The Habitats of the Danish Species of *Pirata*.

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Only three species of the spider genus *Pirata* are found in Denmark, viz. *P. hygrophilus* Th., *P. piraticus* Cl., and and *P. piscatorius* Cl. (Brændegaard 1928). They occur in damp situations, most frequently in bogs and on shores of lakes and ponds. They build their retreat-tubes close to the water, so that they can easily run out on the surface, and in case of imminent danger they can submerge themselves by climbing down plant stems. Here they may sit for some time covered by an air bubble before they emerge again and run back to their retreats.

Apart from this common dependence on free water in their habitats there is a clear difference in environmental requirements of the three species. This results in a difference in local distribution, and in the following account an attempt will be made to give a picture of the habitats as we find them in this country. From abroad there have been investigations on the habitats of the *Pirata* species in Germany by Dahl (1908), and in Finland by Palmgren (1939), while Holm (1947) and Locket & Millidge (1951) give brief descriptions of the habitat preferences in Sweden and Great Britain respectively.

Sampling and material.

Sampling was carried out by catching the spiders in small vials from a limited area of the locality. Because of the marshy conditions of most of the localities the spiders could be forced to leave their hiding places when

the surface layer was pressed down into the water. On shores with sand and gravel the undersides of stones were examined, and the spiders hiding beneath could be picked up.

The material to be discussed was collected in 21 local-

Table 1. Survey of the findings from the localities investigated arranged with reference to type of environment.

Type of environment	Locality no.	Locality name	number of samples	*Pirata hygrophilus*	*Pirata piraticus*	*Pirata piscatorius*	total
I. Sandy shore with stones, sparse vegetation, unshaded	1	Lendrup	3		24		24
	2	Øjesø A	1		5		5
	3	Bogensø	1		22		22
	4	Graamyr	1		5		5
II. Marshy shore, rich vegetation, unshaded	5	Tandrup	4		53	27	80
	6	Blegsø	1		20	5	25
	7	Kradsemosen	1		9		9
III. Like II, but partly shaded	8	Faurskov A	5	59	27	17	103
IV. Edge of bog pond, rich vegetation, unshaded	9	Trend A	1		3	3	6
	10	Lillemosen	2		57	24	81
	11	Langemosen B	8		128	65	193
V. Bog surface, Sphagnum, unshaded	12	Trend B	4		63		63
	13	Næstrup	1		10		10
	14	Øjesø B	1		9		9
	15	Langemosen A	6		89	7	96
VI. Like V, but shaded	16	Faurskov B	4	91	44	3	138
	17	Faurskov C	2	9	8		17
VII. Marshy ground, grassy vegetation, unshaded	18	Rutsker	1		23		23
	19	Spellinge	1		12		12
	20	Kilderne	4		41		41
	21	Porsmosen	2		10		10
			54	159	662	151	972

ities and consists of 54 samples with a sum total of 972 individuals. Each sample contains the spiders collected during ½ hour. The findings from all the samples are placed together in table 1. The localities are grouped under 7 headings indicating the type of environment in question. Most of the collecting was made in Jutland, but four samples were taken on Bornholm.

To illustrate further the main features of the habitats preferred by the *Pirata* species, four of the localities are described in detail below.

Description of localities.

1. Langemosen A. (tab. 1, no. 15). This bog is the property of the Mols Laboratory (Thamdrup 1948). It is a typical Sphagnum bog with small ponds made when peat was being cut in the bog several years ago (fig. 1). The spiders were collected in the Sphagnum carpet. This carpet consists of *Sphagnum apiculatum* and *Sph. palustre. Oxycoccus quadripetalus, Drosera rotundifolia,* and *Hydrocotyle vulgaris* grow on the carpet, and scattered shoots of *Eriophorum angustifolium* and *Carex rostrata* project through it.

In six samples from this locality there were 89 *P. piraticus* and 7 *P. piscatorius.* The individuals of the latter species were all immature.

2. Langemosen B. (tab. 1, no. 11). This locality is situated at the edge of one of the ponds in the above Sphagnum bog (fig. 2). Here the following plants are found growing, partly in the water, and partly on the bog surface: *Sphagnum cuspidatum, Sph. apiculatum, Eriophorum angustifolium, Carex rostrata, Juncus effusus,* and *Comarum palustre.* The Sphagnum carpet of the bog extends some distance on the pond, but a free surface of water can always be seen between the tussocks of sedge and rush.

Eight samples from this locality contain 128 *P. pira-*

Fig. 1. Langemosen A. *P. piraticus* inhabits the Sphagnum cover of this bog.

Fig. 2. Langemosen B. Bog pond surrounded by a rich growth of *Juncus, Carex*, and *Eriophorum*. Here *P. piscatorius* and *P. piraticus* are abundant.

ticus and 65 *P. piscatorius*; mature and immature individuals of both species were taken.

3. Faurskov A. (tab. 1, no. 8). This lake is situated in a depression in a woodland district. It is surrounded by low hills covered with beech and spruce (fig. 3). The spiders were collected on the east shore, which is marshy and covered with litter washed up from the lake in winter. This marshy area merges almost imperceptibly into a reedswamp with *Phragmites communis, Typha latifolia,* and *T. angustifolia.* Tussocks of sedge and rush are scattered on the shore, and a patchy growth of Sphagnum is also present. Shrubby birch and alder grow as far as the edge of the water providing shade over the narrow shore for a considerable part of the day.

The five samples from this locality contain 59 *P. hygrophilus,* 27 *P. piraticus,* and 17 *P. piscatorius.*

4. Faurskov B. (tab. 1, no. 16). A well developed blanket bog has replaced the lake in the southern part of the depression. On this bog there is a dense growth of alder and birch, and the bog surface is more or less shaded during the whole day (fig. 4). The ground layer of vegetation differs greatly from place to place according to light conditions and water contents of the soil. The sampling was carried out in thick cushions of Sphagnum which surrounds a very wet part of the bog, where *Menyanthes trifolium* is common.

Four samples from this locality contain 91 *P. hygrophilus,* 44 *P. piraticus,* and 3 *P. piscatorius* (immature).

Discussion.

The four localities described in the preceding passage range in a descending scale of light intensity from the sunlit surface of Langemosen A to the completely shaded Sphagnum cushions of Faurskov B. In the former *P. piraticus* dominates, while *P. hygrophilus* is the species most frequently met with in the latter.

Fig. 3. Faurskov A. On the shore of this lake all three species of *Pirata* occur. *P. piscatorius* at the edge of the water, *P. hygrophilus* in shaded situations, and *P. piraticus* all over the shore.

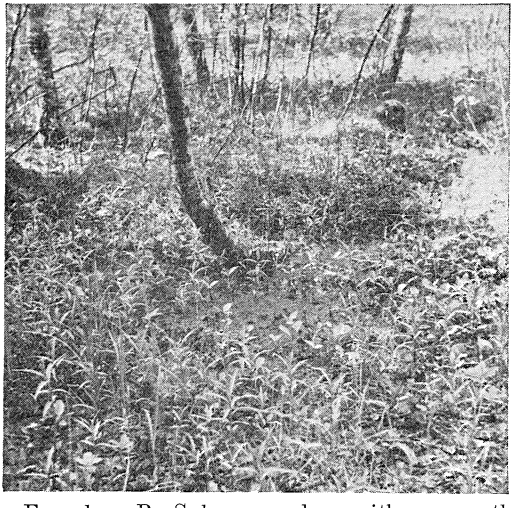

Fig. 4. Faurskov B. Sphagnum bog with a growth of birch and alder. Typical habitat of *P. hygrophilus*. *P. piraticus* also occurs in this locality.

Langemosen B and Faurskov A are characterized by the presence of a free water surface between the plant stems. Here *P. piscatorius* is abundant, while it occurs only accidentally in the two other localities, where the Sphagnum carpet projects above the water surface.

Thus comparing the environmental differences of these four localities with the *Pirata* species inhabiting them we arrive at the conclusion that the conditions of light and water have considerable influence on the local distribution of these spiders. This conclusion is further supported by the findings from all the localities investigated as appears from table 1.

P. hygrophilus occurs in shaded localities only. It is always to be found under trees and bushes where the ground is covered with Sphagnum. This agrees with Dahl's and Rabeler's results from Germany (Dahl 1908; Rabeler 1931) and Holm's from Sweden (Holm 1947). Its retreat will always be found in the Sphagnum layer.

Referring to *P. piraticus* Dahl writes that it "... hält sich nähmlich, im Gegensatz zu *P. hygrophilus*, nur an nicht beschatteten Stellen auf..." On the contrary I have found it in considerable numbers in shaded localities together with *P. hygrophilus* (Faurskov B). It seems to occur in all damp localities, where a little free water is present. It builds its retreat in Sphagnum (Nørgaard 1951), in other low vegetation, in irregularities of marshy ground, or under stones which lie close to the water.

Of special interest is the fact that *P. piraticus* also inhabits localities with brackish water. In August 1944 I took two samples, and in 1945 one sample under stones lying on the shore of a lagoon at Limfjorden (tab. 1, no. 1). The NaCl-contents of the water in a pool under one of the stones were 9.7 ‰, 15.2 ‰, and 12.9 ‰ at the three visits respectively. The samples contained a total of 24 *P. piraticus*. Palmgren writes that immature individuals of this species occur "... auf steinigen Ufern im

Schärenhof..." (Palmgren 1939). I assume this to refer to brackish water though no definite statement is made. In my samples all the individuals were mature, viz. 7 males and 17 females with their egg-cocoons. This suggests that *P. piraticus* is able to live and breed in localities with brackish water.

In accordance with Palmgren (loc. cit.) my findings show that *P. piscatorius* is more dependent on free water in its environment than the two other species. It inhabits swamps and shores with a rich vegetation. Sphagnum may be present or not. It constructs its retreat-tube in tussocks at the very edge of the water. This tube may be 2 cm. wide and 15—20 cm. long, and it is supported by plant stems. Sometimes the lower entrance of it may be found even under the surface.

As appears from the above each of the three species shows characteristic preferences in selecting a place in which to build its retreat-tube. In this way the structure of the environment, i. e. the density and rigidity of plant stems, irregularities of the ground, stones etc., becomes a factor, secondary to water and light, in conditioning the local distribution of the *Pirata* species.

Table 2. Showing the environmental requirements of the *Pirata* species.

	substratum	vegetation	light conditions	retreat
P. hygrophilus	bog surface	Sphagnum	shaded	in Sphagnum
P. piraticus	marshy ground, bog surface, boggy shores, or sandy shores with stones	Sphagnum, grassy plants, or almost bare ground	unshaded, or shaded	in Sphagnum, in irregularities of the ground, or under stones
P. piscatorius	boggy shores of lakes or ponds	grassy plants in tussocks, Sphagnum	unshaded	in tussocks, or in Sphagnum

In conclusion a survey of the habitats of the three species is given in table 2.

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