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Biting midges (Diptera: Ceratopogonidae) from forest habitats in Norway

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ABSTRACT. The Norwegian Forest Research Institute, Norway conducted a study to investigate the biodiversity in Norwegian forests. Samples of the arthropod fauna were collected using a pyrethroid fogger sampling technique in May, June and July 1998-99 at two sites: a *Pinus silvestris* dominated boreal forest in eastern Norway (Sigdal, Buskerud) and a coastal *Pinus silvestris* forest in western Norway (Kvam, Hordaland). Among the Diptera, midges of Ceratopogonidae were abundant. A total of 56 species was identified in 11 genera within the 3879 ceratopogonids collected from the two sites. The majority of specimens were predaceous genera of midges, which was dominated by *Brachypogon* (60.1%). Other genera present were *Forcipomyia* (14.1%), *Culicoides* (12.1%), *Dasyhelea* (8.7%), *Ceratopogon* (2.0%), *Bezzia* (1.2%) and also *Alluaudomyia*, *Schizohelea*, *Serromyia*, *Palpomyia*, and *Atrichopogon* (each <1%). Among 44 species reported from Norway for the first time were boreal *Culicoides alatavicus* and *Bezzia rhynchostylata*; *Dasyhelea ledi*, recorded for the first time in Norway and Europe.

KEY WORDS: Ceratopogonidae, Norway, predaceous midges, biting midges, Diptera, forest habitats, biodiversity, faunistics.

INTRODUCTION

Many species of female Ceratopogonidae are known to vector pathogens to humans, mammals and birds; specifically biting midges in the genus *Culicoides*, that act to vector

disease agents as a consequence of the bloodmeal taken from their vertebrate hosts. Besides the risk of transfer of pathogens, the bite of female *Culicoides* can also be a great nuisance to their hosts. Most *Culicoides* species need a blood meal from a vertebrate host, although some species are autogenous and have limited need for protein in the adult stage.
The females of all Ceratopogoninae, except *Culicoides* are predators on small insects, in many cases males of Chironomidae, small Ephemeroptera, or other Ceratopogonidae (DOWNES 1978). Other genera in Ceratopogonidae have different strategies for obtaining the protein needed for their gonotrophic cycle, for example *Forcipomyia* and *Atrichopogon* feed on hemolymph of larger insects, e.g., caterpillars and adults of Lepidoptera, Odonata, Coleoptera, or Neuroptera. *Dasyhelea* spp. are autogenous, relying on protein from larval stages (SZADZIEWSKI et al. 1997).

The Norwegian Ceratopogonidae fauna is relatively poorly known and described. ZETTERSTEDT (1838, 1850 and 1855) was the first to collect and describe Norwegian species. He reported *Atrichopogon griseolus* (ZETT.), *Dasyhelea flavoscutellata* (ZETT.), *Ceratopogon lacteipennis* ZETT., *Nilobezzia posticata* (ZETT.), *Bezzia nigritula* (ZETT.), and *Palpomyia spinipes* (MEIG.) from Norway (SZADZIEWSKI 1986). KIEFFER (1919) described from the Lofoten Islands of Norway, a female *Brachypogon* (*Isohelea*) *borealis* (as *Psilohelea borealis*, see BORKENT & GROGAN 1995), and subsequently *Culicoides newsteadi* AUSTEN (as *halophilus*, KIEFFER 1924).

The most comprehensive list of Norwegian species of ceratopogonids was by SOOT-RYEN (1943), who recorded the following biting midges: *Atrichopogon brunnipes* (MEIG.), *A. rostratus* (WINN.), *Bezzia nigritula* (ZETT.), *B. solstitialis* (WINN.), *Ceratopogon lacteipennis* ZETT. (other species in the genus not confirmed by BORKENT & GROGAN 1995), *Clinohelea unimaculata* (MACQ.), *Culicoides nubeculosus* (MEIG.), *C. obsoletus* (MEIG.), *C. fascipennis* (STAEG.), *C. pulicaris* (L.), *Dasyhelea corinneae* GOSSERIES (as *scutellata* MEIG.), *D. flavoscutellata* (ZETT.), *D. septuosa* BORKENT (as *obscura* WINN.), *Forcipomyia bipunctata* (L.), *F. pallida* (WINN.), *Mallochohelea nitida* (MACQ.), *Palpomyia armipes* (MEIG.), *P. distincta* (HAL.), *P. lineata* (MEIG.), *P. pubescens* KIEFFER, *P. rufipes* (MEIG.), *P. spinipes* (MEIG.), *P. tibialis* (MEIG.) and *Serromyia femorata* (MEIG.), *S. morio* (FABR.), *Sphaeromias fasciatus* (MEIG.). TJEDER (1944) and GREVE (1968, 1969) identified *Forcipomyia eques* JOH. parasitizing adult Neuroptera. CLASTRIER (1961) described two new species from Norway, *Brachypogon hyperboreus* and *B. incompletus* (as *B. lapiae*) and recorded *B. sociabilis* (see SZADZIEWSKI et al. 1994). Subsequently CLASTRIER (1962a,b) described *Mallochohelea scandinaviae* and *Bezzia nigrita* from Norway. Since then most work on Ceratopogonidae of Norway have been in the genera of *Palpomyia* (KRZYWIŃSKI 1996, 1997) and *Culicoides* (MRÁZ 1997). KRZYWIŃSKI (l. c.) reported *P. pubescens* KIEFF. and *P. remmi* HAVELKA and MRÁZ (l.c.) *C. fascipennis* (STAEG.), *C. chiopterus* (MEIG.), *C. punctatus* (MEIG.) and *C. impunctatus* GOETGH. Lastly *Dasyhelea norvegica* and *Brachypogon norvegicus* (SZADZIEWSKI & HAGAN 2000) are described from Norway.

The objectives of this study were to identify species of Ceratopogonidae present at two sites in eastern and western Norway, and to examine differences in distribution and abundance of the ceratopogonids at the sites.

Acknowledgements

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MATERIALS AND METHODS

In 1997, the Norwegian Forest Research Institute initiated a project first to identify the regional biodiversity hotspots, which focused on identification and selection of small-scale areas for conservation of biodiversity in managed forests. Secondly, the project began to describe and catalog the biodiversity, and develop tools to identify and monitor the environmental qualities that quantify biodiversity (GJERDE et al. 1997). During the sampling of the arthropod fauna in the spring and summer of 1998 and 1999, we found that a major portion of the fauna belonged to the family Ceratopogonidae.

Study sites

The Ceratopogonidae examined were from collections at two sites in the pine dominated forests of eastern and western Norway.

In western Norway (Fig.), collections were made at Geitaknottane, Kvam municipality (5°53' E, 60°05' N) in Hordaland County, at elevations from 180-200 m a.s.l. The Kvam site was a coastal forest with *Pinus silvestris* L. dominant, and a few other trees e.g., *Juniperus communis* L., *Sorbus aucuparia* L. and *Betula pubescens* EHRH. present.

In eastern Norway, collections were made at Gudbrandsseterfjellet, Sigdal municipality (9°25' E, 60°03' N) in Buskerud County, at elevations 400-450 m a.s.l. The Sigdal site was a *P. silvestris* dominated boreal forest, with some *B. pubescens* and *Picea abies* (L.) KARST. present.

Sampling

The arthropod fauna was sampled by fogging selected pines at each of the two sites

(Kvam and Sigdal) with a 1% concentration synthetic pyrethroid, PySekt®, which was dissolved in non-aromatic white spirits. The pyrethroid was applied to isolated *Pinus silvestris*, using a Swingfog® model 50 fogger, while standing on the ground or on the lower branches, directing the fog upwards. Fogging time was ca. 10 minutes at each tree. Prior to spraying, 30 cm diameter collecting funnels were placed concentrically on the ground, 0.5 m from the stem. Funnels were arranged in a circle and 1.0 m apart. The funnels remained on the ground for ca. 1 hour after fogging. Fogging and sample collections were done before dawn, usually between 0400 and 0600 hours. Neither wind nor precipitation was present during the fogging.

A total of 43 samples (pooled from all funnels at the same distance from the trees) were taken at Sigdal, Buskerud, originating from 8 trees, sampled between June 5 - 16, 1998. In 1999, an additional 88 samples were taken between June 19 and July 17.

At the site in Kvam, Hordaland, a total of 39 samples (pooled from all funnels at the same distance from the trees) from 6 different trees were collected between May 26 and June 2, 1998. The collections were initially examined using a dissecting microscope, some mounted on microscope slides using either Hoyer's medium or phenol and Canada balsam and examined with a compound microscope.

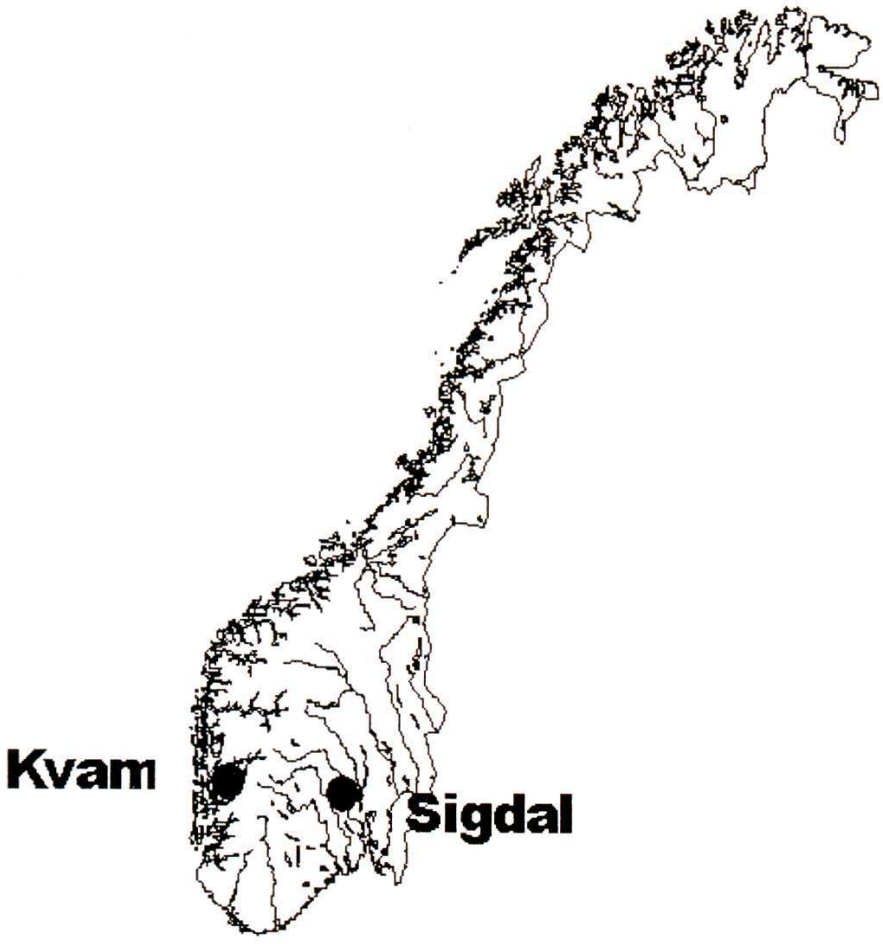

Fig. Geographic position of study sites in Norway.

RESULTS

Table 1 lists the 56 species in 11 genera from the 3879 specimens of ceratopogonids collected from the two study sites in Norway. The majority of specimens were predaceous genera of midges, which was dominated by *Brachypogon* (60.1%). Other genera present were *Forcipomyia* (14.1%), *Culicoides* (12.1%), *Dasyhelea* (8.7%), *Ceratopogon* (2.0%), *Bezzia* (1.2%) and also *Alluaudomyia*, *Schizohelea*, *Serromyia*, *Palpomyia*, and *Atrichopogon* (each <1%).

Table 1. Genera and species present in samples from Kvam and Sigdal, Norway.
Abbreviations: m - male, f - female, * - first record from Norway, ** - first record from Europe.

Taxon	Kvam	Sigdal		Total
	26 May-2 June 1998	5-16 June 1998	19 June – 17 July 1999	
Ceratopogoninae	**351**	**1169**	**1462**	**2982**
Tribe **Culicoidini**				
Culicoides LATREILLE,1809	**65**	**31**	**375**	**471**
***C. alatavicus* SMATOV & ISIMBEKOV, 1971	-	5	-	5 (3m 2f)
**C. albicans* (WINNERTZ, 1852)	11	7	86	104 (38m 66f)
C. chiopterus (MEIGEN, 1830)	2	2	4	8 (4m 4f)
**C. clintoni* BOORMAN, 1984	1	-	195	196 (111m 85f)
**C. comosioculatus* TOKUNAGA, 1956	-	-	3	3 (3m)
**C. dewulfi* GOETGHEBUER, 1936	3	-	-	3 (1m 2f)
**C. grisescens* EDWARDS, 1939	-	-	2	2 (2m)
**C. heliophilus* EDWARDS, 1921	29	10	-	39 (27m 12f)
C. impunctatus GOETGHEBUER, 1920	17	-	18	35 (9m 26f)
**C. kibunensis* TOKUNAGA, 1937	1	5	-	6 (2m 4f)
C. obsoletus (MEIGEN, 1818)	1	-	35	36 (4m 32f)
**C. sphagnumensis* WILLIAMS, 1955	-	-	5	5 (5m)
**C. scoticus* DOWNES & KETTLE, 1952	-	1	1	2 (2m)
**C. vexans* (STAEGER, 1839)	-	1	2	3 (3f)
Undet.	-	-	24	24 (24f)
Tribe **Ceratopogonini**	**283**	**1126**	**1048**	**2457**
Alluaudomyia KIEFFER, 1913				
* *A. quadripunctata* (GOETGHEBUER, 1934)	-	-	**21**	**21** (5m 16f)

Ceratopogon MEIGEN, 1803 *C. lacteipennis* ZETTERSTEDT, 1838	**36**	**4**	**39**	**79** (30m 49f)
Brachypogon KIEFFER, 1899	**238**	**1121**	**972**	**2331**
**B. bialoviesicus* KRZYWIŃSKI, 1994	3	-	-	3 (3m)
B. norvegicus SZADZIEWSKI & HAGAN, 2000	3	8	19	30 (30m)
B. incompletus (KIEFFER, 1925)	4	91	9	104 (104m)
**B. nitidulus* (EDWARDS, 1921)	30	58	32	120 (120m)
**B. perpusillus* (EDWARDS, 1921)	32	-	1	33 (33m)
B. sociabilis (GOETGHEBUER, 1920)	2	191	78	271 (271m)
**B. vitiosus* (WINNERTZ, 1852)	-	-	5	5 (3m 2f)
Undet.	164	773	828	1765 (1765f)
Schizohelea KIEFFER,1917 **S. leucopeza* (MEIGEN, 1804)	-	**1**	**2**	**3** (1m 2f)
Serromyia MEIGEN, 1818 *S. femorata* (MEIGEN, 1804)	**9**	-	**14**	**23** (12m 11f)
Tribe **Palpomyiini**	**3**	**12**	**39**	**54**
Bezzia KIEFFER, 1899	**2**	**12**	**34**	**48**
**B. affinis* (STAEGER, 1839)	-	-	1	1 (1m)
**B. bicolor* (MEIGEN, 1804)	-	-	6	6 (6f)
***B. rhynchostylata* REMM, 1974	2	12	17	31 (4m 27f)
B. nigritula (ZETTERSTEDT, 1838)	-	-	3	3 (3f)
B. solstitialis (WINNERTZ, 1852)	-	-	7	7 (2m 5f)
Palpomyia MEIGEN, 1818	**1**	-	**5**	**6**
P. pubescens KIEFFER, 1919	-	-	5	5 (1m 4f)
**P. serripes* (MEIGEN, 1818)	1	-	-	1 (1f)
Forcipomyiinae	**343**	**11**	**543**	**897**
Tribe **Forcipomyiini**	**24**	**8**	**528**	**560**
Atrichopogon KIEFFER, 1906	**1**	**2**	**9**	**12**
**A. lucorum* (MEIGEN, 1818)	-	2	9	11 (4m 7f)
**A. minutus* (MEIGEN, 1830)	1	-	-	1 (1f)
Forcipomyia MEIGEN, 1818	**23**	**6**	**519**	**548**
**F. acidicola* (TOKUNAGA, 1937)	-	-	1	1 (m)
**F. albostyla* REMM, 1979	-	-	2	2 (2m)
F. bipunctata (LINNAEUS, 1767)	3	-	-	3 (1m 2f)
**F. ciliata* (WINNERTZ, 1852)	-	-	2	2 (2f)
**F. brevipennis* (MACQUART, 1826)	-	3	-	3 (1m 2f)
**F. fuliginosa* (MEIGEN, 1818)	-	-	1	1 (1f)
**F. hygrophila* KIEFFER, 1925	-	-	3	3 (2m 1f)

**F. kaltenbachi* (WINNERTZ, 1852)	-	-	8	8 (1m 7f)
**F. monilicornis* (COQUILLETT, 1905)	2	-	5	7 (7f)
**F. nigra* (WINNERTZ, 1852)	1	1	23	25 (8m 17f)
**F. nigrans* REMM, 1962	10	2	326	338 (43m 295f)
**F. palustris* (MEIGEN, 1804)	7	-	1	8 (4m 4f)
**F. titillans* (WINNERTZ, 1852)	-	-	15	15 (6m 9f)
Undet.	-	-	132	132 (132f)
Tribe **Dasyheleini**				
Dasyhelea KIEFFER, 1911	**318**	**4**	**15**	**337**
**D. bensoni* EDWARDS, 1933	1	3	-	4 (2m 2f)
**D. biunguis* KIEFFER, 1925	-	-	3	3 (2m 1f)
**D. europaea* REMM, 1962	6	-	-	6 (6m)
***D. ledi* REMM, 1993	3	1	4	8 (4m 4f)
**D. luteiventris* GOETGHEBUER, 1934	2	-	-	2 (2m)
**D. modesta* (WINNERTZ, 1852)	107	-	-	107 (43m 64f)
D. norvegica SZADZIEWSKI & HAGAN, 2000	1	-	-	1 (1m)
**D. parallela* REMM, 1962	2	-	-	2 (2m)
Undet.	196	-	8	204 (204f)
Number of specimens	**694**	**1180**	**2005**	**3879**
Number of species	**30**	**19**	**40**	**56**
		45		

Among the species recorded, a small number are inhabitants of animal dung and rotting fungi in the larval stages: *Culicoides chiopterus*, *C. dewulfi*, *C. scoticus*, and *Forcipomyia brevipennis*.

Larvae of all *Forcipomyia* and *Atrichopogon* known are typical inhabitants of rotting wood, bark, touchwoods, plant debris and mosses in forests. For example larvae of the most common among *Forcipomyia*, *F. nigrans*, was found in Poland under rotting bark of *Betula*, *Alnus*, under twigs and fallen branches of *Pinus silvestris*, under mosses covering a log of *Picea excelsa* or among mosses on soil (GIŁKA 1996).

Other species are aquatic or semiaquatic in larval stage (SZADZIEWSKI et al. 1997). It is worth noting that peat bogs are typical breeding places for *Culicoides clintoni*, *C. heliophilus*, *C. albicans* and *C. impunctatus* and these species comprise 79.4% of all *Culicoides* collected.

Sampling site: Kvam, Hordaland

A total of 694 individuals, belonging to 30 species, were examined from this site (Table 1). The most common here were two genera with aquatic larvae i.e. *Dasyhelea* comprising 45.8% and *Brachypogon* (*Isohelea*) - 34.3% of the total ceratopogonids. 9.0% of the specimens were *Culicoides* with aquatic larvae, except for *C. chiopterus* and *C. dewulfi*

which are terrestrial and live in animal dung. Other genera with aquatic immatures: *Ceratopogon*, *Serromyia*, *Bezzia*, *Palpomyia* are rare at this site (6.9%). The genera *Atrichopogon* and *Forcipomyia* which have terrestrial larvae living mostly under bark of trees are also rare, 3.3% of the specimens.

Sampling site: Sigdal, Buskerud

A total of 3185 individuals, belonging to 45 species, were examined from this site (Table 1). Most of these were *Brachypogon* (*Isohelea*) comprising 95.0% of the total ceratopogonids from the site in 1998 and 48.5% in 1999. In 1999 *Forcipomyia* with terrestrial larvae was numerous (25.9%) as well as Culicoides (18.7%). Among samples taken in June and July 1999 40 species were present while only 19 in samples from June 1998.

DISCUSSION

Method of collecting

Insecticides are a unique means to collect biting midges, which may be found in trees or shrubs as resting sites. This is the first sample of the biting midges from a boreal pine forest. Despite the fact that the biting midges were collected only during a short time in late spring and summer the numbers of specimens (3879) and species (56 in 11 genera) were relatively high. Below we compare results of our study using insecticide fogging with the effectiveness of various other sampling techniques, e.g., pan traps, sticky traps, emergence traps and light traps.

Moericke traps (yellow pan traps) collect flying biting midges which may accidentally fall into traps. This trap has not been very successful at catching many biting midges. For example, near Warsaw in a deciduous forest at Klembów (SZADZIEWSKI, unpublished data), biting midges represented only 0.9% of all nematoceran Diptera collected from spring to autumn 1981. Biting midges were represented only by 101 specimens. The material contained most abundantly: *Culicoides* (29.7%), *Forcipomyia* (26.7%), and *Dasyhelea* (18.8%), while other 4 genera were rare: *Bezzia* and *Atrichopogon* (each 7.9%), *Schizohelea* (5.9%) and *Brachypogon* (3.0%).

Sticky traps placed on trees in a forest would be expected to catch biting midges that might be using the trees as resting sites. However, the sticky traps were not as effective as insecticides. For example in pine forests of northern Poland in 1989 and 1990 from spring to autumn, only 154 biting midges in 16 species (SZADZIEWSKI, unpublished) were collected by sticky traps. Among genera collected were: *Culicoides* (52.0%), *Atrichopogon* (18.2%), *Forcipomyia* (15.5%), *Stilobezzia* (13.0%) and *Palpomyia* (1.3%).

Light traps are more selective since they catch positively phototropic biting midges active during evening and night. In Wyskok, Poland, light traps placed in a garden (with a lake, a pond, and small forest nearby) and operated from spring to late summer in both

1994 and 1995, collected a total of 32,553 biting midges. Among genera commonly collected were *Culicoides* (61.6%), *Atrichopogon* (29.7%) and *Forcipomyia* (7.9%), while *Dasyhelea*, *Alluaudomyia*, *Sphaeromias*, *Palpomyia* and *Bezzia* were rare (SZADZIEWSKI, unpublished).

Emergence traps placed in larval habitats provide more accurate data on the species and density of biting midges present. HAVELKA (1976) used emergence traps to collect biting midges emerging from small brooks in Germany. During a two year study, he collected 6,770 specimens in 12 genera and 70 species. Genera collected were: *Palpomyia* (36.8%), *Atrichopogon* (29.2%), *Forcipomyia* (14.1%), *Culicoides* (6.7%), *Stilobezzia* (5.9%), *Dasyhelea* (2.6%), *Brachypogon* (2.2%), *Bezzia* (0.8%), and *Ceratoculicoides*, *Ceratopogon*, *Schizohelea*, *Serromyia* (totaled 1.9%). In a similar study, HAVELKA & CASPERS (1981) collected biting midges emerging from a small brook near Bonn, Germany over a two year period, and found 2,657 specimens in 10 genera and 53 species.

The pyrethroid fogger sampling technique used to collect the Ceratopogonidae in this study, seemed to be quite efficient in that insects may be collected with less bias due to differences in trap attractancy or repellency. Pyrethroids have been used as repellents and in insect pest control for many years (HULL & SHIELDS 1939), but their use in insect surveys has not been reported to our knowledge. This study gives a snapshot picture of the species abundance. A weakness is that it provides only an instantaneous view of species distribution at the hours sampled. Overall the use of fogging for sampling provides a means to assess population diversity and abundance for small sites with greater efficiency and is probably accompanied with less bias due to varying degrees of attractancy for trap design, or synergistics with trap location, etc., when compared with conventional traps.

Diversity

Differences in abundance and distribution patterns of the genera at the two sites were observed. These differences were probably due to the differences in habitats and time of collecting. The forest at Sigdal, Buskerud was a *P. silvestris* dominated boreal forest, with fairly low vegetation diversity, that was mostly flat with no conspicuous ridges and wetland. The site at Kvam, Hordaland was a coastal *P. silvestris* forest, with conspicuous hills and ridges, with wetlands interspersed between the ridges, but with a large variety of vegetation types and located at a lower elevation. At Kvam, a large number of autogenous species (*Dasyhelea* spp.) was observed along with significant representation of *Brachypogon* and *Culicoides*, whereas at the Sigdal site in Eastern Norway, *Brachypogon* were abundant. Elevation, humidity and the proximity of the sea, which affects temperature, vegetation diversity, and provided more diverse habitats for *Dasyhelea* at Kvam. The lower numbers of *Forcipomyia* in the collections taken in 1998 may be due to the season of sampling, since the end of May and beginning of June is early in the spring season for the boreal forest climate. Both the Sigdal and Kvam sites are characterized by a lower abundance of biting midges *Culicoides* than expected for habitats of these types.

It is particularly remarkable that similar genera are common in Oligocene-Miocene Dominican amber (SZADZIEWSKI & GROGAN 1998) and in the recent material (Table 2). In older Eocene/Oligocene Baltic amber the genus *Ceratopogon* predominated (25.3% specimens of biting midges in 15 species) (SZADZIEWSKI 1988). Present materials collected in boreal forests during spring and summer included only 2.0% of *Ceratopogon* within a single species, thus supporting the hypothesis that this group has actually declined since the Eocene. SZADZIEWSKI (l.c.) suggested that *Ceratopogon* was a good example illustrating an extinction taking place in the family in that insects in the genus *Ceratopogon* are rare today and inhabit more northerly parts of the Northern Hemisphere, often restricted to isolated mountain areas. BORKENT & GROGAN (1995) explained the dominance and high diversity of *Ceratopogon* in Baltic amber mostly by their occurrence in early springtime.

Table 2. Genera of Ceratopogonidae in Tertiary Baltic and Dominican ambers (SZADZIEWSKI 1988, SZADZIEWSKI & GROGAN 1998) and Norwegian forests.

	Baltic amber (1103 specimens, 24 genera, 101 species)	Dominican amber (682 specimens, 11 genera, 32 species)	Norway (3879 specimens, 11 genera, 56 species, forest habitats)
Ceratopogon	**25.3%**	-	**2.0%**
Forcipomyia	15.9%	41.6%	14.1%
Brachypogon	14.3%	39.4%	60.1%
Dasyhelea	1.6%	9.8%	8.7%
Culicoides	17.8%	5.3%	12.1%
other genera	25.1%	3.9%	3.0%

Faunistics

During present studies we found 44 species new for the fauna of Norway (Table 1). Three of them are reported for the first time in Europe. These are *Bezzia rhynchostylata, Dasyhelea ledi* and *Culicoides alatavicus*. *Bezzia rhynchostylata* was known from East Siberia where it was collected in the mountains of Verkhoyanskiy Khrebet in east Russia beyond the Arctic circle at 1800 m a.s.l. and from the taiga near Lensk (REMM 1974). *Dasyhelea ledi* is a boreal species known to date only from Yakutia in East Siberia (REMM 1993) and *Culicoides alatavicus* was previously reported only from the tundra of Taimyr and the mountains of Kazakhstan (GLUKHOVA 1989). Among the material were also *Dasyhelea norvegica* and *Brachypogon norvegicus* described in another paper as new (SZADZIEWSKI & HAGAN 2000).

Presently the biting midge fauna in Norway include 85 species in the following genera: *Culicoides* – 18, *Alluaudomyia* - 1, *Ceratopogon* – 1, Brachypogon – 9, *Schizohelea* - 1, *Serromyia* - 2, *Clinohelea* - 1, *Mallochohelea* - 2, *Sphaeromias* - 1, *Nilobezzia* – 1, *Bezzia* - 6, *Palpomyia* – 11, *Forcipomyia* - 15, *Atrichopogon* – 5, and *Dasyhelea* – 11. However, the

Norwegian fauna is expected to be much richer, and we would expect that it should include at least 200 species of biting midges.

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