

# Studies on the Danish Biting Midges, *Culicoides* Latreille (Dipt., Ceratopogonidae).

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## Introduction.

Since the days of R. C. Stæger (1800—1875) no studies have been carried out on the Danish fauna of biting midges (*Culicoides* Latreille). Stæger (1839) describes *Ceratopogon pictipennis*, *Ceratopogon fascipennis*, and *Ceratopogon vexans* on Danish material and these are together with *Culicoides pulicaris* L. (Stæger 1839) the only species of *Culicoides* hitherto known from Denmark.

Wesenberg-Lund (1943) vividly describes an attack of biting midges in Lyngby Aamose but without referring to species, and as his description of the species in question is very incomplete, it is impossible to identify the annoying species.

Recently the biting midges have caused much nuisance in some Danish districts, e. g. in the neighbourhood of Copenhagen. In connection with an investigation on the nuisance of biting midges in Lyngby Aamose, Nielsen (1963) our knowledge on the Danish *Culicoides* was found to be very incomplete. The present paper intends to increase our knowledge on the Danish species of *Culicoides* but, of course, a complete list of the Danish species of biting midges requires more extensive collections in all parts of the country. Nevertheless 21 species are recorded from Denmark in the present paper. Of these species 17 are new to the Danish fauna. According to Campbell and Pelham-Clinton (1960, p. 181) 41 species of *Culicoides* are recorded from Britain.

## Material.

The material of biting midges in the Zoological Museum, Copenhagen, is very scarce but, nevertheless, valuable, because it includes the collection of R. C. Stæger.

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On account of this scarcity of *Culicoides* available, the author had to procure the material himself. By far the most of the material (20,000 imagines, 3000 larvae) was collected by the author, but the colleagues, mentioned in Acknowledgements, have kindly supplied the author with valuable specimens.

The material was collected in various ways, but as a rule taken either by sweeping or by collecting specimens attracted to man. In Lyngby Aamose a light trap (a New Jersey trap) was used and at a single occasion the author had the opportunity to collect biting midges at mercury vapour light at Molslaboratoriet, Femmøller, Eastern Jutland. In 1961-62 emergence-traps were used in Lyngby Aamose, Nielsen (1963). In 1960 three sticky traps were placed in gardens in the neighbourhood of Lyngby Aamose, but the material collected in this way was not very fit for taxonomical studies.

In Lyngby Aamose soil samples were taken and treated in the laboratory. The larvae were sorted out, identified, some of them stored in alcohol and the rest were reared. The soil sampling technique, the method of extraction etc. are described in details by Nielsen (1963).

#### **Localities.**

Unfortunately the author's collections with few exceptions were carried out in the neighbourhood of Copenhagen and as no other Danish collections of *Culicoides* were available this bias could not be compensated.

#### **Zealand:**

Most of the material was collected in Lyngby Aamose, a wooded fen situated North of Copenhagen. Lyngby Aamose is described in further details elsewhere, Nielsen (1963). In Kagsmosen West of Copenhagen the author has collected rather regularly; this locality can be described as a fen consisting of small pools with dense reed-swamps surrounded by a narrow meadow. A part of the old land fortifications of Copenhagen is situated in the neighbourhood of Kagsmosen, in this connection especially the old moat with its muddy surroundings is of interest. Besides this, sampling was carried out in Jonstrup Vang, a beech forest with various small pools; in a garden at Hellerup; at the protected area, Strødam, Hillerød, and the rest of the material of biting midges from Zealand came from a garden

in Bagsværd NV of Copenhagen (Leif Lyneborg leg.), a garden at Birkerød (K. Arevad leg.), Nebbegaard plantation (K. Arevad leg.), and Rungsted (Steen Rasmussen leg.).

Jutland:

Here the author has only had the opportunity to collect at Molslaboratoriet, Femmøller, Eastern Jutland, where a very interesting material was collected at mercury vapour light, and at the estate of Sandbjærg, Southern Jutland. In the collection of the Zoological Museum, Copenhagen, were a few specimens of *C. impunctatus* collected by Mr. O. Bakkendorf at Ørgaard, Nors, Thy, North Western Jutland. The farmer living at Ørgaard told me, that he often had experienced very heavy attacks from the biting midges, and the specimens taken by Mr. Bakkendorf were collected during an evening where the nuisance was very severe. In the protected area moors with *Sphagnum* were present and no doubt the biting midges came from these habitats. Further material was collected by Dr. Hans Lind at the protected area Tipperne in Ringkøbing Fjord and cand. mag. K. Arevad has collected some specimens in fenland near Brande, Central Jutland.

**Preservation, Methods, and Measurements.**

Imagines of the biting midges were stored in alcohol (70 %), but to study the very important characters of the female antennae, mouth-parts, and fronto-vertex, and of the male genitalia it was quite inevitable to make a great number of slides. Thus about 800 slides were made. The imagines were dissected and mounted in Swan's medium (Swan 1936) as recommended by Campbell & Pelham-Clinton (1960). By using this medium the mounting process could be much accelerated because the object can be transferred from alcohol directly to Swan's medium or even placed in this fluid alive. Whole mounts of the biting midges were made, of the females one wing, the head, and one of the antennae were dissected free and placed in the mount. Great care was taken to ensure, that the antennae and the palps were stretched out in the slides, so that all parts were visible. As a rule the female head, the loose antennae, and the body were mounted under the same cover-glass. In the male the head and the genitalia were dissected free but in this case the head and the body were mounted under one cover-glass, the genitalia

under another on the same slide. As a rule some manipulation of the cover-glass was necessary to prevent overlapping. As soon as the mounts were dry enough they were carefully ringed by balsam to prevent drying.

A small material of imagines was pinned as described by Campbell & Pelham-Clinton (1960).

The larvae were stored in alcohol after killing in hot water.

To identify the larvae a closer examination of the pharyngeal skeleton was inevitable and it was necessary to make slides. To examine the pharyngeal skeleton, this structure had to be dissected out. The dissection was performed in the following way. The larva was gently boiled in 10% potash for a few minutes and then treated for a few minutes with hot lactic acid. The head was transferred to a drop of Swan's medium on a slide and the pharyngeal skeleton was dissected out. By means of two fine needles the head of the larva was split and the epipharynx was carefully detached from the hypopharynx. The epipharynx was then placed with its ventral side uppermost, this could easily be done by moving the cover-glass.

In order to ensure a satisfactory examination of the female antennae, especially in order to detect, count, and establish the distribution of the sensilla it was necessary to use an oil immersion objective.

An important side of the identification is the measurement of the female antennae and palps and the female and male wings, see Campbell & Pelham-Clinton (1960) table V, VI, IX, and X. Campbell and Pelham-Clinton used a micro-projector and vernier scale for these measurements, while the author in the present study performed the measurements by the aid of eyepiece micrometer. By using two different sorts of equipment for the measurements it most likely could be rather difficult to compare the results but generally the agreement is satisfying. The measurements were always carried out on specimens mounted in Swan's medium.

In the present study the following measurements and countings were made:

I. Antennal length of female *Culicoides* (Table I p. 265). The individual segments were measured and the measurements were summed up.

**Table I.** Antennal Lengths in Microns of *Culicoides* Females.

Species	No.	Lengths of segments 3 to 15											Total lengths				
		3	4	5	6	7	8	9	10	11	12	13	14	15	Min.	Max.	Mean
<i>segnis</i> .....	13	47	29	29	30	31	31	31	34	54	56	59	62	84	520	630	580 ± 32.5
<i>riethi</i> .....	4	58	37	42	44	46	45	45	45	54	55	54	55	83	613	738	664 ± 52.5
<i>circumscriptus</i> .....	3	45	33	33	35	35	34	32	31	77	75	80	86	117	703	730	715 ± 11.2
<i>duddingstoni</i> .....	1	41	30	30	35	37	35	38	35	57	57	65	70	103			(628)
<i>pictipennis</i> .....	11	52	32	32	32	32	32	34	82	86	89	92	125	683	831	753 ± 38.1	
<i>odibilis</i> .....	2	52	33	35	41	38	40	41	42	82	87	95	122	783	825	804	
<i>cubitalis</i> .....	16	41	26	26	26	26	27	28	28	68	68	75	76	107	542	685	621 ± 35.1
<i>pallidicornis</i> .....	10	39	27	29	30	30	31	32	32	51	50	59	61	87	502	597	556 ± 24.7
<i>truncorum</i> .....	9	41	26	27	27	28	26	28	29	46	53	58	63	85	507	558	537 ± 17.6
<i>albicans</i> .....	11	46	33	34	35	35	35	37	39	54	55	69	69	89	615	644	631 ± 10.0
<i>chiopterus</i> .....	3	34	23	23	24	23	25	26	26	35	38	41	40	66	400	459	424 ± 25.2
<i>obsoletus</i> .....	34	43	28	28	29	30	30	31	34	48	47	50	54	89	438	655	543 ± 55.4
<i>impunctatus</i> .....	26	47	33	34	34	35	33	33	32	44	47	55	62	82	504	615	571 ± 27.6
<i>punctatus</i> .....	14	54	41	42	44	46	43	42	44	62	65	73	81	112	662	863	748 ± 44.9
<i>halophilus</i> .....	4	48	35	38	40	42	40	40	40	50	56	62	66	91	631	663	647 ± 12.4

**Table II.** Antennal Ratios of *Culicoides* Females. See text p. 267.

Species	No.	Min.	Max.	Mean
<i>segnis</i> .....	13	1.08	1.31	1.19 ± 0.064
<i>riethi</i> .....	4	0.76	0.90	0.82 ± 0.056
<i>circumscriptus</i> .....	3	1.51	1.68	1.59 ± 0.070
<i>duddingstoni</i> .....	1			(1.27)
<i>pictipennis</i> .....	11	1.61	1.84	1.70 ± 0.071
<i>odibilis</i> .....	2	1.49	1.52	1.51
<i>cubitalis</i> .....	16	1.57	1.84	1.72 ± 0.075
<i>pallidicornis</i> .....	10	1.14	1.34	1.23 ± 0.054
<i>truncorum</i> .....	9	1.21	1.39	1.30 ± 0.062
<i>albicans</i> .....	11	0.99	1.22	1.13 ± 0.059
<i>chiopterus</i> .....	3	1.00	1.10	1.06 ± 0.043
<i>obsoletus</i> .....	34	1.03	1.26	1.13 ± 0.055
<i>impunctatus</i> .....	26	0.95	1.11	1.02 ± 0.039
<i>punctatus</i> .....	14	1.03	1.21	1.11 ± 0.047
<i>halophilus</i> .....	4	0.97	1.04	1.01 ± 0.026

**Table III.** Wing Measurements in Millimetres of *Culicoides* Females. See text p. 267.

Species	No.	Min.	Max.	Mean	Estimated
<i>segnis</i> .....	13	1.19	1.45	1.31 ± 0.081	1.50
<i>riethi</i> .....	4	1.81	2.10	1.94 ± 0.116	2.22
<i>circumscriptus</i> .....	4	1.46	1.70	1.59 ± 0.085	1.82
<i>duddingstoni</i> .....	1			(1.38)	1.58
<i>pictipennis</i> .....	11	1.54	1.81	1.66 ± 0.078	1.90
<i>odibilis</i> .....	2	1.64	1.64	1.64	1.87
<i>cubitalis</i> .....	16	1.06	1.34	1.24 ± 0.066	1.42
<i>pallidicornis</i> .....	10	1.00	1.16	1.11 ± 0.058	1.27
<i>truncorum</i> .....	8	1.03	1.21	1.12 ± 0.059	1.28
<i>albicans</i> .....	11	1.31	1.45	1.38 ± 0.045	1.58
<i>chiopterus</i> .....	3	0.90	0.98	0.95 ± 0.038	1.09
<i>obsoletus</i> .....	34	0.96	1.39	1.21 ± 0.112	1.38
<i>impunctatus</i> .....	26	1.02	1.43	1.23 ± 0.101	1.41
<i>punctatus</i> .....	14	1.44	1.82	1.69 ± 0.094	1.93
<i>halophilus</i> .....	4	1.39	1.49	1.43 ± 0.039	1.63

II. Antennal ratios of female *Culicoides* (Table II p. 266). The antennal ratio is the ratio of  $a$  (the sum of the five apical flagellum segments (11—15)) to  $b$ , which is the sum of the basal eight (3—10).

III. Distribution of antennal sensilla in *Culicoides* females.

IV. Number of mandibular and maxillary teeth of *Culicoides* females.

V. Length of maxillary palps of *Culicoides* females.

VI. Wing measurements of *Culicoides* females (Table III p. 266). The wing length was measured from arculus to wing tip and the total wing length was estimated by multiplying the measured length by  $\frac{8}{7}$ , Downes and Kettle (1952), Campbell and Pelham-Clinton (1960).

### Danish Species of the Genus *Culicoides* Latr.

In the present paper no attempt will be given to present a comprehensive morphological introduction to the genus *Culicoides*, as nothing new could be added. Campbell and Pelham-Clinton (1960) give an adequate survey of taxonomic characters. As for the classification the author decided to follow the scheme of Campbell and Pelham-Clinton (1960), where the species have been arranged into species groups, mostly based on the distribution of sensilla of the female antennae.

#### *segnis* Group.

##### 1. *Culicoides segnis* Campbell & Pelham-Clinton 1960.

*C. segnis* was described on material from Scotland, Campbell & Pelham-Clinton (1960) and hitherto it was only recorded from Scotland and England.

In Denmark *C. segnis* was collected at Molslaboratoriet (7.VIII. 1961, at mercury-vapour light) and in Lyngby Aamose, Zealand. In this locality *C. segnis* was collected during June and July in the years 1960—61, Nielsen (1963). In 1961 62 specimens were collected by sweeping at sundown and a similar number was taken at mercury-vapour light. Besides this 3 specimens were attracted to man. According to Campbell and Pelham-Clinton (1960) *C. segnis* has never been found biting. Neither in Denmark it seems to be a man-biter, Nielsen (1963).

Further material: Strødam, 20. VI. 1962, 2 ♀ (swept).

**nubeculosus** Group.2. **Culicoides stigma** (Meigen) 1818.

According to Edwards (1939 a) *C. stigma* is an uncommon insect in the South of England, but it may be commoner in the North. Campbell & Pelham-Clinton (1960) found, that *C. stigma* appeared to be commoner in the North of Britain, but they never found it abundantly. Haliday (1833) records it from Northern Ireland.

In Denmark only a single male was collected, taken at mercury-vapour light at Molslaboratoriet (7. VIII. 1961).

According to Kettle & Lawson (1952) this species is a mud-breeder, the larva of which often is found together with *C. nubeculosus*, *C. circumscriptus*, and *C. odibilis* in mud completely drying up in summer.

3. **Culicoides riethi** Kieffer 1914.

This species is known from England and Scotland, Edwards (1939 a), Campbell & Pelham-Clinton (1960).

In Denmark it is known from a single locality, namely Birkerød, where 24 ♀ were collected in a garden (24. VI. 1961, attracted to man).

**salinarius** Group.4. **Culicoides circumscriptus** Kieffer 1918.

According to Edwards (1939 a) *C. circumscriptus* is essentially a coastal species. This view was supported by Campbell & Pelham-Clinton (1960) regarding it as a salt-marsh species.

*C. circumscriptus* is hitherto only known from a single Danish locality, namely Molslaboratoriet, where 2 ♂, 6 ♀ were taken at mercury-vapour light (7. VIII. 1961). Based on this single record nothing can be said on the occurrence of this species under Danish conditions, but it is worth noting, that the specimens from Molslaboratoriet were taken only 1 kilometre from the sea (the creek of Ebeltoft) so they could easily be stragglers from some coastal breeding site.

**odibilis** Group.5. **Culicoides duddingstoni** Kettle and Lawson 1955.

This species was described on material from Scotland, Kettle & Lawson (1955) and is recorded from England too, i. e. Suffolk and Scilly, Campbell & Pelham-Clinton (1960).

Hitherto only two specimens are collected in Denmark; both



specimens from Lyngby Aamose, 1 ♀ swept at sunset 20. VI. 60 and 1 ♀ attracted to man at sunset, 5. VII. 60. This record seems to be the first outside the British Isles.

The type locality in Scotland is described as freshwater marsh with extensive beds of *Phragmites*, and the rest of the British material was collected in similar habitats, Campbell & Pelham-Clinton (1960). In Lyngby Aamose freshwater marsh with *Phragmites* is present, Nielsen (1963).

6. ***Culicoides pictipennis*** (Stæger) 1839.

This species is recorded from England and Scotland and it is locally common in Britain in damp woodland, appearing in May and June, Campbell & Pelham-Clinton (1960). Khalaf (1957) records *C. pictipennis* from Iraq, but according to Campbell & Pelham-Clinton (1960) this is a distinct species differing notably from *C. pictipennis* (Stæger).

This species was described by Stæger (1839) on material from Denmark. Stæger (1839) writes: "Several females in June on willow-hedges". In the Zoological Museum of Copenhagen, 3 ♀ from Stæger's collection were kept. In Denmark it is hitherto only known from Zealand, where it was collected in Malmmosen, 12. VI. 1960 3 ♀ attracted to man, Nebbegaard plantation, 7. V. 1961 7 ♀ attracted to man, and in Kagsmosen, where this species was dominant as man-biter during May 1961, Nielsen (1963). In Lyngby Aamose it was attracted to man during May 1961 and present in the sweep-net collections during May and June, Nielsen (1963). Most likely this species has a maximum in May, Nielsen (1963). It is interesting, that in Denmark the species in question could be collected biting man, while British species of the *odibilis* group were not biting, Campbell & Pelham-Clinton (1960).

7. ***Culicoides odibilis*** Austen 1921.

According to Campbell & Pelham-Clinton (1960) this species has a wide distribution in the palaeartic region.

In Denmark *C. odibilis* has been collected in the following localities: Zealand: Malmmosen, 12. VI. 1960, 1 ♀ and 10. VII. 1960, 1 ♀, both specimens attracted to man. Kagsmosen, 18. V. 1961, 1 ♀, attracted to man, Strødam, 20. VI. 1962, 3 ♀, swept. In Lyngby Aamose it was frequently met with during June and July 1960 and 1961.

8. **Culicoides cubitalis** Edwards 1939.

This species is known from England, Edwards (1939 a), Scotland, where it is very abundant in mid-summer, Campbell & Pelham-Clinton (1960), and Estonia, Remm (1956).

In Denmark it is very common in Lyngby Aamose, where it could be collected during June and July. It was frequent in the light-trap (mercury-vapour light), and in the sweep-net collections at sundown 1961 *C. cubitalis* amounted to 23% of the imagines taken in the bog in this way, Nielsen (1963). According to Campbell & Pelham-Clinton (1960) the British species of the *odibilis*-group have not been found biting. In Lyngby Aamose a single female was attracted to man during 1960 and a single specimen during 1961; in Malmosen one female was attracted to man during 1960. *C. cubitalis* was frequently swept in Malmosen and several specimens were taken at mercury-vapour light at Molslaboratoriet (7. VIII. 1961).

Further material: In the collections of the Zoological Museum, Copenhagen: Dokkedal, Mou, Jutland, 30. VIII. 1925, 9 ♀.

The larvae were very abundant in bare mud at the banks of Lyngby sø and in a similar habitat at Lille Sejdam, Jonstrup Vang. This agrees very well with the information on the breeding places of this species given by Kettle & Lawson (1952).

*fascipennis* Group.

9. **Culicoides pallidicornis** Kieffer 1919.

This species was rather abundant in Lyngby Aamose, especially in the sweep-net collections and the light-trap. Further it was collected at Kidmose bæk, Brande, and at Molslaboratoriet, where it was caught at mercury-vapour light.

10. **Culicoides fascipennis** (Stæger) 1839.

Recorded from Scotland and England, Campbell and Pelham-Clinton (1960).

This species was described by Stæger (1839) on Danish material and we only know, that the specimens were collected in Zealand in 1838 by Schiødte. This species has not been collected by the author. The type material seems to be lost.

*vexans* Group.

11. **Culicoides truncorum** Edwards 1939.

According to Edwards (1939) *C. truncorum* is apparently an uncommon insect in Britain. Later is it recorded by Kettle &

Lawson (1952), who found the larvae in bogland sites with *Sphagnum*, in which *C. truncorum* occurred in association with *C. impunctatus* and *Ceratopogon (Isohelea)*. Besides these findings Campbell & Pelham-Clinton (1960) record three other specimens from England and Scotland. Outside Britain it is only recorded from Estonia, Remm (1956). Campbell & Pelham-Clinton (1960, Table VI, p. 281) call the attention to the variability in some of the characters e. g. female antennal ratio, suggesting the possibility that more than one species has been included under *C. truncorum*. In the Danish material the variability is in no way striking, and it is possible, that all the Danish material belongs to one species only, but more material is necessary to confirm or invalidate this view.

In Denmark this species is hitherto only known from Lyngby Aamose, where it is rather common in the sweep-net collections and in the material from the light-trap. In 1960 and 1961 it has been collected during June, July, and August, the earliest date of collecting being 16. VI. 1961 and the latest 6. VIII. 1961. This species was never collected biting, and the female is together with *C. albicans* characterized by the reduced mouthparts. Nothing is known on the feeding-habits of these species.

In Lyngby Aamose *C. truncorum* was collected in emergence-traps placed in a reed-swamp, in pure *Sphagnum*-vegetation, and in puddles with decaying leaves.

## 12. *Culicoides albicans* (Winnertz) 1852.

*C. albicans* is recorded from Scotland, but seems to be less common in England, Campbell & Pelham-Clinton (1960).

In Denmark it is hitherto only known from Lyngby Aamose, Nielsen (1963) where it was common in the sweep-net collections in 1960 and 1961. In 1961 *C. albicans* amounted to 15% of the total number of *Culicoides* taken in these collections, and it was only exceeded by *C. impunctatus* and *C. cubitalis*, Nielsen (1963). Neither in Denmark this species has been collected biting man, and the feeding habits of this species is unknown (see *C. truncorum*, above). In Lyngby Aamose it was collected during May and June.

In the emergence-traps *C. albicans* was collected from pure *Sphagnum*, *Sphagnum* and ferns, puddles with decaying leaves, and from a reed-swamp, Nielsen (1963). Kettle and Lawson (1952) record the larva from wet bogland.

**13. *Culicoides vexans* (Stæger) 1839.**

Stæger (1839) notes, that the species in question often occurs in houses, where it is a troublesome biter. As far as known other Danish species of *Culicoides* rarely enter buildings for biting.

Through the courtesy of Dr. S. L. Tuxen, Zoological Museum, Copenhagen, the type material of this species (1 ♂, 8 ♀) was placed at the author's disposal. The examination of this material showed, that *C. vexans* (Stæger) is not identical with *C. vexans* (Stæger) sensu Edwards (1939 b). Thus the latter specimens must belong to some new species. This mistake is due to the fact that the type material of *C. vexans* (Stæger) was not examined by Edwards himself (Edwards 1939 b, p. 140).

Actually *C. vexans* (Stæger) is identical with or very closely related to *C. reconditus* Campbell & Pelham-Clinton. Seemingly *C. vexans* (Stæger) is somewhat larger than *C. reconditus* Campbell & Pelham-Clinton, but this matter needs more investigations and will be dealt with as soon as further material is available.

In the present investigation *C. vexans* is only collected in Zealand: Kagsmosen, 3 ♀, 14. V. 1961 and Strødam, 1 ♀, 20. VI. 1962. Further a single specimen from Stæger's collection was labelled "Norges Minde" (Hellerup, Copenhagen).

***obsoletus* Group.****14. *Culicoides dewulfi* Goetghebuer 1936.**

syn. ***Culicoides pseudochoipterus*** Downes and Kettle 1952.

*C. dewulfi* has a wide distribution in Britain, Campbell & Pelham-Clinton (1960). It is recorded from Estonia, Remm (1956), but according to Campbell & Pelham-Clinton (1960), there seems to be a rather bad accordance concerning the male hypopygium between the material from Estonia and the British material. In this respect the Danish material agrees well with the figures given by Kettle & Lawson (1952) as both the basal transverse bar in the aedeagus and the numerous spicules in the sternite emargination are present in the Danish specimens.

Hitherto only five specimens (5 ♂) are known from Denmark, all of them collected at mercury-vapour light, 7. VIII. 1961, Molslaboratoriet. The species is regarded as a dung-breeder, Kettle & Lawson (1952).

**15. *Culicoides chiopterus* (Meigen) 1830.**

This species is known from England and Scotland and has

a wide distribution in the holarctic region, Campbell & Pelham-Clinton (1960). Remm (1956) records it from Estonia as a blood-sucker especially in spring and autumn. Campbell & Pelham-Clinton (1960) mention some records of *C. chiopterus* attacking animals. It is a dung-breeder, Kettle & Lawson (1952).

In Denmark it is known from Jutland: Borup in the neighbourhood of Brande, Central Jutland, where 2 females were attracted to man in the afternoon. Further *C. chiopterus* was collected at mercury-vapour light at Molslaboratoriet, 2 ♂ 7. VIII. 1961.

**16. *Culicoides obsoletus* (Meigen) 1818.**

This species has a very wide holarctic distribution. In Britain it is widely distributed and perhaps the most abundant species, Campbell & Pelham-Clinton (1960).

In Denmark it is known from Jutland: Borup, Brande, and Molslaboratoriet, several ♂♂ and ♀♀ at mercury-vapour light. In Zealand it is recorded from Nebbegaard plantage, Birkerød, and Lyngby Aamose, where it has been collected during May, June, July, and August in the years 1961—62. Further it is known from gardens in Hellerup and Rungsted.

*C. obsoletus* was only taken once in the emergence-traps in Lyngby Aamose which indicates, that the chief breeding media of this species seem to be overlooked when the emergence-traps were distributed in the different types of vegetation, Nielsen (1963). In Lyngby Aamose the single specimen was collected from moist Sphagnum, one of several breeding media recorded by Kettle & Lawson (1952).

*pulicaris* Group.

**17. *Culicoides grisescens* Edwards 1939.**

This species is known from England and Scotland, Edwards (1939 a), Campbell & Pelham-Clinton (1960). It is recorded from the Soviet Union, Gutsevich (1952), Remm (1956).

From Denmark three specimens are recorded hitherto, namely 1 ♂, 20. VI. 1961 and 1 ♀ 27. VI. 1961 taken in the very same emergence-trap covering moist Sphagnum, Lyngby Aamose, Nielsen (1963), and 1 ♂ taken at mercury-vapour light, 7. VIII. 1961, Molslaboratoriet.

**18. *Culicoides impunctatus* Goetghebuer 1920.**

*C. impunctatus* is recorded from the Soviet Union, Gutsevich

(1952), Remm (1956) and according to Campbell & Pelham-Clinton (1960) this species is the most abundant *Culicoides* in most part of highland Britain, and a very troublesome human biter.

In Denmark too, *C. impunctatus* is very abundant, and it often occurs as an annoying pest, e. g. in Lyngby Aamose, Nielsen (1963).

*C. impunctatus* is hitherto known from Molslaboratoriet, where several specimens were taken at mercury-vapour light, 7. VIII. 1961, and Ørsgaard, 2 ♀, 30. VI. 1957. In Lyngby Aamose *C. impunctatus* is by far the dominant species, Nielsen (1963). Here *C. impunctatus* was collected during May, June, July, and August the earliest date of collecting being 15. 5. 61 but as a rule *C. impunctatus* first appears in greater number in the last half of May with maximum in the first half of June, Nielsen (1963).

In the emergence-traps *C. impunctatus* was especially collected from *Polytrichum*, *Sphagnum*, and *Sphagnum* mixed with *Carex* sp., Nielsen (1963).

Further material: In the collections of the Zoological Museum, Copenhagen: Rye, Jutland, 1 ♂ (date unknown), from the collection of Stæger. Dokkedal, Mou, Jutland, 3 ♀, 30. VIII. 1935.

#### 19. *Culicoides punctatus* (Meigen) 1804.

In many parts of Scotland the females of *C. punctatus* are found biting horses and cattle together with *C. pulicaris*, Campbell & Pelham-Clinton (1960). The species is also known from England, Campbell & Pelham-Clinton (1960).

In Denmark *C. punctatus* was collected at mercury-vapour light at Molslaboratoriet 7. VIII. 1961 (several specimens), Sandbjerg, 3 ♀ attracted to man, 31. VIII. 1962, and further it was rather common in Lyngby Aamose, where it appeared in the material from the sweep-net collections and from the light-trap. The species was collected during May, June, and July. In the emergence-traps *C. punctatus* was reared from bare mud, in one of the sites the mud was heavy contaminated.

Further material: In the Zoological Museum, Copenhagen, 1 ♂, 5 ♀ from Stæger's collection (see *C. pulicaris*, below).

#### 20. *Culicoides pulicaris* (Linnaeus) 1758.

This species was recorded from Denmark by Stæger (1839). In the Zoological Museum, Copenhagen, 1 ♂, 5 ♀ were kept, all from the collection of Stæger, and most likely he refers to these specimens in his paper of 1839. The author found all the

specimens mentioned above to be typical *C. punctatus* (Meigen), with "hour-glass" mark of the *punctatus* type and clearly visible white spots at the tips of veins  $M_1$  and  $M_2$ .

*C. pulicaris* was collected by the author at Molslaboratoriet, several specimens at mercury vapour light, 7. VIII. 1961.

#### 21. *Culicoides halophilus* Kieffer 1924.

In Britain this species is only known from coastal marshes, Campbell & Pelham-Clinton (1960). Gutsevich (1952) records a single specimen from Tadzhikistan. This specimen is the only known from the Soviet Union and from outside the Western palaeartic region.

In Denmark it has only been collected once, namely in the coastal marshes at the protected area, Tipperne, Western Jutland, where several specimens were collected in 1961 (date unknown).

#### Summary.

In the present paper 21 species of *Culicoides* are recorded from Denmark, of which 17 are new to the Danish fauna.

Preliminary notes on the identity of *C. vexans* (Stæger) are given.

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