale band is very distinct . . . with a hardly perceptible pale band beyond the middle. . .". Wiedemann cites *Culex punctipennis* Say as a synonym of *crucians*, but it is obvious from the original descriptions that two different taxa are involved and these have been recognized as distinct for a long time (Howard, 1896:23).

ferruginosus. There are three females in NMW collection with *ferruginosus* labels which are probably all part of the type-series, all in poor condition. The specimen bearing the following labels was designated as the lectotype (Belkin, 1968b:9-10): // *ferruginosus* [ink] / Coll. Winthem [printed] // *ferruginosus*/ W. N Orleans [ink; Wiedemann's hand?] //. The lectotype has the palpi broken at end of the second segment (basal long segment) and lacks antennae, abdomen and right hindleg. All three specimens agree quite well with the original description in the remaining parts except for the statement: "Beine kürzer als bei der vorigen Art [*crucians*], schwärzlichbraun, mit gelblichen Schenkeln," which again seems to be a rewording of part of Say's description and comments of *quinquefasciatus*: "Legs much shorter than those of the preceding species [*punctipennis*] . . . feet moderate, fuscous, thighs whitish".

Wiedemann's *ferruginosus* is undoubtedly *Anopheles atropos* Dyar and Knab, 1906 of current usage. The significant statements in the description are: "Fühler und Taster braun, diese dunkeler mit an der Wurzel wenig schneeweissen Gliedern . . . Flügeladern braunbeschuppt; Schwinger fast weiss mit braunem Knopfe".

I am confident that Howard, Handlirsch and Coquillett (Coquillett, 1906:7) were mistaken about the identity of the types of *ferruginosus*. I concur with Alan Stone (*in litt*) that it is hard to believe that Howard, in 1905, could not distinguish an *Anopheles* from a *Culex*. However, the three females of *ferruginosus* I examined had the palpi broken and lacked many other structures. This, coupled with unspotted wings, gives the specimens a *Culex*-like appearance; as a matter of fact, I was fooled for a minute when I first looked at a specimen, expecting it to be a *Culex*.

In Coquillett's discussion (1906:7) the only reference to the types of *ferruginosus* is: "It is represented in the Vienna museum by four specimens of a *Culex*; this is in perfect accord with Say's statement that the legs of this species [*quinquefasciatus*] are much shorter than those of *Anopheles punctipennis*." It is strange that in this discussion no mention is made of any character of the type-specimens of *ferruginosus*, not even a confirmation of the relative leg length, while some details are given for the types of *fatigans* and *pungens* which were examined at the same time. I believe that there is at least a possibility that Howard saw the same material that I did, in part at least, and that he made a very superficial examination. It is, of course, possible that Howard and I examined different specimens. This is suggested by the fact that I found only three specimens labeled *ferruginosus* instead of four seen by Howard. Possibly significant in this connection is one female *Culex* bearing only the printed label // Coll. Winthem // which I found among the miscellaneous material in the general series; this specimen could have been included in the *ferruginosus* series in Howard's time and might be the one examined by him. This specimen may be part of the original series of one of Wiedemann's species but, of course, without a locality or species label it cannot be assigned definitely to any of them now. I believe that it may be part of the *pungens* material, and I have placed it there.

Whether Howard made his decision upon a superficial examination of the one specimen bearing the handwritten *ferruginosus* label (the designated lectotype) or saw a different series of specimens which were *Culex* does not really matter. The specimens labeled *ferruginosus* which I examined agree with the original description in all significant characters and are undoubtedly part of the type-series. The description of *ferruginosus* is of a species of *Anopheles* and not *Culex*. Every other species of *Anopheles* treated by Wiedemann in the same publication is in fact an *Anopheles*, indicating that Wiedemann knew what he was doing when he placed *ferruginosus* in *Anopheles*.

The description of *ferruginosus* by Wiedemann does not fit *quinquefasciatusfatigans* in any significant characters. Therefore, Howard's identification of *ferruginosus* as a *Culex* was erroneous.

pungens. There are three females in NMW collection with *pungens* labels, which are probably all part of the type-series. An additional female *Culex*, mentioned above under *ferruginosus*, may be part of this series. The specimen bearing the following labels was designated as the lectotype (Belkin, 1968b:19): // [small square red label] // Coll. Winthem [printed] // *pungens* [ink] / det. Wiedem. [printed] // *pungens* W. / N Orleans [ink] //. All four specimens agree quite well with the description. I believe that they are *quinquefasciatus-fatigans*, although without a male a positive identification is impossible. I could find no character to suggest any other species of *Culex*. The original description and the handwritten label on the lectotype indicate New Orleans as the provenance of the material. Although there is no statement in the description or on the labels that this material came from Say, it appears probable that it did in fact come from him, as all other mosquito material from New Orleans in Wiedemann's publication (*crucians*, *ferruginosus*) did in fact come from Say (footnote under *ferruginosus*, p. 12; see next section on Wiedemann's material). This is a crucial point, and if we accept it then we can resolve the problem. Since these specimens fit Say's description of *quinquefasciatus*, I believe that Wiedemann described Say's species as *pungens* and incorrectly applied the name *quinquefasciatus* to an *Anopheles* which he renamed *ferruginosus*.

fatigans. In the NMW collection there are two specimens, one male and one female, each with two combination printed and handwritten labels, one locality, the other species. Both specimens are in poor condition, rubbed and faded; unfortunately, the male lacks genitalia and there is no indication of who made the preparation or where it is. The female bears the following labels: // [small square red label] // Ind. orient [ink] / Coll. Winthem [printed] // *fatigans* Wied/ Ind. orient [ink] // *fatigans* [ink] / det. Wiedem. [printed] //. This specimen was designated as the lectotype by Belkin (1968a:68).

Howard examined the female in 1905 and made notes on the tarsal claws and wing venation (Coquillett, 1906:8), but no notation of the male. These two specimens appear to be the authentic type-material and, although in poor condition, there is nothing in external characters different from the Tropical House Mosquito. The female is unquestionably a member of the *pipiens* complex and the remains of the male are also consistent with this. The female fits the original description quite well. The use of "flavidis" and "gelblich" in the description is misleading, the parts so described are very light yellowish brown as is common in faded and rubbed specimens such as Wiedemann's types. "Untergesicht schneeweiss" is a little puzzling; I think it may refer to the very pale ventral membrane at the base of the palpi and proboscis. This membrane is conspicuous and shiny in the male particularly.

Wiedemann's Material

We have to accept, at least in part, Wiedemann's statement that his descriptions of *crucians* and *ferruginosus* were based on specimens which Say himself had seen: "Alle von Thom. Say aufgeführten Arten habe ich, ausser wenigen mit [†] bezeichneten [*Culex triseriatus* and *Corethra punctipennis*], nach den Originalien selbst beschrieben (footnote under *ferruginosus*)." I am confident that the specimens of these species in NMW in 1966 were actually the specimens from Say, as they agree remarkably well with Wiedemann's descriptions.

These specimens bear no original Say label, only Wiedemann and/or Winthem labels and there is no way of determining whether or not Say himself labeled them in any way. Again, we have to accept for these specimens the localities specified on the Winthem/Wiedemann labels. We are interested here only in the specimens labeled New Orleans. These include the type-material of *crucians* and *ferruginosus*. The type-material of *pungens* is also from New Orleans, but unfortunately there is no statement that it came from Say. However, since the only other mosquito material from New Orleans mentioned in Wiedemann's publication is stated to have been derived from Say (*crucians* and *ferruginosus*), I believe it is safe to assume that the specimens of *pungens* were also among the same material.

Wiedemann's statement that his descriptions of Say's species were on the original material ("nach den Originalien selbst") cannot be taken to mean that he examined the actual specimens from which Say drew up his own original descriptions (types). I believe that Wiedemann's statement is best interpreted, as in the past, to mean only that he examined material identified by Say himself. This may or may not have included some of the actual type-series. All sorts of errors may have occurred in this material, in selecting the specimens, labeling, during shipment and after arrival. Additional species may have been included as well as mixed series in shipment, and some of the material may have been lost during transit and the labels (if any) misplaced.

I have been puzzled by Wiedemann's renaming of Say's *punctipennis* and *quinquefasciatus* as *crucians* and *ferruginosus* respectively. Apparently he did not do this as a rule in transferring species to a different genus (e.g. *Beris dorsalis* = *Sargus dorsalis* Say). The reason may have been that the specimens before him did not agree with Say's descriptions. The latter is quite evident when we compare them now. As I have noted above under *crucians* and *ferruginosus*, Wiedemann retained in modified form some of Say's statements which actually do not apply very well to the type material of *crucians* and *ferruginosus*. This suggests that the material before Wiedemann was either unlabeled or incorrectly labeled or that Say's species were composite. Therefore, we can not accept Wiedemann's identifications of Say's

species without comparing the specimens in NMW with Say's original descriptions.

Wiedemann had before him authentic specimens of *An. quadrimaculatus* Say, 1824, and he described this species, crediting it to Say and without renaming it. I did not see any material of *quadrimaculatus* in NMW and know of no published record of it except in Wiedemann.

Say's Descriptions

punctipennis. The only statements in the original description which can be used to identify the species of *Anopheles* involved are: "wings hairy, dusky, with a hardly perceptible pale band beyond the middle . . . When the insect is at rest, the wings being incumbent one on the other, the pale band is very distinct . . ." These characters have been used to identify this species as the *Anopheles punctipennis* of current usage, which shows the pale band very strikingly when the wings are superimposed. As Wiedemann received specimens presumably identified as *punctipennis* which he described as *crucians*, Say may have included the latter in his concept of *punctipennis*. *Anopheles crucians* certainly does not show a "very distinct" pale band on the wing, but it does have some pale areas and it is probable that Say placed in his *punctipennis* all mosquitoes with pale scales on the wing. In Wiedemann's description of *crucians*, the pale band is stated to be distinct (not *very* distinct) on the superimposed wings and hardly or *not at all* perceptible on the individual wing: "in der Ruhe, wo die Flügel auf einander liegen, sieht jenseits der Mitte eine blasse Binde, die an den einzelnen Flügeln wenig oder gar nicht bemerkbar ist." Even this hardly applies to *crucians* and I believe that perhaps Wiedemann included this in his description because it formed such a conspicuous part of Say's description and because he thought that the band might be more conspicuous in some of Say's other specimens.

The evidence is quite clear, I believe, that Say's *punctipennis* was a composite species. Therefore, the two species involved must be preserved in the current usage.

quinquefasciatus. I agree with Alan Stone (1966, *in litt.*) that the most reliable source for the identification of *quinquefasciatus* is Say's original description, no matter how poor and whether or not it was based on more than one species. I also agree with Alan Stone (1957:343) that a number of conspicuous characters in the description point to a species of *Culex* rather than *Anopheles*: "Legs much shorter than those of the preceding species [*punctipennis*] . . . abdomen cinereous; tergum with five black, broad fasciae . . . The hairy covering is very deciduous, and when an individual is caught by hand, the back of the thorax, in consequence of being denuded by the touch, exhibits the dorsal vittae of a blackish colour confluent at the

base, with an oval black spot on each side." I would also add: "thighs whitish", a conspicuous feature of *quinquefasciatus-fatigans* not seen in any dark *Anopheles*. Particularly significant, of course, is the abdominal banding from which the specific name is obviously derived. The name *quinquefasciatus* should be applied to the form with the abdominal banding in case the nominal species was composite. The description of the banding is inaccurate but is still recognizable as that of a *Culex* with the ventral surface and base of the abdominal segments dorsally pale, of a greyish color, and the rest of the dorsal surface of the segments dark. Other than "tail black above", there is really nothing in the description of *quinquefasciatus* that would definitely indicate an *Anopheles*. The statement: "halteres entirely whitish" might suggest *walkeri* but some *quinquefasciatus* have them definitely pale and they were described by Wiedemann as yellowish for *pungens*. "We found them in great numbers on the Mississippi in May and June", as was indicated by Belkin, Schick and Heinemann (1966:4), probably refers to Say's travels on the Mississippi north of the Ohio River in 1819 and could apply to any dark mosquitoes Say observed before the actual description of *quinquefasciatus*.

Conclusions

None of the above mentioned characters (except the legs) in the description of *quinquefasciatus* is in Wiedemann's description of *ferruginosus* and none of them fits the type-specimens of the latter. The legs are a little shorter (not much shorter) perhaps in *ferruginosus* than in *crucians*, but the femora are not yellowish. Again, as in the case of *punctipennis-crucians*, Wiedemann apparently modified some of the statements in Say's description. As indicated above under *pungens*, I believe that Wiedemann probably received from Say the specimens of *Culex* from New Orleans which Wiedemann described as *pungens*. The description of *pungens* agrees with that of *quinquefasciatus* in the all important character of abdominal markings, although this is stated in a reverse way and the color terminology is different: "Hinterleib braun, mit deutlich gelblichen Abschnitten; zwei oder drei letzte Abschnitte an beiden Seiten mit gelblichem Striemchen." This species, *pungens*, is certainly *quinquefasciatus* of American authors. Therefore, I believe that Wiedemann misidentified Say's *quinquefasciatus* and redescribed it as *pungens* and applied Say's name to a different species which he renamed *ferruginosus*. The most likely reason for such an error may have been mislabeling of Wiedemann's specimens from Say, but it is possible that Say included in his *quinquefasciatus* all dark mosquitoes without conspicuous wing, thorax or leg markings.

There is no doubt in my mind that *quinquefasciatus* Say, 1823 and *fatigans* Wiedemann, 1828 both refer to the Tropical (Southern)

House Mosquito as analyzed here and determined earlier by Alan Stone (1957:342-344). Therefore, it is strongly urged that *quinquefasciatus* be used as the specific-group name for the Tropical (Southern) House Mosquito because of priority over *fatigans*.

To formalize this and eliminate ambiguity the following actions should be taken as soon as possible:

1. Designation of a neotype for *quinquefasciatus*. Although it is possible that the type-series of *pungens* in NMW are syntypes of *quinquefasciatus*, this cannot be proved with certainty and is actually quite improbable. Leaving *quinquefasciatus* without a type-specimen would only continue the controversy. Therefore, a neotype specimen should be designated. The type-locality for *quinquefasciatus* has been restricted to the vicinity of New Orleans, Louisiana by Belkin, Schick and Heinemann (1966:5) and an individual from a series of specimens reared from an egg raft collected 18 September 1969 in New Orleans is now available for designation of a neotype.

2. Suppression of *ferruginosus*. Application should be made to the International Commission on Zoological Nomenclature for the suppression of *ferruginosus* Weidemann, 1828, senior subjective synonym of *atopos* Dyar and Knab, 1906 (Belkin, 1968b:10), rejected as *nomen oblitum* by Belkin, Heineman and Page (1970:27).

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