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NOTE ON THE LENGTH GROWTH OF THE CHUB (LEUCISCUS CEPHALUS, PISCES, CYPRINIDAE) IN THE RESERVOIR KLÍČAVA AND THE RIVER BEROUNKA

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Abstract: Age and growth of 1647 specimens of the chub (*Leuciscus cephalus* Linnaeus, 1758) collected during the years 1976—1980 in the reservoir Klíčava (Bohemia) and 60 chubs collected during years 1973—1978 in the river Berounka (Bohemia) was studied using scale method. Chubs up to the thirteenth age class from the reservoir Klíčava and of the tenth age class from the river Berounka were recorded. Lee's phenomenon in the chub from the Klíčava was examined. The length growth of the chub in different European localities is given.

MATERIAL AND METHODS

A part of material examined by me has been collected into gill nets (460 specimens III.—XIII. age classes, 160—450 mm of the body length) during the years 1976—1980, the rest has been collected using close-meshed seining (1187 specimens, 0.—III. age classes, 14—150 mm of the body length) during the years 1977—1978, 1980. Examined scales originated from catching periods of April, 29 — May, 13, in the year 1976 (40 gillnetted chubs), April, 28 — November, 14, in the year 1977 (110 chubs), May, 5 — November, 7, in the year 1978 (143 chubs), May, 5 — August, 23, in the year 1979 (132 chubs), May, 27, — October, 21 (1222 fry and adult chubs) in the year 1980.

The length of gill nets was 30 m, depth 4 m, size of meshes 3 × 3 cm. Gill nets has been set on different places along the banks of the reservoir. In all gillnetted specimens the body length (longitudo corporis) was measured with the accuracy ± 0.5 cm. Fry up to one year of age measured with the accuracy ± 1 mm. All caught fingerlings were preserved in formalin solution. Three selected scales has been taken from the row below the lateral line above the insertion ventrals and afterwards chubs have been returned into the reservoir. From three collected scales only one with clearest annuli was read under the microprojector (Carl Zeiss Jena, magnification 17.5) using the ventro-diagonal scale radius. All material of scales from the river Berounka (locality Radotín, Řevnice and Karlštejn) was taken from angled chubs (III.—X. age classes, 130—317 mm of the body length). The larval marks on scales were ignored. For the determination of the back-calculating length the method after R. Lee (1920) was used with the correction of 18 mm.

RESULTS AND DISCUSSION

1. The structure and growth of scales

Some of chub growth investigators studied the body length of its fry from the begin of scale formation. Prokeš, Libosvárský, Baruš (1977) found in specimen from the Rokytná stream this length as 17.5 mm. Prokeš (1978) from the same locality found 17.3—18.1 mm. Černý (1975) kept chub's fry in captivity and ascertained the appearing of first scales in specimen of 17—18 mm body length. Prokeš (1978) and Černý (1975) recommend the length of the correction 18 mm for back calculating by use of scale method.

I myself found first scales in young of year's juveniles, caught in the year 1980, having the body length 18.5 mm. This material was stained in the alizarin solution.

In adults scales are cycloid, mostly with three lobes (see Figs. 2—5). Scales have concentric circuli (striae) and primary and secondary canals. Primary canals begin, in contrary to secondary ones, in the centre of the scale. Segerstrale (1933), Oliva (1952) cited, in examined specimens, the increasing number of canals following the subsequent growth of fishes, but Balon (1953) has not found this phenomenon in roach *(Rutilus rutilus L.)*. I have examined scales of 148 specimens (caught in years 1976—1977) with regard to the number of primary and secondary canals. In the caudal region of scales I found 2—12 primary and 0—29 secondary canals; in the oral region of scales 2—12 and 0—28 secondary canals (see Hanel, 1980). The number of secondary canals has always dispersion than the number of primary ones. I have not found the relation between the increasing number of primary or secondary canals with growth of the body length. I have found two scales with densely arranged striae and only with primary canals, which were in lateral region of scales, but this was lateral region in the scale of the single chub.

The determination of annuli on scales from the Klíčava reservoir is easy, but in specimens older than three or four years especially the first annulus and the second also are mostly indistinct. In the chub from Willow brook (England), Cragg-Hine and Jones (1969, after Prokeš, 1978) found the first annulus often very indistinct and usually very close to the centre of the scale. Leontovyč (1968) found always more than 20 circuli to the first annulus in chubs; this maybe helpful for the determination of the first annulus. In three river basins from England, Helawell (1971, after Prokeš, 1978) found a big variability in the growth of the chub in the first year of the life. From the centre of the scale up to the first annulus he found 8—23 circuli. In the chub from the Rokytná stream, Prokeš (1978) found ranges of circuli to the first annulus 5—8 (rarely over 11), to the second one 16—22.

For clarity I have examined 449 chub specimens from the reservoir Klíčava (I—XIII age classes) with regard to the number of circuli to the first and second annulus. I found 11—35 (ave. 20.4) circuli up to the first annulus, 38—87 (ave. 63.8) circuli up to second one. Only in one single specimen I have found smaller number (30) up to the second annulus. In my opinion this character may be applicable in the case of indistinct scale structure for the determination of the first or second annulus also for the chub from the Klíčava reservoir. The body length/ventro-diagonal scale radius shows nearly linear relationship (Fig. 1) and therefore Lee's method for the back calculation of length growth was used. Pecl (1969) found the body length/scale radius as linear in the chub from the reservoir Klíčava; in the chub from the Rokytná stream Prokeš, Libosvárský, Baruš (1977) and Prokeš (1978) found linear relationship only in specimens bigger than 50 mm, in smaller specimens the relation body length/scale radius is nonlinear. In these specimens growth of scales is relatively more rapid than in bigger ones.

2. Length growth

The length growth in the first year of life of the chub in the Klíčava reservoir was determined by the use of caught young of the year specimens. The seining with fine mesh net was used in 1980. The seining period was from October 8 to October 21. 1050 specimens altogether showed a wide variablity

Table 1. Back calculated length groth of the chub (in mm) from the Klíčava reservoir, the year 1976, n — number of specimens

Age	n	l_1	l_2	l_3	l_4	l_5	l_6
III.	4	54 (48–58)	132 (127–139)	191 —			
IV.	25	53 (38–77)	120 (82–148)	174 (140–197)	193 (181–201)		
V.	9	48 (36–58)	102 (81–130)	160 (107–192)	185 (149–210)		
VI.	1	44	105	141	166	196	
VII.	1	45	119	151	190	205	224
	40	49 (36–77)	116 (81–148)	161 (107–197)	184 (149–210)	201 (196–205)	224 —

of the body length (ranges 14–44 mm, ave.. 24.4 mm). Youngs of the year were caught in three different places of the reservoir Klíčava (Ostrov, Lánský luh, Klíčavský luh). It is interesting that the average body length of juveniles from same date (October 10, 1980) from two localities of the same water body is different. In the locality Ostrov the average is 27.7 (11 specimens, ranges 17—43 mm of the body length), in the locality Lánský luh it is 21.1 (83 specimens, ranges 14—40 mm). Partial spawning of the chub in the Klíčava reservoir is probable. This previously was mentioned also by Holčík (1965), Pecl (1969), Pivnička (1971), Hanel (1980).

Back-calculated length growth of the adult chub caught in the reservoir Klíčava in the years 1976—1980 is given in Tables 1—5 and from the river Berounka from angled chub in years 1973–1978 in Table 8. Weight averages (Table 7) are influenced by the different number of specimens in subsequent age classes (see Lee's phenomenon). Therefore it is useful to apply simple averages calculated from Tables of back-calculated length growth (Table 7).

The average length growth of the chub in the reservoir Klíčava (as calculated from chub caught in the years 1967—1980) is as follows (in mm): l_1 — 55, l_2 — 125, l_3 — 181, l_4 — 216, l_5 — 242, l_6 — 265, l_7 — 283, l_8 — 305, l_9 — 321, l_{10} — 350, l_{11} — 365, l_{12} — 387, l_{13} — 383.

The average length growth of the chub in the river Berounka (as calculated from angled chub in the years 1973—1978) is as follows (in mm): l_1 — 41, l_2 — 82, l_3 — 120, l_4 — 155, l_5 — 181, l_6 — 213, l_7 — 235, l_8 — 256, l_9 — 272, l_{10} — 286.

From the above mentioned values it is evident that the length growth of the chub in the reservoir Klíčava is more rapid than in the river Berounka.

The comparison of the length growth of the chub from different localities published by various authors is very difficult due to various reasons:

1) differences in the number of specimens in the sample;
2) different methods used for the back calculation of the body length growth, e. g. Lea's, Lee's, Monastyrsky's, Segerstrale's, Hile's, Vovk's method;
3) different individual access to the scales reading — individual evaluation of the position of annuli, using other scale radius or another value of the correction;
4) for the back-calculation of lengths using of simple or weigh averages in the evaluation of the growth;

Table 2. Back calculated length growth of the chub (in mm) from the Kličava reservoir, the year 1977, n – number of specimens

Age	n	l_1	l_2	l_3	l_4	l_5	l_6	l_7	l_8	l_9	l_{10}	l_{11}	l_{12}	l_{13}
I.	6	39 (36 – 47)												
III.	16	59 (43–68)	134 (97–155)	190 (171–213)										
IV.	67	54 (37–89)	126 (68–165)	187 (115–210)	212 (145–240)									
V.	16	52 (40–69)	117 (71–158)	170 (116–209)	208 (187–240)	234 (202–260)								
VI.	1	57	121	201	233	259								
VII.	2	52 (45–59)	153 (142–163)	205 (198–212)	245 (240–250)	277 (272–282)	296 (286–305)	310 (301–318)						
XI.	1	41	109	167	222	240	280	308	335	346	357	369		
XIII.	1	54	120	172	210	239	286	315	343	386	398	410	422	443
	110	51 (36–89)	126 (68–165)	185 (115–213)	222 (145–250)	250 (202–282)	287)280–305)	311 (301–318)	339 (335–343)	366 (346–386)	378 (357–398)	390 (369–410)	422 –	443 –

Table 5 Back calculated length growth of the chub (in mm) from the *Kličava reservoir, the year 1980,* n — number of specimens

Age	n	l_1	l_2	l_3	l_5	l_5	l_6	l_7	l_8	l_9
I.	125	52 (35–70)								
II.	5	48 (39–67)	87 (80–96)							
IV.	9	42 (36–49)	99 (75–122)	152 (108–195)	189 (181–198)					
V.	16	47 (36–61)	110 (82–143)	160 (120–210)	187 (155–233)	209 (175–250)				
VI.	9	49 (39–64)	113 (77–144)	161 (125–197)	193 (143–239)	222 (184–276)	250 (228–297)			
VII	4	50 (43–66)	114 (89–142)	181 (153–214)	209 (188–256)	222 (200–270)	241 (218–294)	279 (241–317)		
VIII.	2	53 (49–57)	140 (139–140)	184 (164–203)	223 (193–252)	240 (212–267)	258 (241–275)	279 (266–291)	310 —	
IX.	1	48	117	186	219	235	255	265	274	
X.	1	48	107	166	196	226	236	255	267	275
	172	49 (35–70)	111 (75–144)	170 (108–214)	202 (143–256)	226 (175–276)	248 (218–297)	270 (241–317)	284 (267–310)	275 —

Table 4. Back calculated length growth of the chub (in mm) from the Klíčava reservoir. The year 1979, n — number of specimens

Age	n	l_1	l_2	l_3	l_4	l_5	l_6	l_7	l_8	l_9	l_{10}	l_{11}	l_{12}
III.	5	47 (38–64)	122 (97–161)	174 (153–188)									
IV.	27	50 (39–67)	124 (90–147)	171 (126–200)	215 (194–241)								
V.	48	52 (39–70)	120 (85–159)	175 (112–210)	208 (157–239)	229 (196–258)							
VI.	34	51 (39–73)	113 (82–141)	167 (99–204)	200 (130–258)	225 (206–258)	262 (233–281)						
VII.	12	49 (42–58)	103 (65–135)	157 (115–189)	193 (160–223)	217 (180–259)	241 (198–282)	261 (221–300)					
VIII.	5	52 (44–58)	109 (75–129)	148 (115–172)	177 (131–204)	213 (177–238)	238 (199–275)	256 (209–295)					
XIII.	1	50	119	167	219	241	279	309	328	350	372	386	396
	132	50 (38–72)	116 (65–161)	166 (99–210)	202 (130–258)	225 (177–259)	255 (198–282)	275 (209–309)	328 —	350 —	372 —	386 —	396 —

Table 6. Demonstration of the Lee's phenomenon in the sample of the chub hatched in the year 1972. Back calculated length growth ($l_1, l_2, \ldots, l_7$), below vertically absolute difference in mm and relative difference in percents of the length of the younger age class.

Age class	No. of sp.	l_1	l_2	l_3	l_4	l_5	l_6	l_7
III. (1975)	20	54 −1 −1,9	125 −5 −4,0	175 −1 −0,6				
IV. (1976)	25	53 −1 −1,9	120 −3 −2,5	174 −4 −2,3	193 +15 +7,8			
V. (1977)	16	52 +1 +1,9	117 +7 +5,9	170 +5 +2,9	208 −1 −0,5	234 −4 −1,7		
VI. (1978)	18	53 −3 −5,7	124 −21 −16,9	175 −18 −10,3	207 −14 −6,8	230 −13 −5,7	247 −6 −2,4	
VII. (1979)	12	49	103	157	193	217	241	261
	91	−1 −1,9	−5,5 −4,4	−4,5 −2,6	0 +0,2	−8,5 −3,7	−6 −2,4	

5) different ratio between males and females in the sample; e. g. Pecl (1969) has found that female chub in the reservoir Kličava showed better growth tempo beginning with the third year of life;
6) different ratio between old and young specimens in the sample (the influence of the Lee's phenomenon)

Therefore the comparison of the back-calculated length growth of the chub in different localities is suitable only with certain limitations. The back-calculated length growth of the chub from various Czechoslovak localities is presented in Table 9. For other European localities see Tables 10—11. The best length growth of the chub from Czechoslovak reservoirs was recorded up to the fourth year of life in the reservoir Pastvinská (l_4 — 217 mm of the body length), subsequently from the fifth year of life better growth, as compared with the Pastvinská reservoir, was found in the reservoir Orava (l_{10} — 378 mm) and the reservoir Klíčava (l_{10} — 350 mm). Generally the worst growth tempo was found in the Slapy reservoir (l_{10} — 298 mm).

The best growth in Czechoslovak rivers was recorded in the river Svratka (l_8 — 293 mm), the river Dyje (l_8 — 287 mm), the river Oslava (l_8 — 266 mm); the worst growth tempo was found in the river Olza (l_7 — 181 mm) and the rivers Orava and Zazrivanka (l_7 — 184 mm). In average I have found that the growth of the chub in Czechoslovakia is better in closed water bodies than in rivers.

The legal length for angling chub in the Czechoslovakia is 250 mm (total length). It can be calculated from Table 9 using the correction factor (1.2). As it is evident, the chub in Czechoslovak reservoirs reaches the legal length in the 4—7th year of life, in rivers in the 5—8th year of life depending on localities. Concerning localities from abroad in the following data of other authors I found the best growth in the river Dněpr (USSR, l_6 — 311 mm), in the Willow brook (England, l_6 — 300 mm), in the central part of the Volha (USSR, l_6 — 290

Table 7. Back calculated average length growth of the chub in the Klíčava reservoir. Below the values of $l_1, l_2, \ldots, l_{13}$ the first value means simple average, the subsequent in vertical direction the weight average.

Year of catching	No. of sp.	Age classes	l_1	l_2	l_3	l_4	l_5	l_6	l_7	l_8	l_9	l_{10}	l_{11}	l_{12}	l_{13}
1967	387	III.–XI.	64	133	195	236	306	285	295	311	316	328	344		
			62	135	165	225	260	286	296	312	314	322	344		
1968	228	IV.–XII.	54	136	203	241	265	288	309	316	325	366	371	374	
			52	130	189	221	240	273	311	314	338	377	371	374	
1969	17	IV.–VII.	64	127	189	220	255	309							
			56	121	175	197	224	309							
1970	38	III,–IX.	67	136	189	220	238	258	283	289	304				
			64	133	191	217	235	254	289	289	304				
1971	43	IV.–XI.	50	121	188	227	245	274	290	305	328	368			
			57	125	192	223	241	265	290	301	328	368			
1972	56	IV.–XII.	61	139	190	226	250	269	286	310	335	363	387	420	
			57	138	193	221	239	252	267	285	310	363	386	420	
1973	42	III.–XIII.	53	111	165	200	227	253	271	287	303	321	339	344	351
			52	110	168	201	226	249	266	282	296	315	338	345	351
1974	11	IV.–XIII.	56	129	176	220	242	259	277	290	319	333	336	348	355
			57	126	175	220	243	261	280	297	319	338	336	348	355
1975	55	II.–XII.	54	123	170	212	237	263	279	300	318	343	368	382	
			54	149	164	215	236	268	278	298	315	338	368	382	
1976	40	III.–VII.	49	116	161	184	201	224							
			52	116	163	181	201	224							
1977	110	I.–XIII.	51	126	185	222	250	287	311	339	366	378	390	444	443
			52	125	180	207	247	287	310	339	366	378	390	422	443
1978	143	III.–XI.	54	126	182	206	225	238	252	296	310	320			
			51	124	182	210	230	242	258	296	310	320			
1979	132	III.–XIII.	50	116	166	202	225	255	275	328	350	372	386	396	
			49	117	169	205	225	255	262	328	350	372	386	396	
1980	172	I.–X.	49	111	170	202	226	248	270	284	275				
			51	108	162	194	217	248	274	290	275				
	1474	s. average	55	125	181	216	242	265	283	305	321	350	365	387	383
		w. average	55	126	174	213	239	265	287	308	320	346	364	389	413

mm), in the river Stour (England, l_6 — 287 mm), in the river Niemen (Poland, l_6 — 278 mm), in the river Ourthe (Belgium, l_6 — 277 mm), in the river Wirowa (Poland, l_6 — 272 mm).

In all rivers mentioned the length growth to the sixth year of the life is more rapid than in Czechoslovak reservoirs and rivers. The worst growth was found in the river San (Poland, l_6 — 206 mm) and in the river Paimionjoki (Finland, l_6 — 141 mm).

Concerning the length growth of the chub in the reservoirs abroad necessary data are lacking (see Table 10).

3. The problem of the Lee's phenomenon

The fact that back-calculated lengths by the of scales from older specimens are lower than those computed for the same age from younger ones was first described by Sund (1911, after Lea, 1913) and Lee (1912). Later Lee's phenomenon was studied, e. g., by Hile (1936, after Ricker, 1975), Kuzněcov (1957), Holčík (1960), 1969), Carlander (1968), Šentjakova (1968),

Table 5. Back calculated length growth of the chub (in mm of the body length) [illegible]
$l_1, l_2, \ldots l_{14}$ — body length

Author	Locality	n	l_1	l_2	l_3	l_4	l_5	l_6	l_7	l_8	l_9	l_{10}	l_{11}	l_{12}	l_{13}	l_{14}
1. Reservoirs																
Leontovyč (1968)	Pastvinská nádrž	5	77	148	188	217	229	256								
Kirka (1965)	Orava	176	77	119	156	198	237	270	301	343	358	378				
Oliva-Frank (1959)		54														
Čihař (1961)	Slapy	47 ave.	64	107	142	171	189	204	224	254	260	298	313	302	302	311
Leontovyč (1968)		80														
Leontovyč (1974)	Švihov	611	60	111	154	183	217	247	285	305	371					
Own results	Klíčava	1474	55	125	181	216	242	265	283	305	321	350	365	387	383	
2. Rivers																
Habashy (1974)	Rouchovanka creek	662	70	88	108	129	152	168	186	208	217	248				
Libosvárský (1956)	Svratka	447	69	108	140	173	211	240	261	293						
Kirka (1965)	Biela Orava + tributaries	262	67	103	136	156	172	208	221							
Kirka (1965)	Mutňanka	—	65	100	124	145	178									
Hochman, Jirásek (1959)	Oslava	361	64	97	128	157	186	212	240	266	293	316				
Kirka (1965)	Čierna Orava + tributaries	385	61	98	127	154	178	286	253							
Oliva (1963)	Kocába	11	56	86												
Leontovyč (1974)	Želivka	22 ave.	60	87	119	149	169	192	209							
Sedlár (1972)	Nitra + tributaries	942	60	97	131	160	188	218	248	263	294	315	336	357	385	
Leontovyč (1968)	Dunaj	—	59	103	135	167	194	215								
Balon (1962)	Polhoranka at Rabčín	—	58	92	117	140	159	178	210	230	251	258				
Leontovyč (1968)	Bečva	—	57	95	128											
Oliva (1963)	rivulet Kocába	11	56	86												
Leontovyč (1968)	Olza	—	54	86	114	136	156	167	181							
Hochman, Jirásek (1960)	Dyje	188	51	97	136	170	200	228	255	287	313	330				
Balon (1962)	Orava + Zazrivanka creek	18	50	93	124	152	180	182	184							
Hochman (1957)	Moravice	—	48	84	117	146	170	189	224	250	263	280	287	308		
Kirka (1962)	Váh at Piešťany	243	44	89	132	168	192	222								
Own results	Berounka	60	41	82	120	155	181	213	235	256	272	286				
Lelek (1959)*	Rokytná	♂♂	—	107	128	156	170									
		♀♀	—	115	135	164	195	228	240	335	347					

Table 8. Back calculated length growth of the chub from the river Berounka, years 1973 – 1978.

Age classes	No. of sp.	l_1	l_2	l_3	l_4	l_5	l_6	l_7	l_8	l_9	l_{10}
II.	1	40	99								
III.	4	39 (37–42)	87 (75–102)	129 (115–154)							
IV.	11	45 (35–38)	83 (61–112)	127 (98–160)	167 (130–221)						
V.	19	41 (33–57)	77 (55–99)	112 (86–130)	140 (103–176)	171 (140–210)					
VI.	10	45 (35–65)	84 (53–116)	117 (74–163)	157 (104–206)	194 (123–246)	230 (153–280)				
VII.	9	43 (36–51)	86 (65–101)	123 (78–167)	155 (113–194)	187 (155–224)	224 (169–291)	246 (180–309)			
VIII.	3	38 (26–47)	91 (71–104)	133 (121–152)	163 (142–186)	190 (180–205)	209 (201–221)	237 (215–261)	269 (259–288)		
IX.	2	35 (—)	58 (56–60)	110 (108–111)	149 (140–158)	161 (150–172)	199 (197–200)	215 (212–217)	241 (232–249)	268 (253–283)	
X.	1	40	75	105	155	183	205	240	257	275	286
	60	41 (26–65)	82 (53–116)	120 (74–167)	155 (103–221)	181 (123–246)	213 (153–291)	235 (180–309)	256 (232–288)	272 (253–283)	286 —

Table 10. Back calculated length growth of the chub from various European reservoirs, $l_1, l_2, \ldots, l_{12}$ — body length in mm.

Author	Locality	l_1	l_2	l_3	l_4	l_5	l_6	l_7	l_8	l_9	l_{10}	l_{11}	l_{12}
Bauch (1970)*	Mügelsee	57	99	142	193								
Vasněcov (1950) after Šapošnikova (1964)	Riverine lake Rybinskoje vodochranilišče (USSR)	47	80	115	154	202	248	305	333	368	400		
Byzgu (after Opalatenko, 1966)	Riverine lake Dubossarskoje vodochranilišče (USSR)	131	183	228	260	292	317						
Wundsch (after Bauch, 1970)*	Hohenwarthe	—	—	—	—	—	209	212	216	220	222	336	374

* Calculated from total length

Table 9. Back calculated length growth of the chub (in mm of the body length) from various Czechoslovak localities. n — number of specimens.

Author	Locality	n	l_1	l_2	l_3	l_4	l_5	l_6	l_7	l_8	l_9	l_{10}	l_{11}	l_{12}	l_{13}	l_{14}
Lewandowska-Jarzynowa (1969)	Tanew (Poland)	175	49	96	139	179	217	258	290	326	368					
Klimczyk (1965)	San (Poland	147	49	88	126	157	183	206	233							
Philippart (1972, after Libosvárský, Baruš 1978)	Ourthe (Belgium)	155	49	83	140	197	238	277	301	324	342	374				
Lewandowska-Jarzynowa (1969)	Bukowa (Poland)	12	47	89	131	164	197	239								
Šapošnikova (1964)	Bolšoj Ik (USSR)	–	47	80	116	154	196									
Vasněcov (1950, after Šapošnikova 1964)	Volha into Rybinskoje vodochranilišče (USSR)	—	47	77	107	141	190	226	298	333	371					
Klimczyk (1965)	Soła (Poland)	173	46	88	125	157	185	215	238	260	300					
Lewandowska-Jarzynowa (1969)	Dzwina (Poland)	—	45	91	134	171	214	255	290	318	333					
Lewandowska-Jarzynowa (1969)	Niemen (Poland)	—	41	86	132	181	232	278	321							
Mann (1976, after Libosvárský, Baruš 1978)	Stour (England)	253	38	72	124	175	257	287	306	321	334	346				
Kanno (1969, after Libosvárský, Baruš 1978)	Paimionjoki (Finland)	97	37	62	83	101	117	141	167	192						
Vasněcov (1950, after Šapošnikova 1964)	Volha into Ivanskoje vodochranilišče (USSR)	–	36	74	102	152	196	235	261	279	298					
Kožin (1949)	Volha (USSR)	—	—	–	195	225	264	290	321	353	378	401	428	445	446	471

* Calculated from the total length

Table 11 Back calculated length growth of the chub from various European rivers, n — number of specimens, $l_1, l_2, \ldots, l_{14}$ — body length in mm.

Author	Locality	n	l_1	l_2	l_3	l_4	l_5	l_6	l_7	l_8	l_9	l_{10}	l_{11}	l_{12}	l_{13}	l_{14}
Michajlova (1964) after Opalatenko, 1966)	Struma (Bulgaria)	—	83	113	148	176	202	215								
Cragg-Hine, Jones (1969, after Prokeš, 1978)	Willow brook (England)	199	80	126	151	211	239	300	299	296	336	344				
Bauch (1970)*	Hermsdorfer brook	—	79	117	193	212										
Vasněcov (1950) (after Šapošnikova, 1964)	Jachroma (USSR)	—	74	109	131	160	193	216	240							
Šapošnikova (1964)	Ural (USSR)	—	70	129	174	207	244	272								
Szczerbowski et al. (1976)	Lyna (Poland)	347	70	118	165	196	240	267	280	292	305	337				
Klimczyk (1965)	Wisla (Poland)	286	55	97	137	172	201	229	255	277	304	313				
Lewandowska-Jarzynowa (1969)	Wirowa (Poland)	14	54	108	151	190	235	272	305							
Kostjučenko (1962, after Žukov, 1965)	Dněpr (USSR)	120	51	105	150	212	265	311	337							
Philippart (1972, after Libosvárský, Baruš, 1978)	Berwine	41	51	89	133	168	198	215								
Lewandowska-Jarzynowa (1969)	Bystrzyca (Poland)	—	51	87	111	173	201	247								
Šapošnikova (1964)	Čazan (USSR)	—	51	79	115											
Opalatenko (1966)	Dněstr (USSR)	71	50	99	151	194	229	258	279							

Ricker (1969), Biljko (1971). In general it is supposed that the Lee's phenomenon is caused by a bigger mortality of better growing specimens. The phenomenon of Rosa Lee was determined from tables of back-calculated growth of the Klíčava chub in the years 1967—1968 (Pecl, 1969) and 1969—1975 (Pecl, Tandon, Pivnička, unpublished) and from the author's own data (1976—1980). All my material (1298 specimens I—XIII age classes) is organized according to the year of the hatching. This enabled the compilation of classified tables of the back-calculated growth of specimens hatched in 1956, 1958—1976, 1978. From each table (of the same type as Table 6) I have calculated absolute differences between the younger and older age groups with an aproximatively identical number of specimens. Absolute differences were always calculated in percent of the length of the older group. For example Lee's phenomenon for l_1 between age groups III and IV (Table 6) is 53–54 = –1, which is –1.9 % of the sum 53. From this example it is evident that the back calculated body length for the first year of life calculated from the IIIrd age class (in general younger) is bigger than the same value calculated from the IVth age class (in general older).

Absolute and relative differences were calculated for each table. Total average values of Lee's phenomenon in chub in the reservoir Klíčava were calculated for all above mentioned years.

The succesive values as follow: l_1 (—3.4 mm, —4.9%), l_2 (—6.5 mm, —3.1%), l_3 (—10.2, —4.7%), l_4 (—13.1 mm, —5.1%), l_5 (—9.7 mm, —3.8%), l_6 (—14.1 mm, —4.6%), l_7 (—7.8 mm, —2.6%), l_8 (—1.7 mm, —1.1%), l_9 (—6.2 mm, —1.7%), l_{10} (—18.3 mm, —4.9%), l_{11} (—20.5 mm, —5.2%), l_{12} (—78.0 mm, —18.6%).

SUMMARY

The length growth of 1647 specimens of the chub from the reservoir Klíčava and of 60 chub from the river Berounka was examined using scale method. The number of secondary canals in the caudal and oral scale region in the chub from the reservoir Kličava shows bigger ranges than the number of primary canals. The number of circuli from the scale centre to the first annulus is 11—35 (ave. 20.4), to the second 38—87 (ave. 63.8).

The ratio of the body length/ventro-diagonal scale radius is nearly linear. The length growth of the chub in Czechoslovakia is better in closed water bodies than in rivers.

Lee's phenomenon was registered in the chub from the reservoir Klíčava.

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Figures 1—5 will be found at the end of this issue.

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NOTE ON MORMYRUS KANNUME (PISCES, MORMYRIDAE)

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Abstract: 27 specimens of *Mormyrus kannume* Forskal, 1775 from two rivers of East Africa were examined with regard to 9 proportions and 10 meristic characters. No significant differences were found between the examined specimens from four localities. A significant difference was found in the number of dorsal rays, as compared with the data published on specimens from the river Nile system.

MATERIAL AND METHODS

All specimens of *Mormyrus kannume* being at disposal were caught by Dr. V. Skořepa in East African rivers in Kenya and conserved in formalin. Data on localities (as given by Dr. V. Skořepa): 23 specimens of *Mormyrus kannume* originated from the river Uaso Nyiro. The river Uaso Nyiro (Ewaso Ngiro) rises in the Aberdare Range (northwest of Nairobi) and in the northern and northwestern slopes of Mount Kenya (northeast of Nairobi) and terminates in the Lorian Swamps near the Kenya — Somalian border. The specimens of Mormyrus kannume were caught 400—500 m east of Archer's Post (0° 40′ N, 37° 40′ E). Specimens from localities designated in Tables and Figures "1" and "2" were caught above small falls. In these localities the water temperature measured 32° C, pH 7.5, the water transparency was low. Water plants were represented only by *Cyperus alternifolius*. Fishes found in these localities: *Barbus intermedius, Barbus oxyrhynchus. Lebistes reticulatus* was introduced here artificially. The presence of *Crocodilus niloticus* was interesting. In the rainy period due to overflow Uaso Nyiro may be connected with the Tana — Athi river system.

Additionally four heads of specimens of *Mormyrus kannume* from the Tana — Athi river system (Adamson's falls, 0° 06′ S, 38° 46′ E) were at our disposal. The Tana — Athi river system takes its origin in the Aberdare range(southeastern slopes) and in the southern and southeastern slopes of Mount Kenya and belongs to the water system of the Indian Ocean. Water conditions in the mentioned locality: temperature 30° C, pH 7.5, KH 4°, GH 4°.

Measurements of the body proportions were made by use of dividers with the ± 0.5 mm accuracy, meristic characters were counted using binocular microscope. A schematic drawing of mormyrid measurements is given in Fig. 1. Geographical variability was studied using the computation and graphical construction of the mean ($\bar{x}$), standard error of the mean ($s_{\bar{x}}$), standard deviation (s) and 95% confidence interval ($t . s_{\bar{x}}$); t ... critical value ($\alpha = 0.05$) (Table 1, 2, Fig. 3, 4). Relationship between the number of dorsal rays and the dorsal fin base length as % of the standard length (body length) was studied using the linear regression and correlation coefficient (r) (Fig. 5).

RESULTS AND DISCUSSION

Our results are summarized in Tables 1, 2, 3 and 4 and Fig. 3, 4 and 5. A specimen of 124 mm in standard length from the river Uaso Nyiro is illustrated in Fig. 2. No significant differences were found among specimens from the Uaso Nyiro above the falls (in Tables 1 and 2 localities designated "1" and "2") and below the falls ("3) using the construction of 95% confidence intervals. It is

Table 1. Meristic characters of *Mormyrus kannume* from the river Uaso Nyiro

	above falls "1"				above falls "2"	under falls "3"				alltogether			
number of specimens		17			1		5				23		
body length in mm		114–239			128		98–145						
	ave.	ranges	s	s_x		ave.	ranges	s	s_x	ave.	ranges	s	s_x
rays in dorsal fin	56	52– 61	2.35	0.57	51	56	53–59	2.18	0.97	55	51– 61	2.40	0.50
rays in anal fin	19	17– 20	0.94	0.23	19	18	17– 19	0.87	0.39	19	17– 20	0.88	0.18
rays in pectoral fin	14	13– 15	0.50	0.12	13	14	13– 14	0.50	0.22	14	13– 15	0.52	0.11
rays in ventral fin	6	6– 7	0.34	0.08	6	6	—	—	—	6	6– 7	0.30	0.06
scales in lateral line	96	91–110	4.55	1.10	92	93	86–96	4.58	2.29	95	86–110	4.57	0.97
scales between dorsal and anal fin,	28	25–32	2.22	0.56	27	26	25– 27	1.00	0.45	28	25– 32	2.08	0.44
above / under lateral line	23	21– 26	1.28	0.33	24	22	20– 23	1.22	0.55	23	20– 26	1.16	0.25
scales between dorsal and anal fin alltogether, without the scale in lateral line	51	46– 58	2.14	0.55	51	48	45–50	2.00	0.89	50	45– 58	2.28	0.49
scales round the caudal peduncle	26	24– 29	1.54	0.37	27	26	24–28	1.66	0.74	26	24– 29	1.51	0.31
teeth in the lower jaw	9	6– 10	1.11	0.29	9	9	7–10	1.12	0.50	9	6– 10	1.26	0.28
teeth in the upper jaw	6	2– 7	1.15	0.31	7	7	—	—	—	7	2– 7	1.38	0.31
gill rakers	10	8– 13	1.24	0.33	–	10	8–13	0.87	0.39	10	8– 13	1.13	0.26

Table 3. Frequency of dorsal rays number of *Mormyrus kannume*

Number of rays	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
Boulenger (1907), Nile system	1				1		1	1	2	2	6	9	7	5	7	5	6	1		2	1		2	2	1
Our data, Uaso Nyiro "1"		1	2	3	3	4	1	1	1		1														
"2"	1																								
"3"			1			1	2			1															

seen from the graphs (Figs. 3, 4) that confidence intervals are overlapped. Specimen "2" (above falls) shows remarkable differences in the length of the pectoral fin in % of the head length, the length of the caudal peduncle in % of its depth and in % of the head length, in the number of dorsal rays and lateral line scales in comparison with those of specimens from other localities ("1" above falls, "3" below falls). Four heads with the average gill raker number 10, ranges 8—13, $s = 2.08$, $s_{\bar{x}} = 1.00$ were at our disposal from the Tana-Athi river system. No differences were ascertained in comparison with the gill raker counts of specimens from the river Uaso Nyiro. In comparison with Boulenger's data (1907) on specimens from the Nile system and Lake Victoria significant differences were found in the number of dorsal fin rays (from Bolulenger's, 1907 data $\bar{x} = 62$, $s = 4.54$, $s_{\bar{x}} = 0.58$ (Table 3, Fig. 3). Specimens from the closed river Uaso Nyiro show fewer dorsal rays in comparison with those from the Nile system. Our specimens have the caudal peduncle and the eye diameter relatively shorter and the number of scales between D and

3

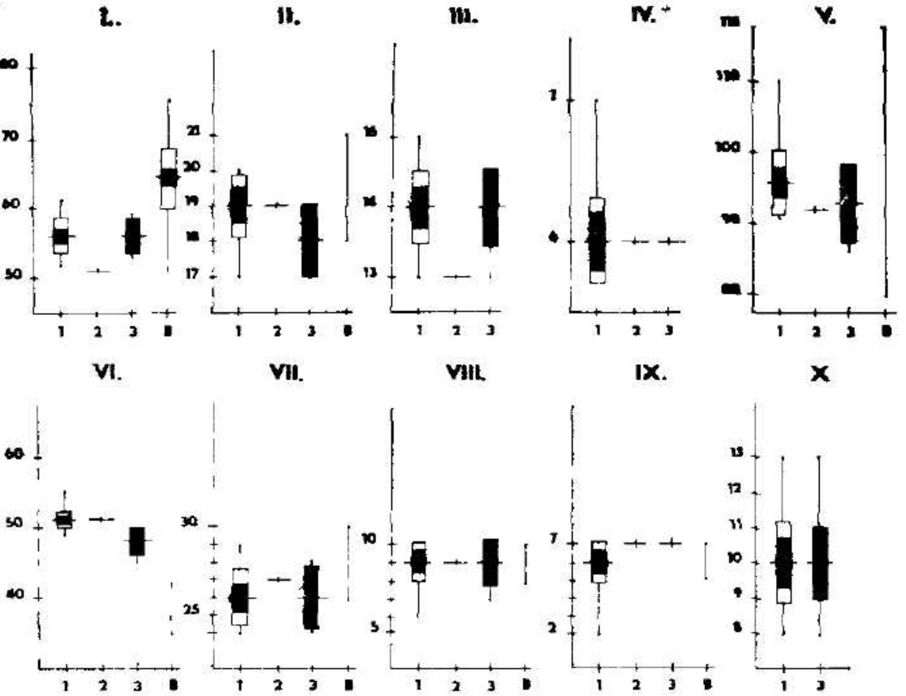

Fig. 3. Graphical demonstration of meristic characters of *Mormyrus kannume*. 1., 2. — Uaso Nyiro above falls; 3 — Uaso Nyiro below falls; B — Boulenger (1907, 1909), Nile system. I — rays in dorsal fin, II — rays in anal fin, III — rays in pectoral fin, IV — rays in ventral fin, V — scales in lateral line, VI — the total of scales between dorsal and anal fin, VII — scales round the caudal peduncle, VIII — teeth in the lower jaw, IX — teeth in the upper jaw, X — gill rakers. m — mean, r — ranges, s — standard deviation, s_x — standard error of the mean, $s_x . t$ — 95% confidence interval, t — critical value ($\alpha = 0.05$).

A higher than the specimens examined by Boulenger (1907, 1909) (Figs. 3 4). We found the maximum body length to be 239 mm (the total length 280 mm) in specimens from the river Uaso Nyiro ("1" above the falls). Boulenger (1907) showed the maximum length 510 mm, Greenwood (1966) 800 mm. Greenwood (1966) found the body depth 20—29% of the body length, the head length 20—25% of the body length, the snout length 100 and less % of

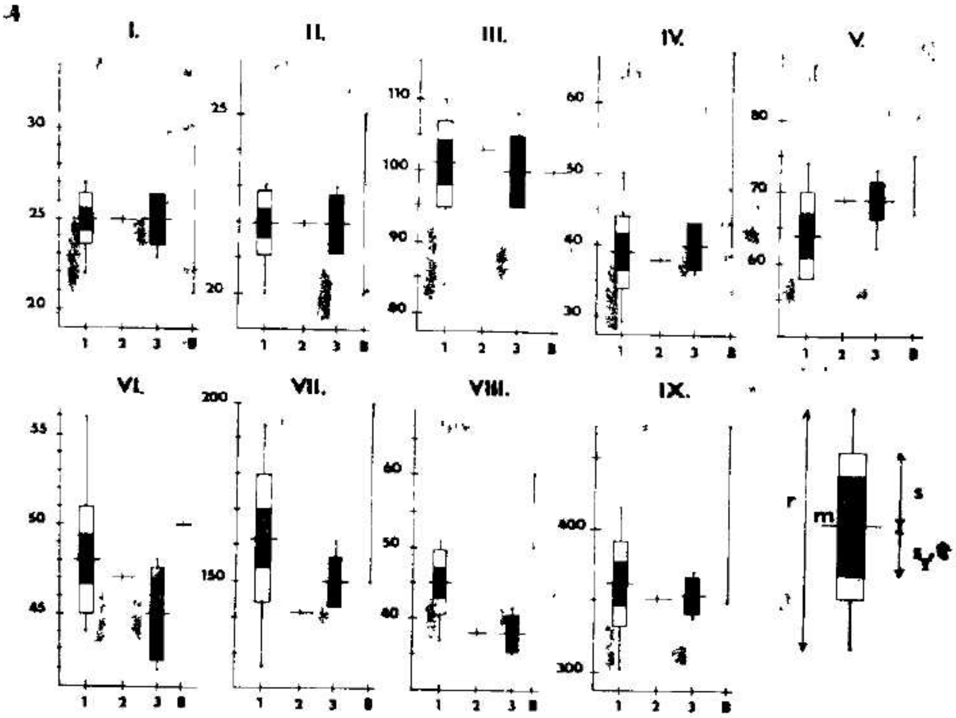

Fig. 4. Graphical demonstration of plastic characters of *Mormyrus kannume*. 1, 2 — Uaso Nyiro above falls; 3 — Uaso Nyiro under falls; B — Boulenger (1907, 1909), Nile system. I — body depth in % of total length, II — head length in % of total length, III — snout length in % of length of postorbital part of head, IV — eye diameter in % of interorbital width, V — length of pectoral fin in % of head length, VI — length of ventral fin in % of head length, VII — length of caudal peduncle in % of its depth, VIII — length of caudal peduncle in % of head length, IX — length of dorsal fin in % of length of anal fin. m — mean, r — ranges, s — standard deviation, $s_{\bar{x}}$ — standard error of the mean, $s_{\bar{x}} \cdot t$ — 95% confidence interval, t — critical value ($\alpha = 0.05$).

length of the postorbital part of the head, eye diameter 40—67% of the interorbital width, the depth o fcaudal peduncle 50—67% of its length, D 55—75, A 17—22, scale in lateral line 80—116, scales round the caudal peduncle 26—30 (in specimens from Lake Edward 32). Our specimens from the river Uaso Nyiro have the relative eye diameter considerably shorter (Table 2) than those examined by Greenwood (l. c.). According to Greenwood (1966) *Mormyrus kannume* is common in lakes Victoria and Kyoga, rare in lakes Edward, Albert and George. Elsewhere it is found in the whole Nile system, probably also in the Athi river system (Kenya). Bailey (1969) found *Mormyrus kannume* 187

Table 2. Body proportions of *Mormyrus kannume* from the river Uaso Nyiro

	above falls "1"				above falls "2"	under falls "3"				alltogether			
number of specimens		17			1		5				23		
body length in mm		114—239			128		98—145						
	ave.	ranges	s	s_x		ave.	ranges	s	s_x	ave.	ranges	s	s_x
body depth in % of total length	25	22— 27	1,41	0.34	25	25	23— 26	1.22	0.55	25	22— 27	1.31	0.27
head length in % of total length	22	20— 23	0.90	0.22	22	22	22— 23	0.71	0.32	22	20— 23	0.83	0.17
snout length in % of length of postorbital part of head	101	84—110	6.18	1.50	103	100	97—108	4.53	2.02	101	84—110	5.64	1.37
eye diameter in % of interorbital width	39	29— 50	5.33	1.23	38	40	36— 43	3.00	1.34	39	29— 50	4.77	1.00
length of pectoral fin in % of head length	64	61— 74	5.83	1.42	69	69	62— 73	4.52	2.02	65	61— 74	5.15	1.08
length of ventral fin in % of head length	48	44— 56	2.91	0.71	47	45	42— 48	2.29	1.02	47	42— 56	3.04	0.63
length of caudal peduncle in % of its depth	162	126—193	18.16	4.41	141	150	144—161	6.44	2.88	158	126—193	15.72	3.28
length of caudal peduncle in % of head length	45	37— 51	4.51	1.09	38	38	35— 41	2.24	1.00	43	35— 51	15.91	3.32
length of dorsal fin in % of length of anal fin	362	302—415	30.98	7.52	353	356	338—369	11.20	5.00	360	302—415	26.85	5.61

Table 4. Frequency of anal rays number of *Mormyrus kannume*

Number of rays	17	18	19	20	21
Boulenger (1907), Nile system		10	22	26	2
Our data, Uaso Nyiro "1"	1	2	9	5	
"2"			1		
"3"	1	2	2		

Table 5. Selected table of differences between East African specimens of *Mormyrus kannume* and Nile ones.

	Uaso Nyiro (our data)	Nile system (Boulenger, 1907, 1909)
Rays in dorsal fin	55 (51–61)	62 ((51) 55–75)
Scales between dorsal and anal fin	50 (45–58)	35–42
Eye diameter in % of interorbital width	39 (29–50)	40–67
Length of caudal peduncle in % of head length	43 (35–51)	50–60

5

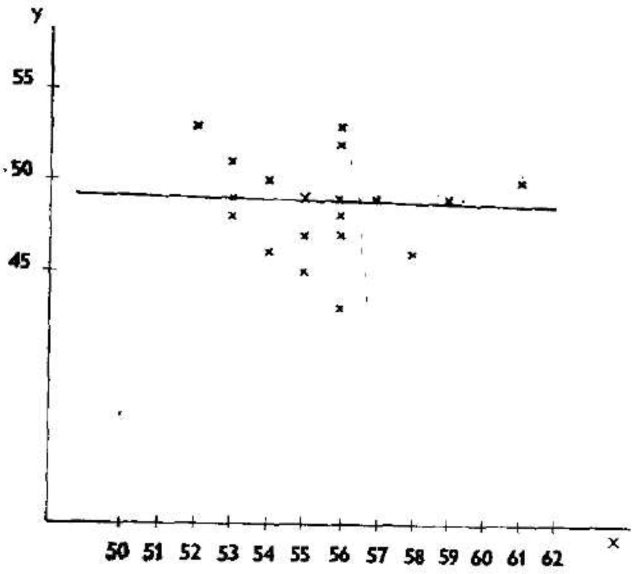

Fig. 5. Relationship between the number of rays in dorsal fin (x) and length of dorsal fin in % of body length (y). y = 46.4430 x − 0.0080; r (correlation coefficient) = −0.2901

mm SL, D 53, A 19 in Pangani (Tanzania). According to Boulenger, (1909) in the Athi river the same species. *Mormyrus hildebrandti* Peters, 1882 was found, which showed D 63, 24 scales round the caudal peduncle. Our specimens of *Mormyrus kannume* from Uaso Nyiro do not fully agree with *Mormyrus hildebrandti* (Athi river) — see Tables 2, 3. Boulenger (1909) synonymized both species, but with a question mark. According to Whitehead and Greenwood (1959) *Mormyrus hildebrandti* seems identical with *Mormyrus kannume*.

Fig. 5 shows the relationship between the relative length of the dorsal fin and the absolute number of the dorsal fin rays of all 23 specimens from the Uaso Nyiro at our disposal. With the increase in the number of dorsal fin rays a decrease in the dorsal fin length as % of the body length has been found, but the correlation coefficient is low ($r = -0.2901$).

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SUMMARY

Description of 23 specimens of *Mormyrus kannume* Forskal, 1775 from the river Uaso Nyiro (a closed river drainage, East Africa, Kenya) is given. Among localities studied no significant differences were found, neither in meristic characteres, nor in body proportions. Specimens from Uaso Nyiro have significantly a smaller number of rays in the dorsal fin than those from the river Nile system (drainage of the Mediterranean Sea) examined by Boulenger (1907). In comparison to further published data (Boulenger, 1907, 1909; Greenwood, 1966; also the Mediterranean Sea drainage) remarkable differences were found in the relative caudal peduncle length, in the relative eye diameter and in the number of scales between the dorsal and anal fin. Four specimens from the Tana-Athi river system (Indian Ocean drainage) do not show differences in the number of gill rakers in comparison with the specimens from Uaso Nyiro.

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Figs. 1 and 2 will be found at the end of this issue.

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FURTHER NOTES ON BOHEMIAN SALMON (SALMO SALAR, PISCES: SALMONIDAE)

Ota OLIVA

Dedicated to Professor Václav Dyk, DSc. on the occasion of the 70th anniversary of his birthday

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Abstract: Salmons, both parrs and adults, from the Labe and Vltava drainages included in the Frič's collection of the National Museum, Prague, Zoological Division of the Nat. Hist. Museum, were studied with regard to Frič's possible misidentifying of Atlantic salmon (*Salmo salar* Linnaeus, 1758) with migratory seatrout (*Salmo trutta trutta* Linnaeus,, 1758). All parrs and heads of adult salmon examined were genuine Atlantic salmon, not sea trouts. This is very interesting, because in the river Vistula drainage, in neighbouring Poland, the sea-trout, and not salmon, is dominant. The former was mistakenly identified in the past as „salmon" apparently due to the similar anadromous migration and great size.

INTRODUCTION AND HISTORICAL REVIEW

The oldest reports concerning the occurrence of salmon in Bohemia are by Balbín who deals with it in one chapter of his famous „Miscellanea Regni Bohemiae" (1679). This chapter written in Latin, was reprinted by Frič (1894). According to Balbín the salmon occurs in the Vltava and migrates into the Otava; at the town of Písek it is possible to find small salmons (parrs, called by him in Czech: „strdliczky — salmunculus digitali longitudine"). In the 17th century the spawning area of the Labe salmon was not only the river Otava, but also the river Orlice, the tributary of the upper Labe in Bohemia, where at Kostelec, on one occasion, 700 specimens were caught. In 1432 such mass of migrating salmons was observed in the main stream of the Labe that "the river bed was not able to accept them." In 1645, salmons were not rare in the Volyňka, but in 1713 the catching of two specimens was noted as an exception (Dyk, 1974). In the past, miners in Dolní Rejštejn (upper part of the Otava) used their own instalations for salmon catch when salmon occured, which was not infrequent (Dyk, 1974). Krejčí (1860, in Wenzig—Krejčí) also noted that salmons penetrated through the Vltava and the Otava every year up to the moutain region where they spawned. Formerly salmon occured more frequently; the decrease was caused by water transport of wood which was especially fatal for salmon fry.

The review of knowledge about the Labe (Elbe) salmon was published by Frič "1894). According to him the oldest note was that by J. Jonston 1663, which he reprinted (see also Dyk, 1956). Hertel 1978), however, took attention to the older paper of Johannes Kentmann, "Ichthyographie der Elbe", written in 1549. The manuscript with illustrations was considered missed for a long time. J. Helm found illustrations with annotations in 1960 in Weimar.

Hertel (1978) published and commented Kentmann's illustrations and commentaries. In this case, the salmon can be recognized clearly from the figure (Hertel's plate at the page 96). From the reprinted notes of Kentmann (Hertel, 1978, 82) it is evident, that he distinguished the winter (autumn) salmon population from the summer one (Berg's, 1948 concept!). Salmon parrs were not figured by Kentmann, but they are mentioned and called "canitzle" by him.

According to previous literary data the salmon migrated also into the river Ohře (Eger) up to Doksany. Siebold (1863) similarly knew salmons from the river Ohře (Eger) near of its spring in Oberfranken (now German Federal Republic) at Weissenstadt. According to Frič (1894) the salmons were captured in Bohemia in the Labe near Roudnice, Mělník, in Prague (see also Schmidt, 1795), in the rivers Berounka and Sázava; most fish migrated up to Otava (near Sušice). Frič pointed out that already Balbín knew that "small salmons" ("salmunculi") were migrating downstream to the sea. During the upstream migration through the main stream of the Labe in Bohemia, salmons were captured at various places (Stará Boleslav, Nymburk, Poděbrady, Hradec Králové). With regard to the decrease of salmons Frič (1879) proposed the arrangements for the increase of their number in Bohemian rivers. He calculated, e. g., with planting of 2 million of salmon fry into the upper Labe and Vltava. Frič (1879) reported in 1875 that 7 642 000 fertilized eggs of the Rhine salmon from Germany were bought and the fry planted into Bohemian rivers. In 1876 the Labe salmons were artificially spawned in Týnec nad Labem and fertilized eggs partially posted to the town of Sušice. The fry was planted into the river Otava. At this time the technology of artificial hatching was not well developed, e. g., one Prague fish trademan kept his sources for obtaining ripe salmons secret. Frič therefore tried to obtain help from the German Fisheries Union and each year in the last quarter of 19th century he received about 400 000 eggs of the Rhine salmon. These transports were repeated up to 1912 because of the regular lack of necessary quantities of eggs from the native Labe salmon. (Andreska, 1973). In the city of Prague, under one of the bridges (now "Švermův most"), the catches were in the year 1877 — 99 salmons, 1878 — 352, 289 in 1879, mostly in May; minimal catches were recorded in March and September. Frič (1891) demonstrated the salmon's life publicly and published statistical data about salmon hatcheries in Bohemia during 1871 — 90. During those 20 years 5 570 000 salmon fingerlings were planted into Bohemian rivers. In 1871 only 1500 specimens were planted, but in 1980 as many as 729 118 again. Frič (1894), in his famous monograph used the material of 245 specimens of the salmon. Of great interest are also his precise statistical data on catches in Bohemian rivers, but the number of salmon is not as high as expected. In the Opatovice dam on the Labe in eastern Bohemia in the years 1850—1884 only 5 (1862) up to 179 (1872) specimens of the salmon were caught annually. The instalation for catching salmon were constructed here et end of the 17th century "Andreska, 1973). For exact data on the former occurrence of the salmon in northeastern Bohemia see Lohniský (1977). The artificial planting of salmon according to Frič's own record was successful, and while the number of salmons caught increased, their market price decreased. On some places where for a long time the salmon was unknown it appeared again, e. g., in 1880 one specimen was caught at Horní Vltavice, in 1883 at Lenora (Andreska, 1973). As Andreska (1973) reported, between 1871 — 93 more than 7 milions specimens of salmon fry were produced in more than 30 hatcheries organized by Frič, mostly in southern Bohemia (upper parts of the rivers Vltava, Otava, Volyňka, Blanice). The intensive outfishing of migrating salmons and high dams prevented salmons from penetrating into spawning places situated in the upper parts of the rivers Vltava and Labe. Frič (1912) took attention to the decrease of salmon in the Prague district of the Vltava; one of the spawning places was also in Prague near the island of Štvanice, where also young parrs were seined. As mentioned above, however, in spite of the reports of catching single specimens of the salmon in the last century, the total number of salmons caught in Bohemia every year was not high; according to Frič (1872, 1879) it was in the average, about 500 per year. This is in agreement with Siebold (1863) who pointed out that the numbers of the salmon decreased due to constructing many river dams. In his time the first fish-ladders were built in England; in Europe they were still unknown. According to the notes in the "Kniha Žichovských rybářů a jejich hostů" (Daybook of Žichovice anglers and their guests) from 1912 — 33, salmons and parrs, angled in the Otava near the town of Žichovice, are mentioned every year (with interruption of 1914–1918 caused apparently by the lst World War). An interesting note is from Aug. 29, 1926, concerning the frequency of occurrence of salmons, the note from June 22 and 23, 1929, written by Professor F. Neuwirt, M. D. ("mass of parrs as before 27 years") and the note by the same author from May 1—5, 1931: "parrs are here all the time, some are full of eggs". It is evident that the anglers recognized here brown trout, parr and adult salmon (data cited above through the courtesy of Professor Dyk, in litt. Jan. 23, 1980). Křemen (1924) noted that at the end of the 17th century professional fishermen in the town of Písek had to sell "rare fishes, as eels, salmons and young salmons", under a strong menace, only to the district office of Písek. The town mayor and the members of the ocuncil themselves preferred these fishes for food and used them also as gifts to "patrons" from the city of Prague and another places. Especially parrs were preferred, and they were posted to Prague cooked and pickled, or smoked. In order to ensure regular supplies of salmons, the town council established regulations for millers preventing them to build high dams which would have made impossible the salmon migration upstream. In the 20th century Tejčka (1925, 1931) recorded the catch of the salmon female 98 cm length (probably the total length) in Soběnov at Kaplice, the rivulet Černá, tributary of the Malše, southern Bohemia. As the places of the past spawning areas of the salmon he cited the rivulets Malše, Stropnička, Černá. According to Tejčka in the first quarter of the century the villagers of Vidov, Straňany, Doudleby, Římov, Velešín, especially millers, remembered well the migratory mays of salmons. In 1870 — 80 salmons were also captured in the river Nežárka in the town of Jindřichův Hradec; their ways were interrupted after the construction of a dam here. In 1921 (July 16) one salmon weighing 6 kg angled in Žichovice by K. Liška (Dyk, 1940). In autumn 1922, two salmons were also observed by him, their weight was estimated as 5 and 12 kg, respectivelly. Klostermann 1926, sec. Dyk, 1976) remembered the catch of about 300 salmons in the town of Sušice in 1896, weighed 8—14 kg. Tejčka (1931) gives a list of the past spawning places in the south — the Bohemian rivers Otava, Křemelná and Vydra. According to him one salmon weighing 9 kg, designated as the "trout", was killed near Račov in a millrow, around 1930 more specimens were illegally caught in the river Otava at Hičice, Žichovice, Sušice; in 1912 one salmon was netted in Strakonice, around 1880 one salmon sprang on the raft and was killed; 3 salmons were observed under a bridge near Strakonice, one of them caught. In the rivers Vydra and Křemelná some specimens were caught every year. Teplý (1937) cited regulations of the Emperor Maxmilian from 1570, concerning selling prices of food articles in Prague. The price of the salmon was proclaimed separately in the presence of the city's Mayor and another official person (!). Regardless to the presence of salmon catching installations near Hluboká in southern Bohemia, salmons for Emperor's kitchen were bought at Litoměřice from the lower part of the Bohemian Labe (1564—98). As seen above, after 300 years Professor Frič had similar difficulties with obtaining ripe salmons for spawning purposes in southern Bohemia, because a substantial number of the salmon were caught in Prague before reaching spawning places (see Andreska, 1973). Many salmons in 1895 again appeared suddenly in southern Bohemia, and Frič's co-worker J. Bauer estimated that about 600 specimens penetrated into the river Otava and were caught near Radešov, in the rivers Křemelná and Vydra, up to the village Modrava. On the contrary, Dyk (1976) noted that during Klostermann's youth salmons migrated only into the river Křemelná, not up to the Vydra. The fish guard Žichovice M. Hlavsa Sen. caught 19 salmons in 1895, the angler Raušar 7 specimens in one day. Such exceptional catches were later generalized, although they were very rare. Teplý (sec. Dyk, 1974) noted that, e.g., in 1637 at Podskalsky mill in Písek 70 salmons were caught, one of them weighing 18 pounds. Schubert (1944) reported that a large salmon (40 kg!) was captured in the Prague part of the river Vltava at Holešovice in 1940, but I did not succeeed in confirming this note. Schubert (1944) brought also some data on the former occurrence of salmon in Bohemia and summarized the previous ones. Volf (1954) noted that as late as in 1936 one adult specimen of the Labe salmon was captured. It is interesting that in 1926, 9 years before the closing of the Labe by the Střekov dam, there was a very rich salmon season; in Prague, the members of the "First Angler's Association" alone captured 369 specimens, weighing in total 2445.3 kg, and it was commonly believed that many salmons arrived at their spawning places in the river Otava in southern Bohemia. A similar situation occurred in 1927, when in Prague salmons of total weight of 1742 kg were caught, in the river Otava at Sušice 155 kg (Andreska, 1973). Naturally many additional specimens were caught illegally. At that time last salmons were artificially spawned in the Sušice hatchery. According to the personal communication of Mr. Brindl, guard on the Labe dam in České Kopisty, salmons were migrating upstream until 1935 in the main stream of the Labe every season. In the town of Lovosice, up to 8 specimens were sometimes captured daily, weighing 8 — 12 kg. Since 1935, when the new dam across the Labe near Střekov, close to the frontier with the GDR, was built the migrations were interrupted (Hrabě — Oliva, 1953). But as late as in 1947 one salmon (according to Volf, 1954) was captured below the Střekov dam in the Labe, weighing 4.6 kg, 92 cm in length. Above the dam, on Nov. 14, 1948, another salmon weighing 1.3 kg, 54 cm in length, was captured again in the town of Lovosice; its head was seen by Volf (1954).

The data on Czechoslovak salmon were reviewed critically by Dyk (1956). He observed salmon parrs also in the river Otava; he referred to their coloration and Mrs. S. Dyková prepared respective figures. Important evidence of the late M. Hlavsa of the former multitude of salmons in the upper part of the river Otava was published by Dyk (1974, 1975) who also recalled (1976) the remarks of famous Czech writer K. Klostermann (1926). In the second half of the 19th century about 100 specimens of the salmon were caught in the river Otava near Žichovice, some weighing up to 18 kg, mostly about 12 kg; a smaller part of the specimens weighed about 8 kg. Salmons were harpooned by a special instrument. Sometimes seining was used. The upstream salmon migration in the river Otava began in April.

The last data concerning the Labe salmon were newly completed by Bauch (1957) who believed that the past situation could be restored if salmons could penetrate into their former spawning places in Bohemia and if the pollution of the Labe river decreased to the status of 1924 — 28. Concerning the 7 m high dam across the Labe in Střekov, Bauch (l. c.) supposed that this represented the most important obstacle for the renewal of the salmon population in the Labe. It must be noted here that he also feared that even if a more suitable fish-ladder were additionally built here there would be only little chance that salmons would be able to get across the dam. He compared the situation with that on the river Rhine, where the supposedly "suitable" fish-ladder at Kemps is virtually of no use. Dyk (1978) published excerpts from the previously mentioned "Žichovice Anglers' Chronicle", where for 1927 three notes of the occurrence of salmon are noted (May 22, Aug. 6, Oct. 5), but only on May 22 salmon was really angled. This is in coincidence with the frequent occurrence of salmons in Prague part of the Vltava in the year 1927.

According to Andreska (1973), years 1900—1910 were not profitable as regards salmons and only single specimens penetrated through the river Otava up to Sušice. Through this decade, M. Hlavsa caught 7 salmons only. The following years were also without remarkable changes and in 1915 the former Frič's assistant J. Kafka resigned from the plans on the construction of fish-ladders on the Vltava dams below Prague; this decision was not correct, as was demonstrated by rich salmon seasons in 1926 and 1927. According to Andreska (1973), also the years 1928, 1932 and 1933 were "good salmon years" along the river Labe. The last salmon in Žichovice was captured by the fisheries guard M. Hlavsa in 1936. The last salmon in Horažďovice was found dead in 1940. In the town of Sušice the last salmon was angled by B. Laně in 1941 or 1942 (Andreska, 1973). According to Hertel (1978) last salmons were captured in the Saxon part of the river Elbe (Labe) around 1920, which is, as follows from previous information, not correct.

From these facts, it is evident that salmon was always a delicacy in Bohemia; rare cases of frequent occurrence were later generalized and thus stories arose about the „triviality of salmon" as human food here. The intensive out-fishing of migrating salmon always hindered the penetration of salmon up to the upper parts of the river Vltava. The same situation was in the upper part of the river Labe in the district of Pardubice (Andreska, 1973). He reports unpublished statistics of salmon catches prepared by Dr. A. Čermáková along the Labe ond the Vltava in Bohemia from 1624 to 1825. The highest annual catch was in 1751 at Mělník (496 specimens). The annual catch in 18th century is estimated as 2400 kg. The survey of literature available shows that nobody noticed Frič's observations as regards the material deposited in the collection of the National Museum in Prague. Similarly the salmon material collected by the late Professor Schäferna († 1950) remained undescribed without regard to Schäferna's (1933) promise that he wold make further studies on "dwarf salmons", with ripe eggs, resembling parrs". Therefore we considered it appropriate to study this material from the recent aspects. The Czech salmon parrs, in reality dwarf salmons, were studied in separate communication (Oliva, Johal, 1981); adult salmons are treated in the present communication.

MATERIAL AND METHODS

I have studied 10 amputated salmon heads deposited in the Zoological Department, Nat. Hist. Museum, National Museum, Prague, apparently a rest of the original documentary material of Professor A. Frič, from the Vltava and Labe, which he used in his salmon monograph (1894). In the collection of Bohemian fishes in the exhibition hall of the National Museum I studied one stuffed salmon (No. 5004) from the river Vltava near Kralupy, coll. Nov. 1909, 920 mm of the total length, and one female salmon, deposited in the "general collection", 655 mm in length, No. 6206. For measuring, Pravdin's (1931) and Smitt's (1886, 1887) schemes were used.

RESULTS AND DISCUSSION

The heads of salmons belong to the true atlantic salmon, and not to the sea trout. In the second half of the last century, the distinctive characters of both species were not so thoroughly established as they are nowadays.

The results of the study of meristic characters in "dwarf" salmons from Schäferna's samples with the data of Berg (1948) and Smitt (1886) have been summarized in a previous paper (Oliva-Johal, 1979).

Selected proportionate and meristic characters of the salmon from the Vltava near Kralupy of TL = 920 mm, SL = 890 mm, weight 5.4 kg, D III 9, A III 8, are the following: In % of body length: head length 19, maxillary length 8.7, mandibulary 10.5. In % of P — V distance: length of P 32, depth of a 82 % of the length of the upper margin of the langth of upper margin of the caudal peduncle length, minimum body depth 30 % of caudal decuncle length, depth of anal fin 72 % of the length of the lower margin of the caudal peduncle, minimum body depth 46 % of this distance. There are 13 scale rows from the end of the adipose fin to the lateral line, inclusive the lateral line scale.

Comparing these data with those Berg (1948), the depth of anal fin is smaller and the pectoral fin length in P – V distance is greater, which is probably due to conservation.

The differences between salmon and trout in Frič's material are evident from the Table 1. When the position of opercle bones was studied, suboperculum in the trout *(Salmo trutta)* reaches up to the praeoperculum (see Schechtel, 1925), but in no salmon head in Frič's collection the suboperculum reaches to the praeoperculum. Frič's specimens differ from Berg's (1948) specimens of aproximately the same length from the White Sea drainage (river Vig) by a longer maxilla (ave 51 % of head length). Berg's specimens have a shorter maxillary (only 34.7 %).

Finally, it is necessary to cite Berg (1935) concerning his results of the study of meristic characters in salmon, in 1103 sp. from the drainage of the White, Barents and Baltic sea, separately of males and females, where no differences were found; in average the number of gill rakers is 19.1 or 20.8. In D 10.1—11.2 (females & males, 1093 sp.) rays were found, in A 7.9—8.2 (females & males, 1091 sp.) rays were counted.

Table 1. Proportionate characters of salmon's and trout's jaws measured on heads of Frič's collection

					salmon							- trout	
	1	2	3	4	5	6	7	8	8	10	ave	1	2	ave
Head length	116	116	124	129	132	157	164	177	200	210	152.5	99	114	106.5
in % of head length														
eye diameter	10	11	11	11	10	10	10	10	10	9	10.2	14	14	14.0
maxilla's length	50	49	51	48	51	50	50	52	51	58	51.0	58	65	61.5
mandibula's length	59	55	60	57	58	58	60	61	62	64	59.4	69	72	70.5

Notes: No 1 — specimen with non-hooked mandibulary; No 2 — captured Aug. 30, 1885 in Prague ("Štvanice"); No 155 of Frič's protocole designated here as "kelt" ("losos tulák") — this fish is a male with a small hook; No 4 — designated as No 214 Frič's protocole, male, June 10, 1886, Prague, without hook; No 5 — captured October 9, 1887 in Hamburg, apparently in the mouth of the Elbe; No 6 — designated by No 111 only as "salmon", mandibulary not hooked; No 7 — without hook and other notes; No 8 and 9 — the same; No 10 — designated as No 172 of Frič's protocole, with a typical hook on mandible. In most cases maxillaries reach up to the vertical from hind margin of the eye, only in Nos. 2 and 9 the maxillary is a little longer. In both trouts, originally deposited in the same glass, the maxillary is longer (as it is clearly seen from the table) and reaches far behind the vertical from the hind margin of the eye.

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SUMMARY

1. Two stuffed adult specimens of the salmon *(Salmo salar)* and 10 heads of the salmon from the Vltava and the Labe in the Frič's collection, measuring in average 152.5 mm, and 2 trout heads, measuring in average 106.5 mm, were studied. In the salmon the eye diameter measured in average 10.2 % of the head length, in the trout 14.0 %; the maxillary length in the salmon was 51.0 % (in the trout 61.5%), the mandible length in the salmon was 59.4 % (in the trout 70.5%) of the head length. The differences are obvious.

2. The investigation confirmed, that the Bohemian salmon was a true salmon and not a sea trout.

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The plate will be found at the end of this issue.

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ZUR PUPPENMORPHOLOGIE UND – TAXONOMIE DENDROPHILER ARTEN AUS DER TRIBUS GRAPHOLITINI (LEPIDOPTERA, TORTRICIDAE)

Jan PATOČKA

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Abstract· The pupae of 34 dendrophilous Tortricidae of tribe Grapholitini (Lepidoptera) from Central Europe are described (six of them were taken from literature data) and a key for determining them is given. The present system of this group was discussed from the point of view of pupal characters.

In diesem Beitrag, welcher an den von Patočka (1980) anknüpft, werden die Puppen der dendrophilen Arten einer weiteren Tribus der Tortricidae, Grapholitini behandelt. In der dem Verfasser zugänglichen Literatur sind die Angaben darüber spärlich vertreten, so bei Danilevskij (1950), Patočka et al. (1960), Patočka (1980a), Speyer (1958). Sie betreffen meistens einige vom Gesichtspunkte der Land- oder Forstwirtschaft interessante Arten. Viele andere sind wohl bisher unbeschrieben worden, obzwar die Bestimmung der Lepidopteren — schon im Puppenstadium — beim Verfolgen sowohl der theoretischen wie auch praktischen Fragen nötig ist und in der Tribus Grapholitini sich mehrere vom land- und forstwirtschaftlichen Hinsichte wichtige Arten befinden. In dieser Arbeit werden 34 Arten (davon 28 auf Grund des eigenen Materiales-coll. des Verf. — und 6 nur nach Literaturangaben) von 5 Gattungen behandelt und ihre Stellung in dem dieszeitlichen System im Sinne von Obraztsov (1954—1961), Hannemann (1961), Danilevskij, Kuznecov (1968) und Bradley et al. (1979) auf Grund der Puppenmorphologie diskutiert. Für die Übergabe mehrerer Puppen ist der Verfasser den Herren Doz. Ing. M. Čapek (B. Štiavnica) und Dr O. Karsholt (Praest, Dänemark) zum verbindlichsten Dank verpflichtet.

MATERIAL UND METHODIK

Durch lange Jahre wurden Puppen und Puppenexuvien gesammelt und trocken aufbewahrt. Bei manchen von erwähnten Arten lagen grössere Serien für die Untersuchung vor. Die Beschreibung und Zeichnung erfolgte mit Hilfe eines Stereomikroskopes, teilweise auch des Abbe'schen Zeichenapparates. Als Unterlage benützte man die Verbandzeugwatte, an welcher das Objekt die gewünschte Lage behalt.

Die wichtigsten Merkmale und ihre Variabilität

Ausser der Länge und Breite, Färbung der Puppe und ihrer Exuvie, der Skulptur und des Glanzes werden folgende Merkmale berücksichtigt: Form des Oberteiles der Stirn, relative Länge der Zunge und Unterlippe, Tiefe und Form des vorderen Ausschnittes am Hinterbrustrücken, Form des Spitzenteiles der Vorderflügel sowie der Luftlöcher, der Index = die grösste Länge: die Breite an der Rückenmitte vom 1. Hinterleibstergit, Anwesenheit, Grösse, Dichte und Form der Dornen am Rücken der Hinterleibsringe. Ab- oder Anwesenheit bezw. Form des Kremasters, Form des Hinterleibsendes, Form und Zahl der Häkchen am 10. Hinterleibsring.

Die Puppen varieren ziemlich stark (auch je nach den Geschlechtern, in der Grösse, weniger in der Färbung). Die erwähnten Hauptmerkmale varieren auch ziemlich. Trotzdem war es möglich, verlässliche Merkmale fur das Charakterisieren der einzelnen Arten aufzufinden.

Abkürzungen

Bre = Basalreihe, D = Dorn, Dornen, Eh = Endhäkchen, F = Fühler, Hbr = Hinterbrustrucken, Hlb 1–10 = 1.–10. Hinterleibsring, -- glier, Kr = Kremaster, Kre = Kaudalreihe, Kaudalreihen, Ll = Luftloch, Luftlocher, P = Puppe, Puppen, Peh = Perianalhäkchen, Rbt = Rückenborsten, Vfl = Vorderflügel.

CHARAKTERISTIK DER PUPPEN DER TRIBUS GRAPHOLITINI

Stirn zwischen den Wurzeln der F (mit wenigen Ausnahmen) abgerundet und nicht hervorstehend, oder aber kegelförmig- schräg nach vorn, seltener nach oben erhaben. Hbr meistens zu $^{1}/_{3}$—$^{1}/_{2}$, seltener tiefer ausgeschnitten. Kre der D am Hleib 4—6 meist kammartig, d. h. die Basen der einzelnen D sind nach vorn leistenartig fortgesetzt, dazwischen feine Rinnen (Abb. 30). Hlb 10 (wenige Ausnahmen) mit D, die aber nicht grösser als die am Hlb 4—6 sind. Hlb 10 auffallend kurz (meist nicht länger als die Eh), er trägt 4, seltener 6 Eh und 2, seltener 1 oder 3 Paare von Peh. Seltener sind 8 Eh vorhanden. Kr (mit wenigen Ausnahmen) fehlt vollständig.

Die Vertreter der Tribus Archipini Obraztsov, 1942, Tortricini Obraztsov, 1949 und Olethreutini Obraztsov. 1946 unterscheiden sich meistens durch den entwickelten Kr, durch mehrere Eh, oft auch durch den Mangel von D am Hlb 10 und durch die hervortretende Stirn. Bei der Tribus Cnephasiini Obraztsov, 1949 sind die D am Hlb 10 meist stark vergrössert. Die Tribus Eucosmini Obraztsov, 1956 unterscheidet sich durch die vor die Wurzel der F hervortretende Stirn (meistens aber ohne einen kegelförmigen Höcker zu bilden), durch den längeren Hlb 10 und meistens auch durch die nicht kammförmigen D der Kre.

Die Raupen der dendrophilen Grapholitini-leben in den Früchten, in den Gallen der Cynipiden, im Bast und der Rinde, seltener zwischen versponnenen Blättern der Nährpflanzen. Sie verpuppen sich am Frassort oder ausserhalb desselben (oft an oder unter der Rinde, in morschem Holz oder am Boden) in einem weichen bis festen Gespinst.

BESTIMMUNGSTABELLE DER ARTEN DER TRIBUS GRAPHOLITINI

(dendrophile Arten Mitteleuropas**)

1. Kr deutlich entwickelt. Hlb 10 mit 8 Eh (Abb. 113, 114 116) 2
– Kr fehlt ganz oder fast ganz. Hlb 10 mit 4–6 Eh (Abb. 4, 47, 73) . . . 3
2 (1) Hlb 10 mit einer Dornreihe (Abb. 114) . . . . *Eucosmomorpha albersana*
– Hlb 10 ohne Dornreihen (Abb. 113) . . . . *Enarmonia formosana*
3 (1) Ränder der Ll schmal (Abb. 7,49) 5
– Ränder der Ll breit, scheibenförmig (Abb. 106) 4
4 (3) Bre, sowie Kre der D am Hlb 2 und –3 deutlich kleiner als an den folgenden Ringen . . . . *Strophedra nitidana*

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*) Das meiste Material stammt von der Slowakei, **C. *inquinatana*, C. *janthinana*,** *P. agnotana* und *P. rhediella* von Dänemark.

**) Es fehlen noch folgende Arten: *Cydia interruptana* Herrich-Schäffer, 1848, C. *leguminana* Zeller, 1846, C. *zebeana* Ratzeburg, 1840, C. *pinetana* Schläger, 1848, C. *tenebrosana* Duponchel, 1843, *Pammene trauniana* Denis et Schiffermüller, 1775, *P. aurantiana* Staudinger, 1871, *P. germmana* Hübner, 1796–1799, *P. insulana* Guenée, 1845, *P. juniperana* Millıere, 1858, *P. obscurana* Stephens, 1834.

— Bre, sowie Kre von D am Hlb 2—3 wenig kleiner als an den folgenden Ringen, die D uberhaupt grösser als bei ***S. nitidana*** . . . . *Strophedra weirana*

5 (3) Stirn kegelformig hervortretend oder stark erhaben (Abb. 33, 56, 97) . . 6

— Stirn abgerundet, nicht-oder sehr schwach hervortretend (Abb. 42, 76, 105) . 13

6 (5) D am Hlb 8—10 stark reduziert oder fehlend (Abb. 58) 7

— D am Hlb 8 und —10 deutlich (Abb. 32, 93) 8

7 (6) Hlb 10 oben ungerunzelt (Abb. 58). Bre der D am Hlb 3—6 schmal, die D stumpf (Abb. 61) . . . . *Cydia strobilella*

— Hlb 10 oben langsgerunzelt. Bre der D am Hlb 3—6 breit . . ***Cydia conicolana***

8 (6) Bre von D am Hlb 3—6 mehrfach (Abb. 95) . . *Pammene ochsenheimeriana*

— Bre von D am Hlb 3—6 einfach (Abb. 36, 101) 9

9 (8) Stirnhocker zweispitzig (Abb. 45) . . . . ***Cydia pyrivora***

— Stirnhocker einfach (Abb. 39, 97) 10

10 (9) Stirnhocker lang, scharfwinklig (Abb. 97). Hbr. kaum zu $^1/_2$ ausgeschnitten. Am Hlb 4 D der Kre viel kleiner als die der Bre (Abb. 101) . . . . *Pammene amygdalana*

— Stirnhocker kurz, stumpf- oder rechtwinklig (Abb. 33). Hbr. zu $^2/_3$ ausgeschnitten (Abb. 35). Am Hlb 4 D der Kre wenig kleiner als die Bre (Abb. 36, 39) . 11

11 (10) Mit 3 Paar Peh Am Hlb 4 zwischen den Rbt 9—11 D der Bre . ***Cydia amplana***

— Mit nur 1 Paar von Peh (Abb. 31) Am Hlb 4 zwischen den Rbt 4—8 (selten 9) D der Bre 12

12 (11) Bre der D am Hlb 4 rel. schräg und dicht, zwischen den Rbt gibt es dort meist 7—8 D der Bre. Kre von D am Hlb 7 rel stark, deutlich kammartig . . . . *Cydia splendana*

— Bre der D am Hlb 4 rel. steil und dünn, zwischen den Rbt gibt es dort 4—6, seltener 6 D der Bre. Kre der D am Hlb 7 schwach, nicht kammartig, D steil . . . . *Cydia fagiglandana*

13 (5) Bre von D am Hlb 3—6 mehrfach (Abb. 64, 77, 81) 14

— Bre von D am Hlb 3—6 einfach (Abb. 17) 22

14 (13) Reihe der D am Hlb 9—10 mehrfach (Abb. 103) . . . *Pammene rheidiella*

— Reihe der D am Hlb 9—10 einfach (Abb 73) 15

15 (12) Hlb 7 mit Bre und Kre von D 16

— Hlb 7 nur mit der Bre von D 19

16 (15) Zunge etwa um $^1/$[illegible] langer als die O1 (Abb. 62). Stirn zwischen den F sanft erhaben (Abb. 105) . . . . *Cydia janthinana*

— Zunge rd 2× langer als die O1 (Abb 8. 71). Stirn zwischen den F ganz abgerundet (Abb. 76) 17

17 (16) Bre der D am Hlb 2 verkummert. Ende des Hlb rel. spitzig (Abb. 73). P bis 6,5 × 1.5 mm . . . . *Pammene agnotana*

— Bre der D am Hlb 2 gut entwickelt. Ende des Hlb von oben an stumpf (Abb. 85) P meist 7 × 1,8 mm und mehr 18

18 (17) D am Hlb 9 stark, am Hlb 10 stark und dicht — 8—10 D (Abb. 88) . . . . *Pammene regiana*

— D am Hlb 9 winzig, die am Hlb 10 stark, aber dünn — 4—5 D (Abb. 85) . . . . *Pammene fasciana*

19 (15) Stirn ganz flach abgerundet (Abb. 76) 20

— Stirn sanft über die Wurzel der F erhaben (Abb. 105) . . *Pammene inquilana*

20 (19) Am Hlb 3—6 die Bre der D drei- oder mehrfach (Abb. 81) P über 6 mm lang . . . . *Pammene albuginana*

— Am Hlb 3—6 die Bre von D zweifach (Abb. 77). P unter 6 mm lang . . 21

21 (20) Reihe von D am Hlb 7 einfach. Ende des Hlb rel. spitziger (Abb. 78) . . . . *Pammene splendidulana*

— Reihe von D am Hlb 7 zweifach. Ende des Hlb rel. stumpfer . . . . *Pammene argyrana*

22 (13) Kopf und Hbr dunkel gefleckt (Abb. 3). Hlb hell gebändert (Abb. 4). Hlb 2: Bre von D reduziert . . . . *Cydia servillana*

— Weder Kopf und Hbr dunkel gefleckt, noch Hlb gebändert. Hlb 2: Bre von D deutlich 23

23 (22) Hlb 3—6: D der Bre und Kre fast gleichgross, beide kammartig (Abb. 13, 17, 22). Hlb 4: Zwischen den Rbt meist 12—18 D der Bre 24

— Hlb 3—6: D der Bre deutlich grosser als die der Kre (Abb. 21, 41, 48). Hlb 4: Zwischen den Rbt gibt es 4—10, seltener bis 12 D der Bre 27

24 (23) Hlb 1: Index unter 2,5. P rd. 6 × 1,2 mm. Hlb 10: D von denen der Bre am Hlb 2 wenig verschieden . . . . *Cydia cosmophorana*
– Hlb 1: Index meist 3 und mehr. P über 7 × 1,8 mm. Hlb 10: D von denen der Bre am Hlb 2 stark abweichend 25
25 (24) D am Hlb 9–10 stumpf (Abb. 17) . . . . *Cydia pactolana.*
– D am Hlb 9–10 spitzig (Abb. 13) 26
26 (25) P stark glänzend 8–9 × 2,3–2,5 mm . . . . *Cydia millenniana*
– P schwach glänzend 7–8 × 1,8–2 mm . . . . *Cydia duplicana*
27 (23) Hlb 4: Zwischen den Rbt gibt es 4–8 D der Bre und 12–22 D der Kre . 28
– Hlb 4: Zwischen den Rbt gibt es 9–12 D der Bre und 24–38 D der Kre . 33
28 (27) Ende des Hlb von oben an rel. spitzig, Kr. angedeutet (Abb. 47) . . . . *Cydia inquinatana*
– Ende des Hlb von oben an stumpf, Kr nicht angedeutet (Abb. 43, 66) . 29
29 (28) P 9–13 mm lang 2.2–2,5 mm breit. Ll lang oval (Abb. 40) . *Cydia pomonella*
– P 4–8 mm lang, unter 2 mm breit, Ll breit oval bis rund (Abb. 18, 49) . 30
30 (29) P 6–7 × 1,5–1,7 mm. Hlb 10: D nicht hoher als an der Basis breit (Abb. 86, 94) 31
– P 4–6 × 1,2–1,5 mm Hlb 10: D deutlich höher als an der Basis breit (Abb. 66, 67) 32
31 (30) Hlb 10: D gross und rel. stumpfer, ihre Höhe meist rd $^1/_4$–$^1/_3$ der Entfernung zwischen ihrer Basis und der Analspalte (Abb. 86) . . . . *Cydia molesta*
– Hlb 10: D klein und rel. spitziger, ihre Hohe meist unter $^1/_5$ der Entfernung von ihrer Basis zur Analspalte (Abb. 94) . . . . . . *Cydia funebrana*
32 (31) D der Bre am Hlb 2 gut entwickelt (Abb. 69) . . . . . *Pammene spiniana*
– D der Bre am Hlb 2 verkümmert (Abb. 70) . . . . . *Pammene populana*
33 (27) Hlb 1 :Index unter 2,5. Hbr spitzig ausgeschnitten (Abb. 53) . *Cydia corollana*
– Hlb 1: Index über 2,5. Hbr abgerundet ausgeschnitten (Abb. 10, 27) . . 34
34 (33) Hlb 4· Kre der D kammartig (Abb. 21). Hlb am Ende von der Seite an rel. spitziger (Abb 20) . . . . *Cydia coniferana*
– Hlb 4: Kre der D nicht kammartig (Abb. 25). Hlb am Ende von der Seite an stumpfer (Abb 24) . . . . *Cydia illutana*

ÜBERSICHT DER GATTUNGEN UND ARTEN

Gattung *Cydia* Hübner, 1825

Syn. *Laspeyresia* Hubner 1825

Die Puppen dieser Gattung kann man nicht eindeutig charakterisieren. Stirn abgerundet oder erhaben, dann jedoch rel. stumpf. Bre der D nur selten mehrfach (*C. janthinana*). Die D insbes. der Kre bei vielen Arten kammartig. Bei einigen (*C. conicolana, C. strobilella*) kommt es zur Reduktion der D am Hlb 8—10. Auch die Untergattungen (mit Ausnahme von *Coccyx* Treitschke, 1829) kann man an Hand der Puppenmerkmale nicht leicht abgrenzen. Einige mitteleuropäische Arten (wie *C. zebeana* (Ratzeburg, 1840), *C. leguminana* (Zeller, 1846), *C. tenebrosana* (Duponchel, 1843)) waren mir als Puppen nicht zugänglich.

1. *Cydia* (Cydia) *servillana* (Duponchel. 1836)

P 8 × 1,3 mm(1 ♀), graubraun, Hlb im Hinterteil der Ringe heller, Stirn, Scheitel und Seiten des Hbr (Abb. 3) dunkler, ziemlich glänzend. Stirn ganz abgerundet, Basen der F aber gesenkt. Zunge um $^2/_3$ länger als die Ul (Abb. 1). Vfl unter der Spitze schwach konkav (Abb. 2). Hbr winkelig zu $^1/_2$ ausgeschnitten (Abb. 3). Hlb dorsal ziemlich rauch skulpturiert. Hlb 1: Index = 2,2. Ll breit oval, nicht erhaben (Abb. 7). Am Hlb 2 fehlt die Bre der D, die Kre ist winzig. Am Hlb 4—6 die D der Kre viel kleiner als die der Bre (Abb. 6). Hlb 8—10 nur mit einer Dornreihe, die D dünner und steiler als an den vorgehenden Ringen mit der Tendenz, im Mittelteil eine Doppelreihe zu bilden. Hlb 10 von oben an rel. stumpf, von der Seite an spitziger mit 4 Eh und nur 1 Paar von Peh (Abb. 4,5). Kr fehlt.

Die Raupe lebt in Gallen an Trieben der Weiden, insbes. Salweiden. Verpuppung daselbst, Kokon seidig.

2. *Cydia* (Cydia) *millenniana* (Adamczewski, 1967)

P 8—10 × 2—3,5 mm (4 P), rotbraun bis schwärzlich, Hlb heller, Exuvie rötlich gelbbraun ,stark glänzend, fein skulpturiert. Stirn abgerundet. Zunge rd. 2 × länger als die Ul (Abb. 8). Vfl mit stumpfer Spitze, darunter schwach konkav (Abb. 9). Hbr zu $^1/_2$ breit abgerundet ausgeschnitten (Abb. 10). Ll breit oval, klein. Hlb 1: Index = rd. 3; zuweilen dort die Kre der D angedeutet. Am Hlb 2—3 die D der Bre steiler als an den folgenden Ringen. Am Hlb 2—7 die Bre und Kre der D sichtbar, am Hlb 6 beide kammartig, die D der Kre wenig kleiner als die der Bre (Abb. 13). Am Hlb 7 die D der Kre klein, nicht kammartig. Am Hlb 9 und — 10 die D klein, aber spitzig (Abb. 11—13). Hlb am Ende abgestumpft mit 4 Eh und 2 Paar Peh (Abb. 11, 12). Kr fehlt.

Die Raupe lebt in Gallen an Zweigen der Lärche. Verpupt sich daselbst, Kokon seidig.

3. *Cydia (Cydia) pactolana* (Zeller, 1840)

P 7—8 × 1,8—2,2 mm (f. *grunertiana* Ratz. von der Lärche, 1 ♂ und 1 ♀), pech- bis schwarzbraun, nur mässig glänzend, Exuvie gelbbraun. Stirn abgerundet, stumpfer als bei *C. millenniana*, Zunge rd. 2 × länger als die Ol, Vfl unter der Spitze konkav (Abb. 16). Hbr dem von *C. millenniana* ähnlich. Ll breit oval. Hlb 1: Index = rd. 3; zuweilen die D der Kre als Längsleisten angedeutet. Bre der D am Hlb 2—3 steiler als an den folgenden Ringen. Die D der Bre schwächer, die der Kre stärker kammartig, am Hlb 7 aber die D der Kre klein und nicht kammartig. Am Hlb 3–6 die D der Bre wenig grosser als die der Kre (Abb. 17). Am Hlb 8—10 nur eine Reihe von D, diese stumpf, insbes. am Hlb 10 (Abb. 14, 15, 17). Ende des Hlb von oben an ziemlich stumpf mit 4 Eh und 2 Paar von Peh (Abb. 14, 15). Kr fehlt.

Raupe im Bast von jungen Fichten am Grund der Quirle, jedoch auch von Lärchen (f. *grunertiana*). Verpuppung daselbst.

4. *Cydia (Cydia) coniferana* (Saxesen, 1840)

P 7,8 × 1,8 mm (1 ♂), braun, Exuvie braungelb, Glanz mässig, Skulptur fein. Stirn oval abgerundet. Zunge um rd $^3/_4$ länger als die Ol. Spitze der Vfl ähnlich wie bei der vorigen Art. Ll klein, fast kreisrund (Abb. 18). Hbr wie bei den vorigen. Hlb 1: Index = rd. 3,0. Hlb 2—10 mit Dornreihen, die D rel. klein. Am Hlb 2–7 gibt es 2 Reihen von D; am Hlb 2 die D der Bre kleiner und steiler als die der Kre. Am Hlb 4 die D der Bre rel. steil, bedeutend grösser als die der Kre. die Kre kammförmig (Abb. 21). Zwischen den Rbt gibt es dort 10 D der Bre und 25 D der Kre. Die D am Hlb 7 denen an vorgehenden Ringen ähnlich. Hlb 9: D rel gross und zahlreich, im Mittelteil verdoppelt. Hlb 10 mit rd. 10 D, die denen der Bre am Hlb 4 ähnlich sind. Ende des Hlb von oben an stumpf, von der Seite jedoch rel. spitziger (Abb. 19, 20). Mit 4 Eh und 2 Paar von Peh, Kr fehlt.

Die Raupe lebt in Wunden, insbes. Krebswunden von Coniferen. Verpuppung daselbst.

5. *Cydia (Cydia) duplicana* (Zetterstedt, 1840)

P (Patočka et al., 1960) den vorigen ähnlich, die Dornreihen an mittleren

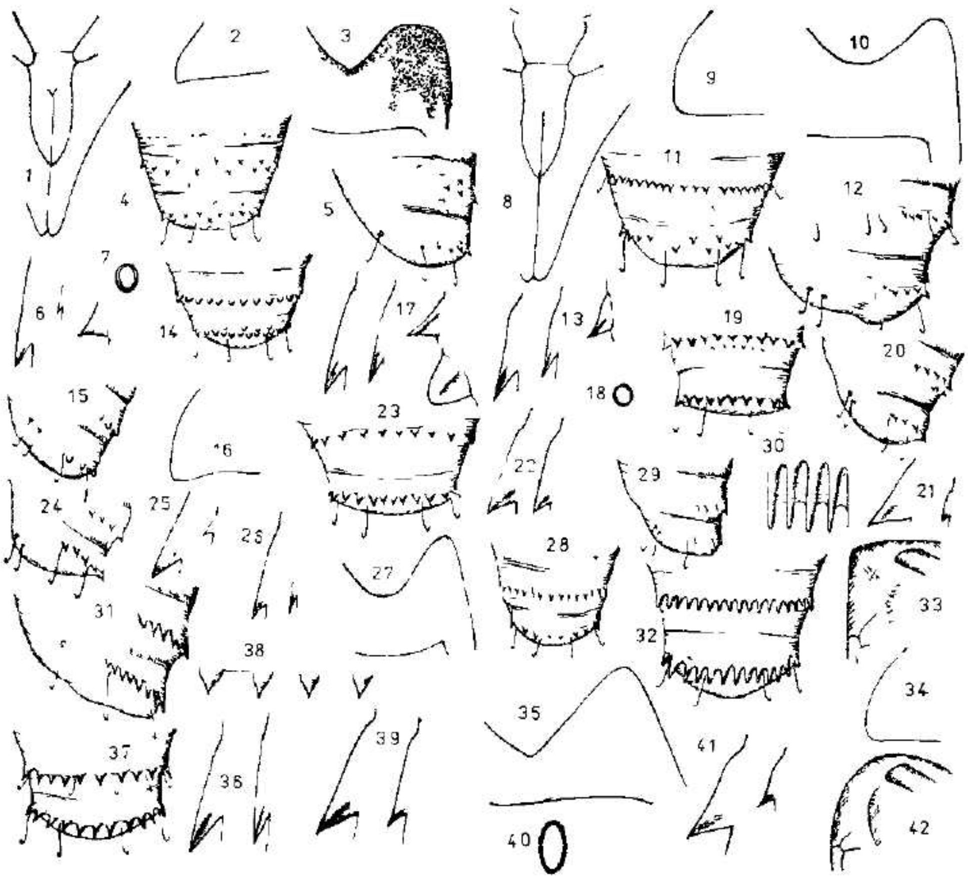

Abb. 1 Ul und Zunge von *Cydia servillana.* — Abb. 2. Spitze des Vfl. — Abb. 3. Hbr. — Abb. 4. Ende des Hlb von oben. — Abb. 5. Ende des Hlb von der Seite. — Abb. 6. D der Bre und Kre am Hlb 4 und D am Hlb 10 (Längsschnitt, schematisch). — Abb. 7. Ll amHlb 2 von ders Art — Abb 8. Ul und Zunge von *Cydia millenniana.* — Abb. 9. Spitze des Vfl. — Abb. 10. Hbr. — Abb. 11. Ende des Hlb von oben — Abb. 12 Ende des Hlb von der Seite — Abb. 13. D der Bre und Kre am Hlb 4 und D am Hlb 10 (Längsschnitt, schematisch) von ders. Art. — Abb. 14. Ende des Hlb von oben von *Cydia pactolana.* — Abb. 15. Ende des Hlb von der Seite. — Abb. 16. Spitze des Vfl. — Abb. 17. D der Bre und Kre am Hlb 4, D der Bre am Hlb 2 und D am Hlb 10 (Längsschnitt, schematisch) von ders. Art. — Abb. 18 Ll von *Cydia coniferana* am Hlb 2. — Abb. 19. Ende des Hlb von oben. — Abb. 20. Ende des Hlb von der Seite. — Abb. 21. D der Bre und Kre am Hlb 4 (Langsschnitt,schematisch) von ders. Art. — Abb. 22. D der Bre und Kre am Hlb 4 von *Cydia duplicana* (Längsschnitt, schematish). — Abb. 23. Ende des Hlb von *Cydia illutana* von oben. — Abb. 24. Ende des Hlb von der Seite. — Abb 25 D der Bre und Kre am Hlb 4 von ders. Art. — Abb. 26. D der Bre und Kre am Hlb 4 (Langsschnitt, schematisch) von *Cydia cosmophorana.* — Abb. 27. Hbr. — Abb 28. Ende des Hlb von oben. — Abb. 29. Ende des Hlb von der Seite von ders. Art. — Abb 30. Kre der D am Hlb 4 von *Cydia splendana.* — Abb 31 Ende des Hlb von der Seite. — Abb. 32 Ende des Hlb von oben. — Abb. 33. Stirn von der Seite. — Abb. 34. Spitze des Vfl. — Abb. 35. Hbr. — Abb. 36. D der Bre und Kre am Hlb 4 (Längsschnit, schematisch) von ders. Art. — Abb. 37. Ende des Hlb von oben von *Cydia fagiglandana.* — Abb. 38.

Ringen des Hlb aber fast gleichgross, wenig schräg, sehr regelmässig (Abb. 22). Hlb 10 dorsal mit 6 besonders starken Dornen (Postner, 1957).

Die Raupe lebt ähnlich wie die vorige.

6. *Cydia (Cydia) illutana* (Herrich-Schäffer, 1848)

P 7,5 × 8,5 × 1,7—2 mm (1 ♂ und 1 ♀) braun, Exuvie braungelb, mässig glänzend, fein skulpturiert. Stirn abgerundet, Basen der F schwach gesenkt, Zunge um rd. $^3/_4$ länger als die Ul. Vfl unter der länglichen Spitze deutlich konkav. Hbr. ähnlich wie bei *C. coniferana*, L1 oval Hlb 1: Index = rd. 2,6. Hlb 2—10 mit D, am Hlb 2—7 in 2 Reihen, die D der Kre am Hlb 7 sehr klein. Am Hlb 2 die D der Bre nicht kleiner als die der Kre. Am Hlb 4 die D der Kre winzig und nicht kammförmig (Abb. 25). Zwischen den Rbt gibt es dort 10—12 D der Bre und 26—28 D der Kre. Am Hlb 9 sind normale, starke D, am Hlb 10 gibt es 10—17 D, die etwas starker als die der Bre von Hlb 4 sind. Ende des Hlb von der Seite an deutlich stumpfer als bei *C. coniferana* (Patočka et al., 1960), Abb. 23, 24.

Die Raupe lebt in Zapfen von Coniferen und in den *Sacchiphantes*-Gallen an Fichten. Verpuppung daselbst.

7. *Cydia (Cydia) cosmophorana* (Treitschke, 1835)

P 6 × 1,2 mm (1 ♂), schlank, braun, Exuvie braungelb, mässig glänzend, fein skulpturiert. Stirn abgerundet, Zunge rd. um $^3/_4$ länger als die Ul. Vfl unter der schlanken, scharfen Spitze mässig konkav. Hbr zu $^1/_2$ breit abgerundet ausgeschnitten (Abb. 27). L1 klein, breit oval. Hlb 1: Index = rd 2,3. D am Hlb 2 wenig kleiner als an den folgenden Ringen. Am Hlb 4 die beiden Dornreihen stark kammartig (Abb. 30), fast gleichgross (Abb. 26). Am Hlb 7 ist die Kre normal, am Hlb 9 die D gut erhalten. Am Hlb 10 bei der untersuchten P nur 6 rel. schwache D. Ende des Hlb von oben an abgerundet, von der Seite ziemlich spitzig. 4 Eh und 2 Paar von Peh vorhanden (Abb. 28, 29), Kr fehlt.

Raupe in verlassenen Harzgallen von *Petrova resinella* (Linnaeus, 1758) an jungen Kiefern, auch an Stammwunden von Coniferen (Postner, 1957). Verpuppung daselbst.

8. *Cydia (Cydia) splendana* (Hübner, 1796—1799)

P 8—12 × 2,3—3 mm (6 P), rotbraun, Exuvie rötlich gelbbraun, mässig glänzend. An der Stirn ein stumpfer Höcker (Abb. 33). Zunge um rd. $^3/_4$ länger als die Ul. Spitze der Vfl stumf, darunter der Aussenrand mässig konkav (Abb. 34). Hbr zu $^2/_3$ breit winkelig ausgeschnitten (Abb. 35). L1 kreisförmig, am Hlb 2 mehr oval. Hlb 1: Index variabel = 3—4. Hlb 2 bereits mit 2 starken Reihen der D. Am Hlb 3—7 die D stark, schräg, die der Bre wenig grösser als die der Kre (Abb. 36), die Kre stark kammartig (Abb. 30). Am Hlb 4 gibt es zwischen den Rbt 7—10 D der Bre und 18—22 D der Kre. Hlb 9 stark bedornt, am Hlb 10 12—14 ebenfalls starke D. Ende des Hlb rel. stumpf, Kr fehlt (Abb. 31, 32). Mit 4 Eh und nur 1 Paar von Peh.

Die Raupe lebt in Eicheln, Edelkastanien und Walnüssen und verpuppt sich in einem festen Kokon im Boden.

Kre der D am Hlb 7 — Abb 39. D der Bre und Kre am Hlb 4 (Längsschnitt, schematisch) von ders Krt — Abb. 40. Ll am Hlb 2. — Abb. 41. D der Bre und Kre am Hlb 4 (Längsschnitt, schematisch). — Abb. 42. Stirn von der Seite von *Cydia pomonella*.

9. *Cydia (Cydia) amplana* (Hübner, 1796—1799)

P der von C. *splendana* sehr ähnlich. D an mittleren Ringen des Hlb kleiner und dichter. Am Hlb 4 zwischen den Rbt 9—11 D der Bre. Mit 3 Paar von Peh (Danilevskij, 1950).

Die Raupe lebt und verpuppt sich wie die vorige.

10. *Cydia (Cydia) fagiglandana* (Zeller, 1841)

P den vorigen ähnlich (1 ♂), D an mittleren Ringen des Hlb rel. dünner und steiler (Abb 39). Am Hlb 4 zwischen den Rbt bei der untersuchten P nur 4 D der Bre und 18 D der Kre. Am Hlb 7 die D der Kre klein, rel. steil, nicht kammartig (Abb. 38). D am Hlb 8—10 rel. kleiner, steiler, nicht kammartig (Abb. 37). Mit 2 Paar von Peh.

Die Raupe lebt in Bucheckern. Verpuppung in festem Kokon am Boden.

11. *Cydia (Cydia) pyrivora* (Danilevsky, 1947)

Syn. *C. (C.) danehli* (Obraztsov, 1950)

P (nach Danilevsij et Šeldešova, 1950) 11—13 mm lang, dunkelbraun, Stirn mit einem oben doppelten kegelförmigen Ausläufer (Abb. 45). D stark, die der Kre kammartig. Hlb 10 ohne Kr, mit 10—18 D, die lateralen besonders stark, Eh nicht hakenförmig, nur 1 Paar von Peh vorhanden.

Die Raupe lebt in Birnen und verpuppt sich in einem festen Kokon am Boden.

12. *Cydia (Cydia) pomonella* (Linnaeus, 1758)

P 9—13 × 2—2,5 mm (10 P), rötlich braun, Exuvie gelb- bis ockerbraun, mässig glänzend und fein skulpturiert. Stirn abgerundet (Abb. 42). Zunge rd. 2 × länger als die Ul. Vfl. unter der Spitze mässig konkav. Hbr zu mehr als $^1/_2$ sanft abgerundet ausgeschnitten. L1 länglich oval (Abb. 40), insbes. am Hlb 2. Hlb 1: Index variabel, = 3—4. Am Hlb 2 beide Reihen von D fast gleichgross ,aber rel. klein. Am Hlb 3—7 die Kre kaum kammartig, ihre D kleiner als die der Bre (Abb. 41). Am Hlb 4 gibt es zwischen den Rbt 4—6 D der Bre und 15—22 D der Kre. Am Hlb 8—10 die D rel. klein, ihre Zahl am Hlb 10 variabel (4—12). Ende des Hlb rel. stumpf, ohne Kr, mit 4 Eh und 2 Paar von Peh (Abb. 43, 44).

Die Raupe in Früchten von Obstbäumen, insbes. in Äpfeln und Birnen, auch in Walnüssen. Verpuppung unter Rindenschuppen u. dgl. in leichtem Kokon.

13. *Cydia (Cydia) inquinatana* (Hübner, 1796—1799)

P 8 × 1,5 (1 ♂), braun, Exuvie braungelb, fein skulpturiert und mässig glänzend. Stirn abgerundet. Zunge um $^2/_3$ länger als die Ul, Vfl spitzig, Aussenrand deutlich konkav. Hbr zu $^1/_2$ mässig abgerundet ausgeschnitten (Abb. 46). L1 hervortretend, breit oval (Abb. 49). Hlb 1: Index = 3,2. Hlb 2: D rel gross, die der Bre grösser und steiler als die der Kre. Am Hlb 3—6 die D schräg, etwas kammartig, die der Bre deutlich grösser als die der Kre (Abb. 48). Hlb 7 mit 2 Dornreihen, sogar Hlb 8 mit winzigen Dörnchen der Kre. Am Hlb 4 zwischen den Rbt gibt es 6 D der Bre und 14 denen der Kre. Am Hlb 8—10 die D rel. stark. Ende des Hlb auffallend zugespitzt mit angedeutetem Kr, 4 Eh und 2 Paar von Peh (Abb. 47, 50).

Die Raupe lebt in Früchten von Ahorn, Kokon unter den Rindenschuppen.

Cydia (Cydia) corollana (Hübner, 1822—1823)

P 6,2 × 1,3 (1 ♂) schlank, gelbbraun, Exuvie bräunlich strohgelb, rel. glatt, mässig glänzend. Stirn breit, ganz flach abgerundet. Zunge um rd $^1/_3$ länger als die Ul. Vfl unter der mässig abgerundeten Spitze sanft konkav (Abb. 51). Hbr zu mehr als $^1/_2$ winkelig ausgeschnitten (Abb. 53). Ll fast kreisrund. Hlb 1: Index = 2,1. Hlb 2—7 mit 2, 8—10 mit 1 Dornreihe, D im allgemeinen klein, schon am Hlb 2 gut entwickelt. Am Hlb 3—6 die D der Bre deutlich grösser als die der Kre. die ersteren mittelsteil, die letzteren etwas kammartig (Abb. 55). D am Hlb 9 deutlich. Am Hlb 10 rd 10 rel. kleine und schräge D (Abb. 52, 55). Ende des Hlb stumpf abgerundet, ohne Kr, mit 4 Eh und 2 Paar Peh (Abb. 52, 54).

Die Raupe lebt an Espen in verlassenen Gallen von *Saperda populnea*. Verpuppung daselbst.

15. *Cydia (Cydia) conicolana* (Heylaerts, 1874)

P (nach Betts, 1958) 4,5—6 mm lang, braun. Stirn mit einem stumpfen Ausläufer. Kopf und Brust dunkler als der Hlb. Hlb 3—7 mit 2 Reihen von D, die Bre breit mit starken D, die Kre einfach, D dort feiner. Am Hlb 2 die D der Bre verkümmert, Hlb 8—9 dornlos. Hlb 10 abgerundet, länglich gerunzelt mit 10 Häkchen, davon 4 Eh und 3 Paar von Peh.

Die Raupe lebt in Zapfen von Kiefern, Verpuppung daselbst.

16. *Cydia (Coccyx) strobilella* (Linnaeus, 1758)

P 7,5—8,5 × 1,4—1,8 mm (10 P), hellbraun, Exuvie braungelb, glänzend, fein skulpturiert, am Hlb zwischen den Dornreihen matter. Stirn springt zwischen den Wurzeln der F stark nach oben vor (Abb. 56, 57). Zunge etwa um $^2/_3$ länger als die Ul. Spitze der Vfl stark vorgezogen, darunter deutlich konkav. Hbr zu $^1/_2$ winkelig ausgeschnitten (Abb. 60). Ll langoval. Hlb 1: Index = 2—2,5. Hlb 2—7 mit 2—, —8 mit einer Reihe von D. Hlb 9—10 dornlos oder mit einzelnen winzigen Dörnchen (Abb. 58, 59). D im allgemeinen stumpf und breit, die der Kre bedeutend kleiner als die der Bre, Dornreihen schwach kammartig (Abb. 61). Am Hlb 4 gibt es rd 10 D der Bre und 18—24 D der Kre zwischen den Rbt. Zwischen den stumpfen D der Bre gibt es manchmal kleine spitzige Dörnchen (Abb. 61). Ende des Hlb abgerundet, Hlb 10 mit 4 Eh und 3 Paar von Peh (Abb. 58, 59).

Die Raupe lebt in Zapfen der Fichten, Verpuppung daselbst.

17. *Cydia (Grapholitha) funebrana* (Treitschke, 1835)

P (nach Danilevskij, 1950, Speyer, 1958) 5—7 mm lang, braun, im allgemeinen und insbes. am Hlb 8—10 der von *C. pomonella* ähnlich, die Ll aber breit oval, fast kreisrund. Stirn abgerundet. Am Hlb 10 die D klein, breit, spitzig (Abb. 94), ihre Höhe beträgt kaum $^1/_5$ der Entfernung von ihrer Basis zur Analspalte (Baker, 1963).

Die Raupe in Früchten von *Prunus*, insbes. von *P. domestica*. Kokon an der Stammbasis oder am Boden.

18. *Cydia (Grapholitha) molesta* (Busck, 1916)

P (nach Baker, 1963) der von *C. funebrana* ähnlich, die D am Hlb 10 aber grösser und stumfer. Ihre Höhe rd. 3—4 × kleiner als die Entfernung zwischen ihrer Basis und der Analspalte (Abb. 86).

Die Raupe in Trieben und Früchten von Obstbäumen. Kokon an Zweigen, Früchten, Stämmen oder Boden.

19. *Cydia (Grapholitha) janthinana* Duponchel (1834)

P 5,8 × 1,5 mm (1 ♀), braun, Exuvie bräunlich gelb, ziemlich glänzend, fein skulpturiert. Stirn abgerundet ,aber sanft vor die Wurzel der F hervortretend (Abb. 105). Zunge etwa um $^{1}/_{2}$ länger als die Ul (Abb. 62). Hbr zu mehr als $^{1}/_{2}$ abgerundet ausgeschnitten. Spitze der Vfl. vorgezogen, darunter konkav. L1 klein, breit oval, hervorstehend. Hlb 1: Index = 2,8. D am Hlb fein, bleich. Am Hlb 2 insbes. die der Bre verkümmert. Am Hlb 4—5 die Bre dreifach, die Kre einfach die D der Kre kaum kleiner als die der Bre (Abb. 64), ziemlich breit, aber spitzig. Am Hlb 7 die Bre 2—3—fach, die Kre klein aber deutlich. Am Hlb 8—10 nur eine einfache Dornreihe. Am Hlb 8 die D rel. klein, dicht, am Hlb 9sehr klein, dünn, am Hlb 10 rel. gross, dunkel, steil (10 D am untersuchten Stück). Ende des Hlb rel. stumpf, mit 4 Eh und 2 Paar von Peh (Abb. 63, 65).

Die Raupe lebt hauptsächlich in Früchten von Weissdorn, Kokon am Stamm oder Boden.

Gattung *Pammene* Hübner, 1825

Auch diese Gattung kann man durch Puppenmerkmale nicht eindeutig charakterisieren. Stirn abgerundet, meist nicht hervortretend, manchmal aber auch kegelförmig, rel. spitzig. L1 schmal begrenzt, meistens kurz oval. Die Bre der D am Hlb 3—6 meist mehrfach, zuweilen auch einfach. D am Hlb 9 manchmal reduziert ,am Hlb 10 vorhanden und meist rel. stark, manchmal dünn, selten mehrfach. Kr fehlt. Meistens mit 4 Eh und 2 Paar von Peh. P von manchen Arten (*P. obscurana* (Stephens, 1834), *trauniana* (Denis et Schiffermüller, 1775), *aurantiana* (Staudinger, 1871), *germmana* (Hübner, 1796—1799) u. a.) standen mir nicht zur Verfügung.

1. *Pammene spiniana* Duponchel, 1843

P 4—5 × 1,2—1,5 mm (6 P), hellbraun, Exuvie bräunlich gelb, mässig glänzend, fein skulpturiert. Stirn abgerundet, nicht hervortretend. Zunge etwa um $^{1}/_{3}$ länger als die Ul. Vfl. rel. stumpf, unter der Spitze schwach konkav (Abb. 68). Hbr zu $^{2}/_{3}$ winkelig ausgeschnitten, L1 breit oval, fast kreisrund. Hlb 1: Index = 2,8—3. Am Hlb 2—7 zwei, am Hlb 8—10 eine Reihe von D, überall einfach. Am Hlb 2 die D der Bre normal, steil. die der Kre kammartig (Abb. 69). Am Hlb 4 die D der Kre wenig kleiner als die der Bre, beide rel. schräg und etwas kammartig (Abb. 67). Am Hlb 9 die D gut entwickelt, am Hlb 10 länger als breit (7—9 D). Ende des Hlb abgestumpft mit 4Eh und 2 Paar von Peh (Abb. 66).

Die Raupe in Blüten von *Prunus* u. a. Verpuppung daselbst im Kokon.

2. *Pammene populana* (Fabricius, 1787)

P der vorigen ähnlich (15 P), am Hlb 1 Index = 2,4—2,7. Am Hlb 2 die D klein, insbes. die der Bre ziemlich verkümmert (Abb. 70).

Die Raupe in versponnenen Trieben von Weiden, Kokon am Stamm oder in morschem Holz.

3. *Pammene agnotana* Rebel, 1914

P 6 × 1,5 mm (1 ♀), gelbbraun. Exuvie braungelb, mässig glänzend, fein

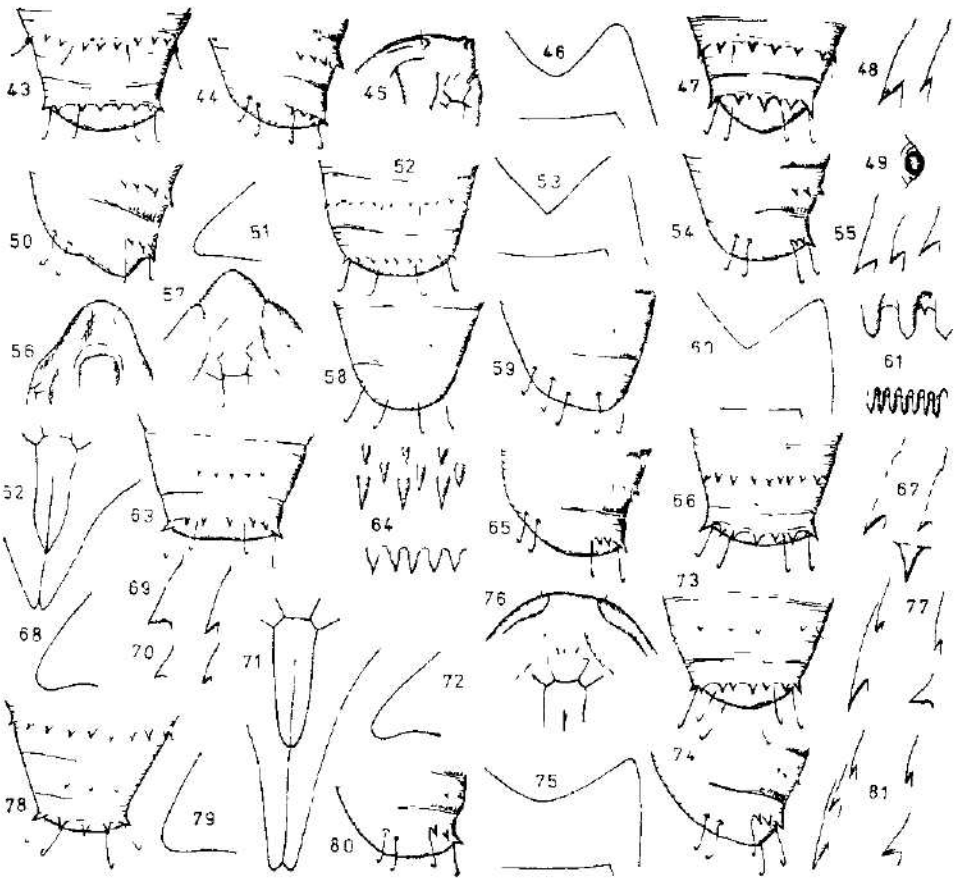

Abb. 43. Ende des Hlb von oben von *Cydia pomonella*. — Abb. 44. Ende des Hlb von der Seite von ders. Art. — Abb. 45. Stirn von der Seite von *Cydia pyrivora* (nach Danilevskij et Šeldešova). — Abb. 46. Hbr von *Cydia inquinatana*. — Abb. 47. Ende des Hlb von oben. — Abb. 48. D der Bre und Kre am Hlb 4 (Längsschnitt, schematisch). — Abb. 49. Ll. — Abb. 50. Ende des Hlb von der Seite von ders. Art. — Abb. 51. Spitze des Vfl von *Cydia corollana* — Abb. 52. Ende des Hlb von oben. — Abb. 53 Hbr. — Abb. 54. Ende des Hlb von der Seite. — Abb. 55. D der Bre und Kre am Hlb 4 und D am Hlb 10 (Längsschnitt, schematisch) von ders. Art. — Abb. 56. Stirn von der Seite von *Cydia strobilella*. — Abb. 57. Stirn von vorn. — Abb. 58. Ende des Hlb von oben. — Abb. 59. Ende des Hlb von der Seite. — Abb. 60. Hbr. — Abb. 61.Bre und Kre von D am Hlb 4 von ders. Art. — Abb. 62 Ol und Zunge von *Cydia janthiana*. — Abb. 63. Ende des Hlb von oben. — Abb. 64. Bre und Kre von D am Hlb 4. — Abb. 65. Ende des Hlb von der Seite von ders. Art. — Abb. 66 Ende des Hlb von oben von *Pammene spiniana*. — Abb 67. D. der Bre und Kre am Hlb 4 und Dam Hlb 10. — Abb. 68. Spitze des Vfl. — Abb. 69. D der Bre und Kre am Hlb 2 von ders. Art. — Abb. 70. D der Bre und Kre am Hlb 2 (Längsschnitt, schematisch) von *Pammene populana*. — Abb 71 Ul und Zunge von *Pammene agnotana*. — Abb 72. Spitze des Vfl. — Abb. 73. Ende des Hlb von oben. — Abb. 74. Ende des Hlb von der Seite. — Abb 75. Hbr von ders. Art. — Abb. 76. Stirn von vorn von *Pammene splendidulana*. — Abb. 77. D der Bre und Kre am Hlb 4 und D am Hlb 10 (Längsschnitt, schematisch). — Abb. 78. Ende des Hlb von oben. — Abb. 79. Spitze des Vfl. — Abb. 80. Ende des Hlb von der Seite von ders. Art. — Abb. 81. D der Bre und Kre am Hlb 4 und D am Hlb 10 (Längsschnitt, schematisch) von *Pammene albuginana*.

skulpturiert. Stirn breit, flach abgerundet. Zunge 2 × länger als die Ul (Abb. 71). Spitze der Vfl vorgezogen, darunter stark konkav (Abb. 72). Hbr. zu kaum $^1/_2$ breit abgerundet ausgeschnitten (Abb. 75). Ll breit oval. Hlb 1: Index = 3,0. Dornen am Hlb im allgemeinen klein, bleich, kurz, breit und stumpf. Am Hlb 2 insbes. die Bre verkümmert. Am Hlb 3—7 die Bre wenigstens dreifach, ane Hlb 3-6 die D der Kre wenig kleiner als die der Bre und etwas kammartig, am Hlb 7 deutlich, aber klein. A am Hlb 9 rückgebildet, am Hlb 10 rd. 10 D, rel. schwach. Ende des Hlb von oben an abgerundet, von der Seite ziemlich spitzig mit 4 Eh und 2 Paar von Peh (Abb. 73, 74).

Die Raupe lebt in der Rinde von *Crataegus*, verpuppt sich wohl daselbst.

4. *Pammene splendidulana* (Guenée, 1845)

P 5,5—6,5 × 1,6—2 mm (4 P), braun, Exuvie gelbbraun, fein skulpturiert, mässig glänzend. Stirn abgerundet, nicht hervortretend (Abb. 76). Zunge um $^3/_4$ länger als die Ul. Hbr mehr als zu $^1/_2$ winkelig ausgeschnitten. Vfl unter der Spitze wenig konkav (Abb. 79). Ll breit oval. Hlb 1: Index = 2,8—3. Hlb 2—10 mit D, am Hlb 2—6 2 Dornreihen, die Bre doppelt (Abb. 77), die Kre einfach, kammartig. Am Hlb 7 nur eine Reihe von D, meist einfach. Am Hlb 9 wenige oder fehlende D, am Hlb 10 4—6 dünne, steile D. Ende des Hlb abgerundet mit 4 Eh und 2 Paar von Peh (Abb. 78, 80).

Die Raupe zwischen versponnenen Blättern der Eichen. Kokon in der Rinde, morschem Holz oder in den Eichengallen.

5. *Pammene albuginana* (Guenée, 1845)

P 6,5—8 × 1,7—2 mm (4 P), rötlich braun, Exuvie rötl. gelbbraun. Stirn wie bei *P. splendidulana*. Zunge um $^1/_3$ länger als die Ul. Vfl. unter der Spitze deutlich konkav (Abb. 83). Hbr zu mehr als $^1/_2$ mässig abgerundet ausgeschnitten. Ll oval. Dornreihen ähnlich wie bei *P. splendidulana*, die Bre am Hlb 3—6 aber dreifach (Abb. 81), am Hlb 8 die D schräger, am Hlb 10 spärlich, zuweilen mit nur 3 D. Ende des Hlb rel. stumpf mit 4 Eh und 2 Paar von Peh (Abb. 82, 84).

Die Raupe lebt in Gallwespengallen an Eichen, Kokon wie bei der vorigen.

6. *Pammene argyrana* (Hübner, 1796—1799)

P 5—6 × 1,2—1,5 mm (3 P), den vorigen ähnlich. Am Hlb 3—6 die Bre der D doppelt, D der Kre rel. schwach. Am Hlb 7 nur eine Dornreihe, D am Hlb 10 schwach.

Die Raupe lebt und verpuppt sich wie die vorige.

7. *Pammene inquilana* Fletcher, 1938

P der von *P. albuginana* ähnlich (2 ♂), mehr gelbbraun, Stirn jedoch stärker vor die Wurzel der F vorgewölbt (vgl. Abb. 105). Die Bre der D am Hlb 3—6 manchmal nur 2-fach. Hlb 7—10 mit nur einer Dornreihe. D, Eh und Peh am Hlb 10 auffallend stark.

Die Raupe lebt und verpuppt sich wie die vorigen.

8. *Pammene fasciana* (Linnaeus, 1761)

P 7—8 × 1,8—2 mm (3 P), hellbraun, Exuvie dünnwandig hell braungelb, Stirn abgerundet, nicht hervortretend, breit (vgl. Abb. 76). Zunge um $^3/_4$ länger als die Ul. Hbr kaum zu $^1/_2$ ausgeschnitten. Hlb 2—7: zwei —, 8—10: eine

Dornreihe. Am Hlb 2 die D bereits rel. stark, an mittleren Ringen die Bre dreifach. Hlb 9 mit dünnen, winzigen, Hlb 10 auch mit dünnen aber starken D (Abb. 85).

Die Raupe lebt in Eicheln, Edelkastanien un Bucheckern. Verpuppung wie bei den vorigen.

9. *Pammene regiana* (Zeller, 1849)

P 7,8 × 2,3 mm (1 ♀), rel. gedrungen, rotbraun, Kopf oben dunkler, Exuvie hell rotbraun. Skulptur fein. mässig glänzend. Stirn oben fein rugulos, vor die Wurzed der F kaum hervortretend, abgerundet. Zunge um $^{3}/_{4}$ länger als die Ul. Vfl unter der Spitze kaum konkav (Abb. 89). Hbr zu $^{1}/_{2}$ schwach abgerundet ausgeschnitten. Ll breit oval, hervortretend. Hlb 1: Index = 3,2. D denen bei der vorigen Art ähnlich, am Hlb 2 bereits stark. Die Bre der mittleren Ringe dreifach (Abb. 87), am Hlb 7 1—2-fach, dort auch eine deutliche Kre, die aber nicht mehr kammartig ist. D am Hlb 9 rel. stark, am Hlb 10 stark und dicht (8 D), (Abb. 87, 88, 90).

Die Raupe lebt in Ahornfrüchten, Kokon unter Rindenschuppen.

10. *Pammene ochsenheimeriana* (Lienig et Zeller, 1846)

P (vgl. Patočka, 1957, Patočka et al., 1960) 4.6—5 × 1,2—1,4 mm (7 P), braun, Exuvie dünn, bräunlichgelb, mässig glänzend, am Hlb fein zellenartig skulpturiert. Stirn mit einem konischen, am Ende rugulosen Ausläufer (Abb. 91). Zunge fast 2 × länger als die Ol. Spitze der Vfl. vorgezogen, darunter stark konkav (Abb. 92). Hbr zu mehr als $^{1}/_{2}$ fast rechtwinklig ausgeschnitten. Ll klein, breit oval. D am Hlb 2 sehr klein, am Hlb 3—6 die der Bre mehrfach (5—6-fach, Abb. 95), breite Bänder bildend, die der Kre einfach, sehr fein, am Hlb 7 die Kre fehlend. Am Hlb 9 die D fein und dünn, am Hlb 10 auch klein, selten fehlend. Mit 6 Eh und 2 Paar Peh. Ende des Hlb von oben an abgestutzt (Abb. 93. 96).

Die Raupe in abgestorbenen Knospen bezw. in absterbenden Zweigen der Tanne und in *Sacchiphantes* — Gallen an Fichten. Verpuppung daselbst.

11. *Pammene amygdalana* Duponchel. 1843

P 7,3—7,8 × 2,2—2,6 mm (5 P), braun, Exuvie braungelb, mässig glänzend. Stirn stark kegelförmig vorgezogen (Abb. 97), am Ende rugulos. Vfl. stumpf, unter der Spitze konkav (Abb. 98). Zunge nur um $^{1}/_{4}$ länger als die Ul. Hbr zu $^{1}/_{2}$ breit abgerundet ausgeschnitten (Abb. 100). Ll fast kreisförmig. Hlb 1: Index = 2,8—3,2. D mittelstark. Am Hlb 2—6 die Kre der D vorhanden, am Hlb 7 fehlend. Am Hlb 2 die D der Bre klein, am Hlb 3—6 rel. schräg und viel grösser als die der Kre (Abb. 101). Die Bre überall einreihig. Am Hlb 4 gibt es zwischen den Rbt 9—10 D der Bre und 28—32 D Kre. D am Hlb 9 dünn und rel stark, am Hlb 10 stark und steil (Abb. 99, 101). Ende des Hlb rel. stumpf mit 4 Eh und 2 Paar von Peh (Abb. 99, 102).

Die Raupe in Eichengallen, Verpuppung meist auch daselbst.

12. *Pammene rhediella* (Clerck, 1759)

P 5,7 × 1,4 mm (1 ♂), gelbbraun. Exuvie bleicher, glänzend. Stirn flach abgerundet. Zunge rd. 2 × länger als die Ol. Vfl. unter der Spitze deutlich konkav. Hbr zu $^{1}/_{2}$ breit winkelartig ausgeschnitten. Ll oval, klein, erhaben. Hlb 1: Index = 2,6. Bre der D mehrfach — auch an den letzten Ringen, Kre am Hlb 2—7

einfach, ihre D kaum kleiner als die der Bre. am Hlb 3—6 ist 5—6-fach. Ende des Hlb stumpf abgerundet, mit 4 Eh und nur 1 Paar von Peh (Abb. 103, 104).
Die Raupe in Früchten von *Crataegus* u. a., Kokon meist am Stamm.

Gattung *Strophedra* Herrich-Schäffer, 1854

Diese Gattung kann man durch Puppenmerkmale gut charakterisieren: Ll an breiten, scheibenförmigen Flächen. Stirn abgerundet, aber vor die Wurzel der **F** hervortretend. Bre der D einfach. Hlb 10 kurz, ohne Kr, mit 6 Eh und 2 Paar von Peh.

1. *Strophedra weirana* (Douglas, 1850)

P (20 P) 4—5 × 1.2—1,5 mm. braun, Exuvie gelbbraun. mässig glänzend. Stirn schwach vorgezogen (Abb. 105). Zunge um $^3/_4$ länger als die Ul, Vfl. spitzig (Abb. 107), Hbr zu mehr als $^1/_2$ abgerundet ausgeschnitten. Ll an scheibenförmigen Flächen (Abb. 106). Hlb 1: Index = 2,7—2,9. D am Hlb rel. stark, am Hlb 2 rel. gross (Abb. 111) Bre überall einfach, Kre kommt an Hlb 2—7 vor, am Hlb 7 rel.stark. Am Hlb 4 die D der Bre deutlich grösser als die der Kre (Abb.111). zwischen den Rbt gibt es dort 5—7 D der Bre und 11—13 D der Kre. D am Hlb 9 und 10 stark und dünn, am Hlb 10 meist 4—6 D. Ende des Hlb abgestumpft mit 6 Eh und 2 Paar von Peh (Abb. 108, 109).
Die Raupe zwischen versponnenen Blättern der Buche, Kokon daselbst.

2. *Strophedra nitidana* (Fabricius, 1794)

P (1 ♂, 1 ♀) der von *S. weirana ahnlich*, Vfl. aber meist stumpfer (Abb. 110), die D deutlich kleiner, insbes am Hlb 2—3 klein, ± verkümmert (Abb. 112).
Die Raupe an Eichen, lebt und verpuppt sich wie die vorige.

Gattung *Eucosmomorpha* Obraztsov, 1951

Stirn deutlich vor die Wurzel der F vorgezogen, Hlb 10 mit D, Kr deutlich, abgeflacht. ohne Zähne. 8 Eh vorhanden, Peh fehlen.

1. *Eucosmomorpha albersana* (Hübner, 1811—1813)

P 5—6 × 1,4—1,8 mm (4 P), Hlb nach hinten stark verjüngt, Färbung rötlich braun, Exuvie gelbbraun, glänzend, fein skulpturiert. Stirn vorgezogen (Abb. 115). Zunge fast 2 × langer als die O1, Vfl unter der Spitze deutlich konkav. Hbr fast zu $^1/_2$abgerundet ausgeschnitten mit Leisten. Ll oval. D am Hlb 2 bereits stark, Bre uberall einfach, die Kre am Hlb 2—7, ihre D kleiner als die der Bre. Am Hlb4gibt es zwischen den Rbt 4—5 D der Bre und 18—20 denen Kre. D an letzten Ringen rel. klein. Kr entwickelt, von oben breiter als lang (Abb. 114), dorsoventral abgeflacht (Abb. 116), 4 Eh am Hlb 10 und 4 am Kr (Abb. 114).
Die Raupe zwischen Blättern von Lonicera und Symphoricarpus, Verpuppung in einem Kokon daselbst oder am Boden.

Gattung *Enarmonia* Hübner, 1826

Stirn erhaben. Dornreihen einfach, Hlb 10 ohne D, aber mit Kr und 8 Eh.

1. *Enarmonia formosana* (Scopoli, 1763)

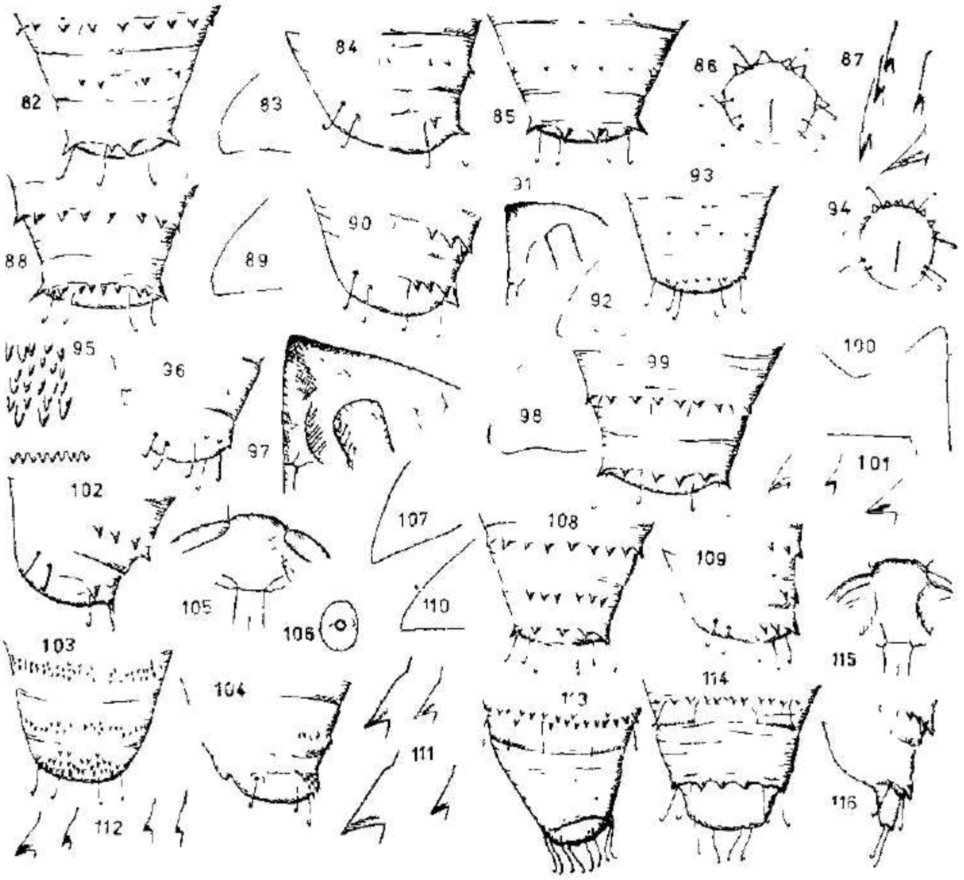

Abb. 82. Ende des Hlb von oben von *Pammene albuginana.* – Abb. 83. Spitze des Vfl. – Abb. 84. Ende des Hlb von der Seite von ders. Art. – Abb. 85. Ende des Hlb von oben von *Pammene fasciana.* – Abb. 86. Ende des Hlb von hinten von *Cydia molesta* (nach Baker). – Abb. 87. D der Bre und Kre am Hlb 4 und D am Hlb 10 (Längsschnitt, schematisch) von *Pammene regiana.* – Abb. 88. Ende des Hlb. – Abb. 89. Spitze des Vfl. – Abb. 90. Ende des Hlb von der Seite von ders. Art. – Abb. 91. Stirn von der Seite von *Pammene ochsenheimeriana* Abb. 93. Ende des Hlb von oben von ders. Art. – Abb. 94. Ende des Hlb von hinten von *Cydia funebrana* (nach Baker). – Abb. 95. Bre und Kre von D am Hlb 4 von *Pammene ochsenheimeriana.* – Abb 96. Ende des Hlb von der Seite von ders. Art. – Abb. 97. Stirn von der Seite von *Pammene amygdalana.* – Abb. 98 Spitze des Vfl. – Abb. 99. Ende des Hlb von oben. – Abb. 100. Hbr. – Abb. 101. D der Bre und Kre von Hlb 4 und D am Hlb 10. – Abb. 102. Ende des Hlb von der Seite von *Pammene amygdalana.* – Abb. 103. Ende des Hlb von *Pammene rhediella.* – Abb. 104. Ende des Hlb von der Seite von ders. Art. – Abb. 105. Stirn von *Strophedra weirana* von vorn. – Abb. 106. Scheibenartige Platte mit Luftloch, Abb. 107. Spitze des Vfl. – Abb. 108. Ende des Hlb von oben. – Abb. 109. Ende des Hlb von der Seite von ders. Art. – Abb. 110. Spitze des Vfl. von *Strophedra nitidana.* – Abb. 111. D der Bre und Kre am Hlb 2 (oben) und Hlb 4 (unten – Längsschnitt, schematisch) von *Strophedra weirana.* – Abb. 112. D der Bre und Kre von Hlb 4 (links) und Hlb 2 (rechts) von *Strophedra nitidana.* – Abb. 113. Ende des Hlb von oben von *Enarmonia formosana* (Nach Speyer). – Abb. 114. Ende des Hlb von oben von *Eucosmomorpha albersana.* – Abb. 115. Stirn von vorn. – Abb. 116. Ende des Hlb von der Seite von ders. Art.

P (nach Šämal, 1926, Speyer, 1958) 7—8,5 × 2—2,8 mm, braun, Hlb zum Ende verjüngt, Stirn vorgezogen. Hlb 2—9 mit D, die Bre einfach. Hlb 10 dornlos, rel. rauh, Kr. deutlich, kurz, abgeflacht, am verjüngten Ende 2 × eingebuchtet. Am Hlb 10 gibt es 4, am Kr auch 4 Eh (Abb. 113).

Bemerkung: Šamal (1926) beschreibt und abbildet offensichtlich die P von *Exapate congelatella* (Clerck, 1759) anstatt deren von dieser Art.

Die Raupe bohrt in der Rinde und im Bast von Kirschen, Aprikosen und anderen Obstbäumen, Verpuppung daselbst.

DISKUSSION

Bei den Puppen von *Grapholitini* gibt es mehrere Merkmale, die mit dem Übergang von einem leichten Kokon am Frassort zu einem festen Erdkokon in Zusammenhang sind und über eine höhere Spezialisierung der Puppe zeugen. U. a. sind es die dünnere Puppenhaut, die konisch vorgezogene Stirn zum Durchbrechen des festen Kokones, die Differenzierung und Reduktion der Häkchen, sekundäre Reduktion des Kremasters usw. Dagegen sind die mehrfachen Dornreihen wohl als primitives Merkmal zu betrachten, da sie sonst bei altertümlichen Familien wie Incurvariidae und Apodidae vorkommen.

Über die Puppentaxonomie hinsichtlich des modernen Systems dieser Gruppe ist folgendes zu sagen: Die Abtrennung der Arten *albersana* und *formosana* in besondere Gattungen ist voll berechtigt, darüber hinaus ihr Eindruck in dieser Tribus ist ziemlich fremdartig, da sie in mehreren Punkten an Eucosmini erinnern. Die Abtrennung der Gattung *Strophedra* scheint ebenfalls berechtigt zu sein. Die beiden grossen Gattungen *Cydia und Pammene* bieten einen mehr heterogenen Eindruck: so bilden bei der ersteren die Arten *splendana, amplana, fagiglandana* und *pyrivora* eine spezialisierte Gruppe, andere Arten wie *pomonella, coniferana, duplicana* scheinen mehr primitiv zu sein, insbesondere aber die *janthinana*, welche offensichtliche Beziehungen zur Gattung *Pammene* aufweist. Die Einreihung der Art *inquinatana* in die Gattung *Cydia* ist wohl berechtigt, sie steht aber trotzdem etwas isoliert, ähnlich auch die Arten *illutana, corollana* und *servillana*. Die puppentaxonomischen Gruppen entsprechen im Rahmen der Gattung *Cydia* ziemlich den bionomischen.

In der Gattung *Pammene* stehen die Arten *spiniana* und *populana* isoliert mit Beziehungen zu *Cydia*. Die *rhediella* besitzt als wohl die primitivste Art auch eine Sonderstellung. Die die Eichengallen bewohnenden Arten *albuginana, argyrana* und *inquilana* stehen einander nahe, die *amygdalana* weicht davon aber stark ab (als eine mehr spezialisierte Art). Es knüpfen daran dagegen die samenbewohnenden *fasciana* und *regiana*, die rindenbewohnende *agnotana* und die exophage splendidulana an. Die *ochsenheimeriana* is wiederum mehr spezialisiert und steht von den anderen ziemlich isoliert.

ZUSAMMENFASSUNG

Die vorliegende Arbeit bringt Diagnose und Unterscheidungscharakteristik der Tribus Grapholitini, Bestimmungstabelle der dendrophilen Arten dieser Tribus von Mitteleuropa und deren Diagnosen auf Grund der Puppenmerkmale. Es werden ferner Einflüsse des Kokonbaues auf den Puppenbau und das moderne System dieser Gruppe vom Gesichtspunkte der Puppentaxonomie diskutiert. Die neu aufgestellten Gattungen *Eucosmomorpha, Enarmonia* und *Strophedra* haben sich in dieser Weise als voll berechtigt gezeigt, während die grossen Gattungen *Cydia* und *Pammene* einen weniger einheitlichen Eindruck äussern.

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FOOD AND FEEDING OF THE LESSER BANDICOOT RAT BANDICOTA BENGALENSIS (MAMMALIA: RODENTIA)

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Abstract: The lesser bandicoot rat *Bandicota bengalensis* (Gray) is a serious rodent pest in India which lives in field crops as well as in residential premises. The studies on feeding behaviour have been conducted in order to prepare suitable bait for the control of this species. Food preferences and feeding on whole grains are described with different factors. The order of preference among whole cereals offered was found to be as sorghum $\geqq$ millet or rice > wheat > maize. Cereal flour was markedly preferred to the whole forms. The rats specially exhibited preference for the foods mixed with cottonseed oil or cane-sugar. The factors like texture, taste or nutritional value were found to influence their food choice. The daily food consumptions were found to be equal to 4 to 7% of the body weight of the individual.

The Indian mole rat *Bandicota bengalensis* (Gray) is considered to be one of the most voracious feeders among rodent species. Due to the 'omnivory' habit (Kamal and Khan 1977) they cause extensive losses or spoilages to all kinds of agricultural produce quantitatively or qualitatively. They mostly feed on variety of materials like paddy stem and grains, rhizome of grasses, green vegetation, snails and crabs etc., available in fields (Srivastava 1968 and Anonymous 1970).

As they are seemed to be serious pests of croplands in Punjab, the studies on feeding pattern of this species have been conducted in order to prepare suitable poison baits for their control. The present findings describe the food preferences and feeding on whole cereals of this species in laboratory conditions.

MATERIAL AND METHODS

The individuals were collected from sugarcane fields by cage-trapping. They were brought to the Rodent Laboratory in collection cages and were isolated in live traps of the size 50 × 24 × 19 cm each. The animals were kept under seven days laboratory acclimatisation with adlibitum food and water. Ten healthy individuals (five males and five females) were selected for the experiment.

The food stuffs tested were most common cereals of Punjab — whole grains of sorghum (*Sorghum vulgare*), pearl millet (*Pennisetum typhoideum*), rice (*Oryza sativa*) and paddy (rice with husk), wheat (*Triticum aestivum*) and maize (*Zea mays*) and a cereal flour (maize, unextracted). Gingelly oil (of *Sesamum indicum*) and cottonseed oil (of *Gossypium* species) were separately tested by adding them to whole cereals in 0.8% and 1% concentrations respectively and cane-sugar was tested in 25% cereal mixture (maize flour).

Two kinds of food stuffs were offered in each combination in separate food cups at a time to the individual. Water was provided enough at all times in small glass troughs. Each test was maintained for a minimum period of five days. Individuals were weighed in each test to the nearest 1.0 g. level. Daily individual food intakes were recorded to the nearest 0.05 g after collection and manual separation of spillage.

The combinations offered were whole cereals of sorghum and millet, sorghum and rice, sorghum and wheat ,sorghum and maize, millet and rice, millet and wheat, millet and maize, rice and wheat, rice and maize, paddy and maize and wheat and maize. In addition unextracted maize flour was tested with the combination of whole forms of maize and sorghum separately. The oily and sweet foods were tested separately alongwith the plain alternatives. Feeding on whole cereals and the analysis of various factors affecting their food preferences were described fully in the paper.

Protein, fat and calorific values of various food stuffs were read from Aykroyd Manuals (1941 & 1966). Students' 't' test (Bailey 1959) was applied to test the significance of preferences observed.

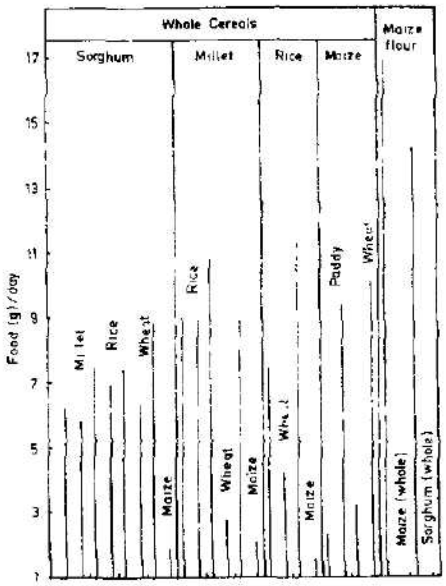

Fig. 1. Mean daily consumptions of whole cereals and cereal flour tested in combinations of two at a time.

RESULTS

The results were summarized in Tables 1 & 2 and Figures 1—6.

Whole cereals:

Equal preferences were observed when sorghum was tested with millet and rice separately (Table 1, Fig. 1). But sorghum was markedly preferred over both wheat and maize (Table I, Fig. 1). Rice and millet were eaten in equal amounts, when offered (Table 1, Fig. 1). However, millet was markedly preferred to both wheat and maize. In the choice of rice and wheat, rice was preferred significantly. Maize was not preferred overall (Table 1).

Cereals and cereal flour:

Maize flour was preferred over both the whole forms of maize and sorghum (Table 1, Fig. 1).

Sweet and oily foods:

The mixtures of cottonseed oil and cane sugar were significantly consumed over the plain alternatives (Table 2).

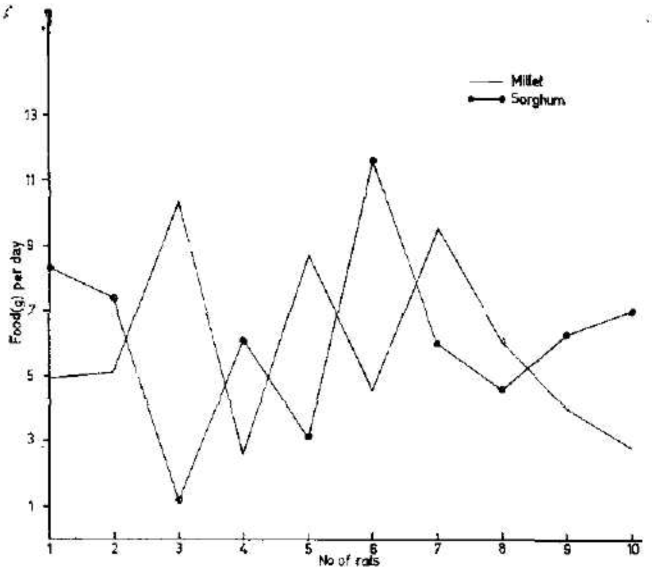

Fig. 2. Mean daily food intakes of rats when preferred foods are offered at a time.

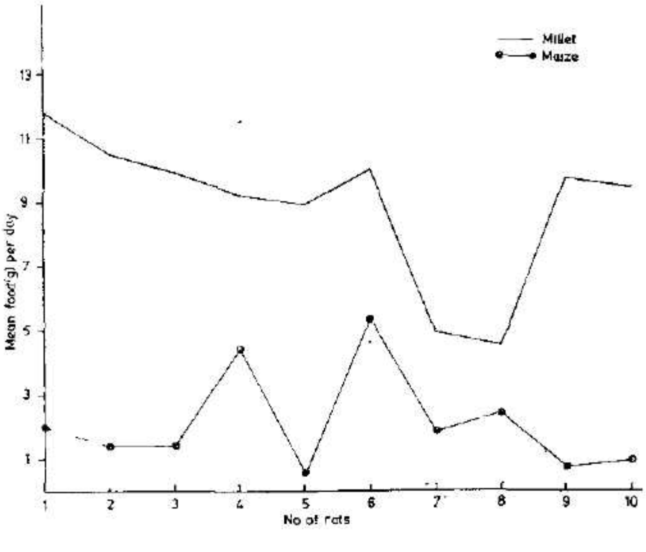

Fig. 3. Sampling of the least preferred food (maize) by rats when offered with preferred food (millet).

Table 1. Relative intakes of whole cereals, tested in combinations of two at a time. The comparison of cereal flour with the whole forms is also given.

Test No.	Length of test (days)	Choice offerred	Ratio of mean daily intakes	Per 100 g body weight			
				Calories/day	Total consumption g/day	Total intake of protein g/day	Total intake of fat g/day
1	5	Sorghum; Millet	1 : 0.95*	8.7052; 8.3338	4.7667	0.5235	0.1624
2	5	Sorghum; Rice	1 : 0.92*	9.8797; 8.3675	5.3198	0.4794	0.0628
3	5	Sorghum; Wheat	1 : 0.85**	9.6639; 7.9353	5.0147	0.5537	0.0860
4	5	Sorghum; Maize	1 : 0.21	11.3661; 2.4444	4.0488	0.4260	0.0890
5	5	Millet; Rice	1 : 0.99*	11.3788; 10.9449	6.3103	0.6031	0.1709
6	5	Millet; Wheat	1 : 0.25	14.8748; 3.5183	5.1632	0.6009	0.2223
7	5	Millet; Maize	1 : 0.23	11.8154; 2.6299	4.0611	0.4671	0.1922
8	5	Rice; Wheat	1 : 0.57	9.9325; 5.5931	4.4714	0.4050	0.0357
9	5	Rice; Maize	1 : 0.13	16.8011; 2.1667	5.4553	0.4319	0.0420
10	7	Paddy; Maize	1 : 0.26	13.5799; 3.4344	4.9022	0.3803	0.0516
11	5	Wheat; Maize	1 : 0.32	12.7836; 4.0305	4.8853	0.5681	0.0979
12	5	Maize flour; Maize (whole)	1 : 0.05	25.0591; 1.2915	7.4172	0.841	0.0487
13	5	Maize flour; Sorghum (whole)	1 : 0.08	20.3610; 1.5525	6.1556	0.0796	0.0367

* $P > 0.05$ ** $P > 0.05$ but $P < 0.2$

Table 2. Relative intakes of sweet and oily foods when compared with plain foods.

Test No.	Length of test (days)	Choice offerred	Ratio of mean daily intakes (plain: sweet/ oily foods)	Per 100 g body weight			
				Calories/day	Total consumption g/day	Total intake of protein g/day	Total intake of fat g/day
14	5	Whole wheat; Whole wheat + Cottonseed oil	1 : 3.1351	5.3509; 16.7763	6.4137	0.7568	0.0962
15	5	Whole wheat; Whole wheat + Gingelly oil	1 : 0.8562*	9.8952; 8.4725	5.3241	0.6282	0.0798
16	6	Maize flour; Maize flour + Cane sugar	1 : 15.4326	1.1523; 18.1483	5.3198	—	—

* $P > 0.05$

Daily food intake:

Cereal flour and sweet foods were eaten in greater amounts than the whole cereals or oily foods. The total daily consumption was varied from 4.05 g to 7.42 g/100 g. body weight/day according to the various foods offered. The mean daily intake was 4.9453 ± 0.1945 g/100 g. body weight for the whole cereal combinations and 5.3143 ± 0.2235 g/100 g body weight for various foods offered.

Calorie intake was varied from 14.3105 to 26.8693 cal./100 g. body weight/day. The daily calorie intake was 18.7048 ± 0.7933 cal./100 g. body weight for various foods offered. The total mean protein and fat intakes were 0.4658 ± 0.0476 and 0.0988 ± 0.0152 g/100 g. body weight/day respectively.

Feeding on whole cereals:

The rats mostly preferred germ portions of the grains. Plate I, Figs. 4, 5 illustrate the 'roughage' containing seed coats and germ eaten grains of maize and wheat respectively.

As soon as the food cup was placed, few individuals tilted it (Plate II, Fig. 6) so as to scatter the grains on cage floor and started eating. Smaller and rounded grains like millet were taken into mouth directly by burying their noses into food cups. Maize and wheat grains were holded firmly between both the forepaws. Wheat grain was seized with the longitudinal axis of the grain positioned at right angles to individual's body length. The germ portion of the grain was directed towards mouth and the ventral groove 'crease' positioned away from the body side. Maize grain was seized between forepaws with the germ portion upwards. It followed the activities like nibbling and swallowing etc.

DISCUSSION

Versatile feeding or omnivory (Fig. 2) is well examplified by the tests of sorghum and millet, sorghum and rice, millet and rice where equal preferences observed (Table 1, Fig. 1). Supplementation of diet (Kamal and Khan 1977) is found in the tests of sorghum, millet and rice combinations with wheat where the less preferred food is consumed in copious amounts (Table 1, Fig. 1). 'Sampling' is clearly pronounced in the tests of whole maize combinations where inferior foods are consumed in negligible amounts (Table 1, Fig. 3). It has survival value (Barnett & Prakash 1975) with which the individual has been abled to select favourable foods and to avoid toxic foods (Armour & Barnett 1950 and Cowan 1976). The possibility of enhancing bait acceptance is revealed by the tests o6 sweet foods and cereal flours where total daily consumptions are found to be markedly increased (Table 1 & 2, Fig. 1).

Order of preference:

The bandicoot rats do not select food in a linear preferential order (Harrison and Woodwille 1950, Spillet 1968 and Kamal & Khan 1977). It has also been supported by the present tests which have shown versatile feeding nature. Sorghum and millet are equally preferred and again the both are equally preferred to rice (Table 1, Fig. 1). However, the order of preference among whole cereals is found to be as sorghum ⋛ millet or rice > wheat > maize.

Analysis of factors affecting food preferences:

The rats are observed to have varied response to various foods offered. This variation is mainly due to the effects of various factors such as physical — texture and size and physiological factors — taste and nutritive values. In addition few factors relating to feeding behaviour of the rats are also described.

Texture:

Even minor variations in texture are clearly demonstrated in the black rats *Rattus rattus* L. (Khan 1974). Brown rats prefer finely divided foods (Barnett & Spencer 1953) but equivocal choices in similar situations are also observed in black rats (Chitre & Deoras 1966, Spillet 1968). The present study demonstrates that soft and finely divided foods are preferred to harder and coarser ones as in brown rats (Barnett 1963). Thus cereal flour is preferred over whole cereals (Table 1). Sorghum or millet are preferred food among whole cereals (Table 1, Fig. 1). Whole maize is rejected due to its hardness.

Size:

It has been observed that small and rounded grains like sorghum and millet are preferred among whole cereals as the grains are easily taken into mouth either by handling or by directly poking the noses into foods. However, the effect of this factor is not clear and is appearing to be supplementary one.

Taste:

The effect of taste immediately influences the choice as it has direct action on gustatory organs. The rats showed marked liking to the foods mixed with cottonseed oil or cane-sugar (Table 2).

Among the whole cereals, sorghum is markedly consumed due to its softness. But with the combination of maize flour sorghum is almost rejected (Table 1). Here the combined effect of texture and taste seems to be played an important role. Thus maize flour is consumed markedly due to its softness and taste leading to the total rejection of sorghum. Whole maize is totally rejected but it is consumed in greater amounts when it is in the form of flour. Here the effect of taste is masked by texture. So it is observed to be as texture > taste.

Nutritional value:

Wild rats prefer foods of high nutritional value (Harrison & Woodville 1950, Barnett & Spencer 1953). It has been clearly demonstrated by our tests that the rats show their preference to high nutritive foods in various choices. Sorghum and millet have been preferred equally because of similarity in texture and nutritional values. In the choice of maize flour and sorgum, maize flour is preferred due to its texture and taste even though the components have similar nutritional value (Aykroyd 1941 & 1966). Thus it is observed that the rats prefer highly nutritive foods under the exception of texture.

Calorie intake is not steady in the individuals (Table 1 & 2) mainly due to the differences in food texture. In various choices whole maize is rejected due to the low calorific value and hardness. The daily protein and fat intakes are also varied (Table 1) due to the effect of texture. The mean total calorie intake is found to be 47.9026 ± 1.9 cal/rat/day with the mean body weight 256.7575 ± 19.78 g. for various foods offered.

Feeding experience and its factors:

Previous experience is, however, a behavioural attribute of serious import for such phenomenon as "cultural conditioning" (Barnett 1966, Jackson 1968). The effects of previous feeding experience is not well marked, as the individuals show quick responses to soft and sweet foods (Table II). This is well indicated in black rats (Khan 1974) by the acceptance of maize flour after regular feeding on millet flour and wholemeal. This may be due to 'omnivory' with which the rats fail to show linear preferential order.

Feeding on the grains in most convenient is well exhibited in the activities like tilting of the food cup and handling of the grains. The 'nibbling' process during eating is also appearing to play a supplementary role in food selection. Thus millet like grains and maize flour are preferred to wheat due to the absence of it. However this factor is no yet clear.

According to Pingale et al. (1967) the rat daily consumes 8% of its body weight. The daily food consumptions for various foods offered vary from 5% to 10% of the body weight (Kamal & Khan 1977). In our experiments it is found to be 4 to 7% of the body weight for various foods offered. The mean total daily intake is found to be 13.6022 ± 0.53 g/rat/day.

Acknowledgement

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Plates I and II will be found at the end of this issue.

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BEITRAG ZUR ERKENNUNG DER GATTUNG SALOCA (ARANEAE, MICRYPHANTIDAE)

Vlastimil RŮŽIČKA

Eingegangen am 2. April 1981

Abstrakt: Die bisher nicht veröffentlichten Beschreibungsangaben über *Saloca diceros* (O. P. Cbr., 1871) und *Saloca kulczynskii* Mill. et Krat., 1939, Differentialdiagnose der Weibchen und Angaben über die Verbreitung beider Arten sind angeführt.

In der Arbeit Chyzer, Kulczynskii (1894) is die Art *Panamomops diceros* angeführt. Miller und Kratochvíl wiesen auf einige Unterschiede in der Beschreibung dieser Art von der ursprünglichen Beschreibung (Cambridge. 1871) auf und der Vergleich mit dem Typenmaterial bestätigte eine neue Art, die *Saloca kulczynskii* benannt wurde. In der Beschreibung (Miller, Kratochvíl, 1939) sind jedoch nicht Differenzen zwischen den Weibchen der beiden Arten angegeben, die ihre Unterscheidung ermöglichen.

Männchen

Beine: Weder in den Massen der einzelnen Beinglieder, noch in der Stellung der Stacheln oder der Sinnesorgane bestehen zwischen beiden behandelten Arten wesentliche Unterschiede (Tab. 1).

Weibchen

Cheliceren: Beide Arten haben den vorderen Klauenfurchenrand mit sechs Zähnchen, der proximale ist etwas isoliert, der zweite ist der grösste. Der hintere Klauenfurchenrand weist fünf ungefähr gleich grosse Zähnchen auf.

Beine: Weder in den Massen der einzelnen Beinglieder, noch in der Stellung der Stacheln oder der Sinnesorgane gibt es zwischen beiden behandelsten Arten wesentliche Unterschiede (Tab. 1).

Epigyne: Unterschiede zwischen den Epigynen beider Arten sind nicht zu deutlich, das Aussehen der Epigyne ändert sich je nach dem aus welcher Richtung man die Epigyne ansieht. Betrachtet man senkrecht die Unterseite des Abdomens, sind die Ränder der Deckplatte der Epigyne *S. diceros* nach innen gebogen und in der ganzen Länge gut sichtbar (Abb. 1A). Die Ränder der Deckplatte der Epigyne *S. kulczynskii* sind mässig nach aussen gebogen. in ihrem unteren Teil durch die Wölbung der Deckplatte der Epigyne wenig deutlich (Abb. 1 B). Betrachten wir senkrecht die Deckplatte der Epigyne (d. h. schräg von hinten zur Bauchseite des Abdomenes hin) überwiegt bei S. diceros die Form der Epigyne mit den oben fast geraden Rändern der Deckplatte (Abb.

Tab. 1. Masse an den Beinen. Länge der einzelnen Glieder (mm), Gesammtlänge der Beine (mm), Stellung der Stacheln an der Tibia / relative Länge der Stacheln, Stellung der Bothriotrichia an dem Metatarsus, Lage des Tarsalorgans.

	Fe	Pt	Ti	Mt	Ta	Fe-Ta	Stacheln an Ti		Btr Mt	To
S. diceros — Männchen										
I	0,48	0,16	0,36	0,32	0,26	1,58	0,14/0,52	0,67/0,54	0,37	0,71
II	0,44	0,14	0,32	0,28	0,25	1,43	0,09/0,57	0,68/0,59	0,32	0,60
III	0,35	0,13	0,26	0,25	0,23	1,22	0,11/0,60	—	0,31	0,53
IV	0,49	0,14	0,41	0,32	0,25	1,61	0,15/0,66	—	—	0,49
S. kulczynskii — Männchen										
I	0,47	0,16	0,36	0,32	0,30	1,61	0,13/0,42	0,68/0,45	0,35	0,68
II	0,43	0,16	0,30	0,28	0,26	1,43	0,10/0,37	0,90/0,50	0,35	0,66
III	0,37	0,13	0,25	0,25	0,23	1,23	0,14/0,63	—	0,33	0,56
IV	0,48	0,15	0,41	0,33	0,26	1,63	0,18/0,67	—	—	0,54
S. disceros — Weibchen										
I	0,40	0,16	0,29	0,24	0,23	1,32	0,12/0,82	0,67/0,85	0,40	0,62
II	0,37	0,14	0,25	0,22	0,22	1,20	0,12/0,87	0,65/0,90	0,35	0,60
III	0,32	0,13	0,21	0,20	0,20	1,06	0,16/0,80	—	0,35	0,47
IV	0,43	0,13	0,35	0,25	0,22	1,38	0,17/0,91	—	—	0,46
S. kulczynski — Weibchen										
I	0,42	0,16	0,30	0,25	0,25	1,38	0,09/0,93	0,68/0,93	0,39	0,65
II	0,39	0,14	0,26	0,23	0,23	1,25	0,09/0,85	0,66/0,82	0,39	0,59
III	0,33	0,13	0,22	0,22	0,21	1,11	0,14/0,80	—	0,33	0,46
IV	0,45	0,15	0,36	0,26	0,23	1,45	0,11/1,00	—	—	0,45

1 C), bei *S. kulczynskii dagegen* die Form mit den oben stark ausgewölbten, gegeneinander gebogenen Randern der Deckplatte (Abb. 1 D). Die Übergangsform mit den gegeneinander massig gebogenen Randern der Deckplatte findet *man bei den beiden Arten* (Abb. 1 E).

Vulva: In dem Bau der Vulva gibt es zwischen beiden Arten einen Unterschied in der gesamten Form des Rezeptaculums. Bei *S. diceros* (Abb. 1 F) ist das Rezeptaculum an der inneren Seite ausgebeult, der Krümmungshalbmesser des vorderen Teiles ist offenbar kleiner als der des hinteren Teiles. Bei *S. kulczynskii* (Abb. 1 G) ist die Ausbeulung an der inneren Seite des Rezeptaculums nach vorn verschoben, so dass sie in den vorderen Teil des Rezeptaculums übergeht, das Rezeptaculum dehnt sich nach vorn almmählich aus. Der Krümmungshalbmesser des vorderen Teiles ist grösser als der des hinteren.

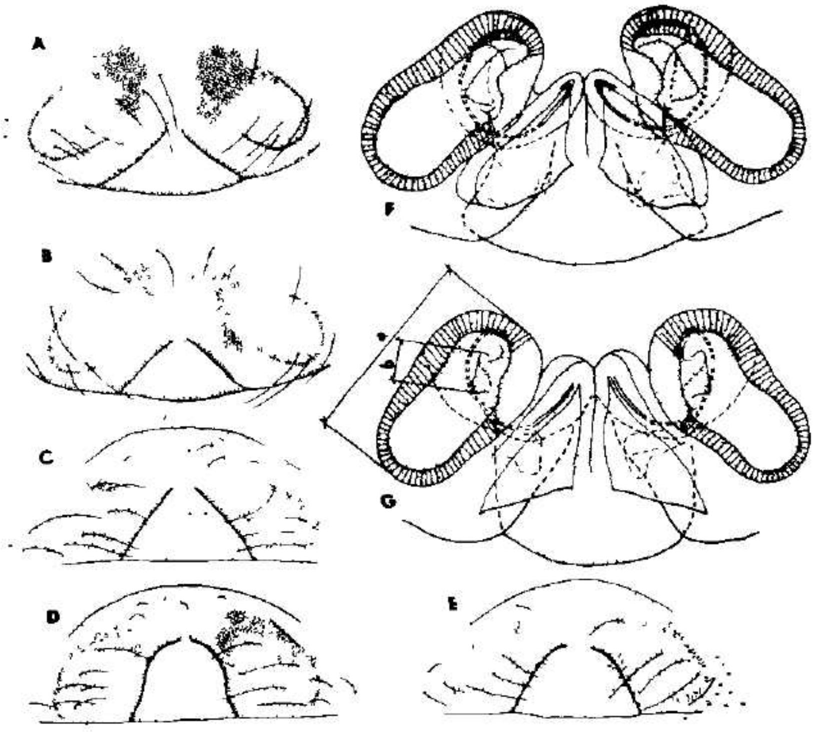

Abb. 1. Epigyne, Blick senkrecht zur Bauchseite des Abdomens: A — *S. diceros*, B — *S. kulczynskii*. Epigyne, Blick senkrecht zur Deckplatte der Epigyne: C — *S. diceros*, D — *S. kulczynskii*, E — die mögliche Form bei den beiden Arten. Vulva: F — *S. diceros*, G — *S. kulczynskii* (a — Länge des Rezeptakulums, b — Länge des inneren Ausläufers).

Verschieden ist die Grösse des inneren Langsausläufers der Wand des Rezeptaculums. Bei *S. diceros* ist dieser Ausläufer länger als bei *S. kulczynskii*. Die Länge des Ausläufers sowie des Rezeptaculums ist gut messbar (Abb. 1 G). Die berechneten Intervalle für das Verhaltnis dieser Langen x ± ts uberdecken sich, was jedoch durch die kleine Anzahl der gemessenen Exemplare verursacht werden kann. Bei *S. diceros* ist die Länge des Auslaufers zu der Länge des

Rezeptaculums im Verhältnis 0,31 ± 0,06 (gemessen an 10 Exemplaren), bei *S. kulczynskii* ist dieses Verhältnis 0,20 ± 0,12 (gemessen an 5 Exemplaren).

Bei *S. diceros* ist die Mundung des Befruchtungsgangs in der Wand des Rezeptaculums etwas eingelassen. Der unregelmässige Umriss des inneren Raumes des Rezeptaculums ist meistens auch durch die deutlichere Verstärkung der Wand des Rezeptaculums an der Basis des oben genannten Längesausläufers bedingt. Bei *S. kulczynskii* liegt die Mundung des Befruchtungsganges im verhältnismassig fliessenden inneren Umriss des Rezeptaculums.

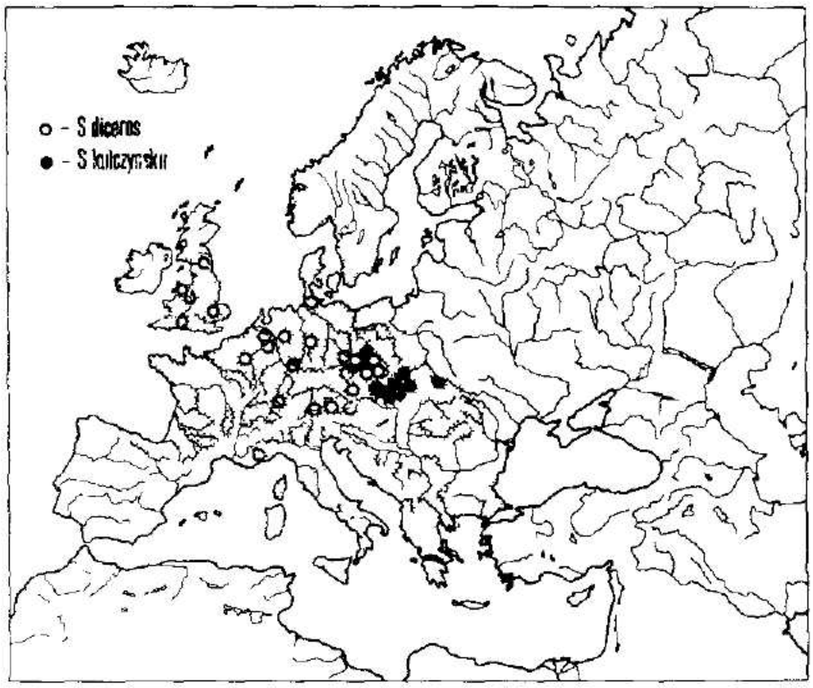

Abb. 2. Areal der Verbreitung der Arten *S. diceros* und *S. kulczynskii* in Europa. Mit den Punkten das Areal der Verbreitung der Buche *(Fagus silvatica)* bezeichnet. Nach verschiedenen Literaturangaben.

Diese Unterschiede im Bau der Vulva können sicher nicht absolut genommen gelten, die Form des Rezeptaculums kann sich auch durch das Zusammendrücken der Präparate verändern. In ihrem Komplex bieten sie jedoch die Möglichkeit, die meisten Exemplare zu determinieren.

Verbreitung

Die beiden genannten Arten der Gattung *Saloca* leben lediglich im Laub der Buchenwälder. Das Areal ihrer Verbreitung reicht deshalb nicht über die Verbreitung der Buche (*Fagus silvatica* L.) hinaus. im Gegenteil, es ist kleiner. Das Areal der Verbreitung beider Arten liegt ungefähr zwischen dem 43 und 55 Grad nördlicher Breite (Abb. 2). *Saloca diceros* ist im westlichen Teil Europas beheimatet, von England bis zum östlichen Rand des Böhmischen Massivs (Gebirge Hrubý Jeseník; Bergland Drahanská vrchovina — Miller, in verb.), und der österreichischen Alpen (Eisenerz — Franz, 1950). *Saloca kulczynskii* lebt im westlichen Teil des Karpatensystems am Gebiet Polens und der Tschechoslowakei. Der westlichste Fund von *S. kulczynskii* stammt nach Bednarz und Czajka (1968) aus Niederschlesien (Góra Kosciuszki im Sudetenvorgebirge).

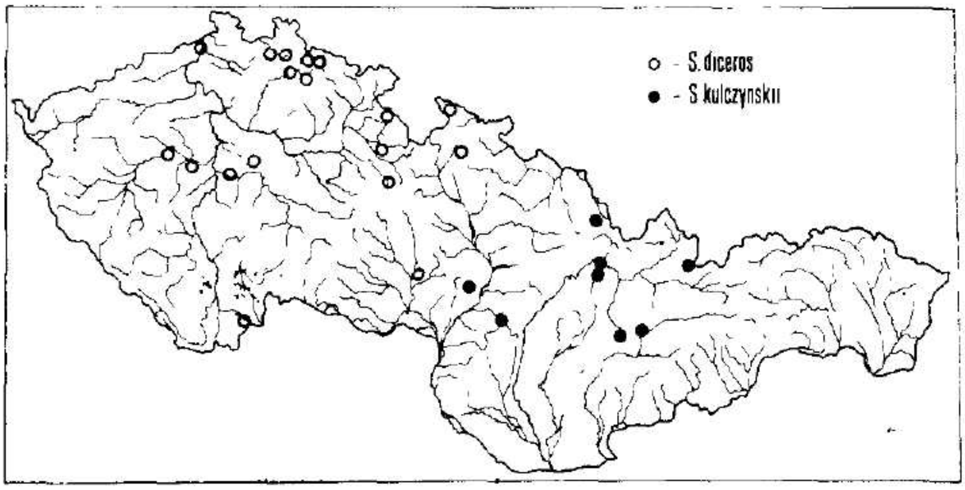

Abb. 3. Verbreitung der Arten *S. diceros* und *S. kulczynskii* in der Tschechoslowakei. Nach den Angaben des Prof. F. Miller, des Dozenten J. Buchar, des Herren M. Antuš und nach eigenen Angaben.

Zwei Männchen, die Bednarz und Czajka gefangen haben, unterscheiden sich jedoch von der ursprünglichen Beschreibung dadurch, dass sie an dem vorderen Rand des Cephalothorax nur zwei isolierte Borsten anstatt zweier Borstbündel haben. Dieser Fund ist bisher einzeln und erst die Vergleichung mit weiteren Funden wird ihre genaue Auswertung ermöglichen. Der östlichste Fund von *S. kulczynskii* stammt nach Pilawski (1965) aus dem polnischen Gebirge Biesczady.

Der wesentliche Grenzenteil zwischen den Arealen der Verbreitung beider Arten liegt auf dem Gebiet der Tschechoslowakei und ist mit der zoogeographischen Grenze zwischen dem Böhmisch-Mährischen Distrikt und dem Subkarpatendistrikt fast gleich (Mařan, 1958). Der südliche Teil dieser Grenze liegt offenbar in dem Talgrund zwischen dem Bergland Drahanská vrchovina und dem Bergland Chřiby. Der Abstand zwischen den Grenzfunden *S. diceros* (Ochoz u Brna — Miller, in verb.) und *S. kulczynskii* (der Hügel Holý kopec gegenüber der Burg Buchlov) beträgt nicht mehr als 45 km. In dem nördlichen Teil des Gebiets der Tschechoslowakei ist nicht möglich die Grenze der Verbreitung beider Arten so genau festzusetzen. Der östlichste Fund von *S. diceros* stammt aus dem Talkessel Velká kotlina im Gebirge Hrubý Jeseník, der westlichste Fund von *S. kulczynskii* stammt aus dem Naturschutzgebiet Mionší bei Dolní Lomná im Gebirge Moravskoslezské Beskydy. Der Abstand dieser zwei Funden Beträgt ungefähr 120 km.

Das Sammelaufwand sollte man auf das Gebiet zwischen den Gebirgen Hrubý Jeseník und Moravskoslezské Beskydy lenken. Bei *S. kulczynskii*, angesichts ihres Fundes in Unterschlesien, wäre es nötig, eine grössere Menge von Angaben zu haben, die eine genauere Festsetzung der Grenze ihrer Verbreitung ermöglichen könnte.

Danksagung

Ich danke herzlich Herrn Prof. F. Miller, Herrn Dozenten J. Buchar und Herrn M. Antuš für ihre Angaben über die Verbreitung der Arten *Saloca* in der Tschechoslowakei. Ich danke auch meinem Bruder Herrn F. Růžička für seine opferwillige Hilfe beim Sammeln des Materials.

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CRANOMETRIC ANALYSIS OF A CZECHOSLOVAK AND A POLISH POPULATION OF ERINACEUS CONCOLOR (MAMMALIA: ERINACEIDAE)

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Received February 19, 1981

Abstract: We measured 137 skulls of a Czechoslovak population of *E. concolor* from Bohemia and Moravia, and 70 skulls of a Polish population of this species, and compared 23 cranial characters and 4 indexes. All skulls were from adult animals. We also compared our results with literary data on other European populations of *E. concolor*. Skulls of animals from the Polish population were found to be generally bigger than those of *E. concolor* from Bohemia and Moravia. The t-test disclosed a highly significant difference ($P \leq 0.01$) for all cranial characters except postorbital width and width measurements of nasals, but the coefficient of difference (CD) did never attain the value of 1.28. It was found that small size differences in the structure of the skull among the two populations were responsible for a considerable reduction of the taxonomic values for several indexes. In values for cranial measurements, the Polish population differs more from the Czechoslovak population which lives close to it than from several distant populations of East- and SE-Europe which have been described by Markov (1957) and Ruprecht (1972), but in spite of these findings, it has to be allocated to the subspecies *E. c. roumanicus* (sensu Kratochvil 1974, 1980).

INTRODUCTION

Owing to doubts still existing on the correct taxonomic position of several European populations of *E. concolor* (Corbet 1970), numerous descriptions of different forms on the specific, subspecific level and even below it can be found in the literature. Frequently, these forms have been established on the basis of thier geographical distribution rather than on marked differences in their morphology. We have used as a starting point for our comparative study the statement emphasized by Kratochvíl (1966, 1974, 1980), namely that all populations of the eastern European hedgehog should be regarded as *E. concolor*.

The purpose of the present paper is to contribute to an understanding of the influence of an interpopulation variability on the usability of cranial indexes employed as diagnostic characters, and to establish a base upon which the two populations under study could be compared with other European populations of *E. concolor*. Since it has been inferred by Kratochvil (1980) that there is no reliable evidence of the common origin of the Polish and Czechoslovak population, and also that we do not know whether the Polish population had traversed the ranges of the Carpathian and Sudeten Mts. in northern direction or arrived at the north of the Carpathian Mts. from the East, any piece of information will be of utmost importance in an elucidation of these problems.

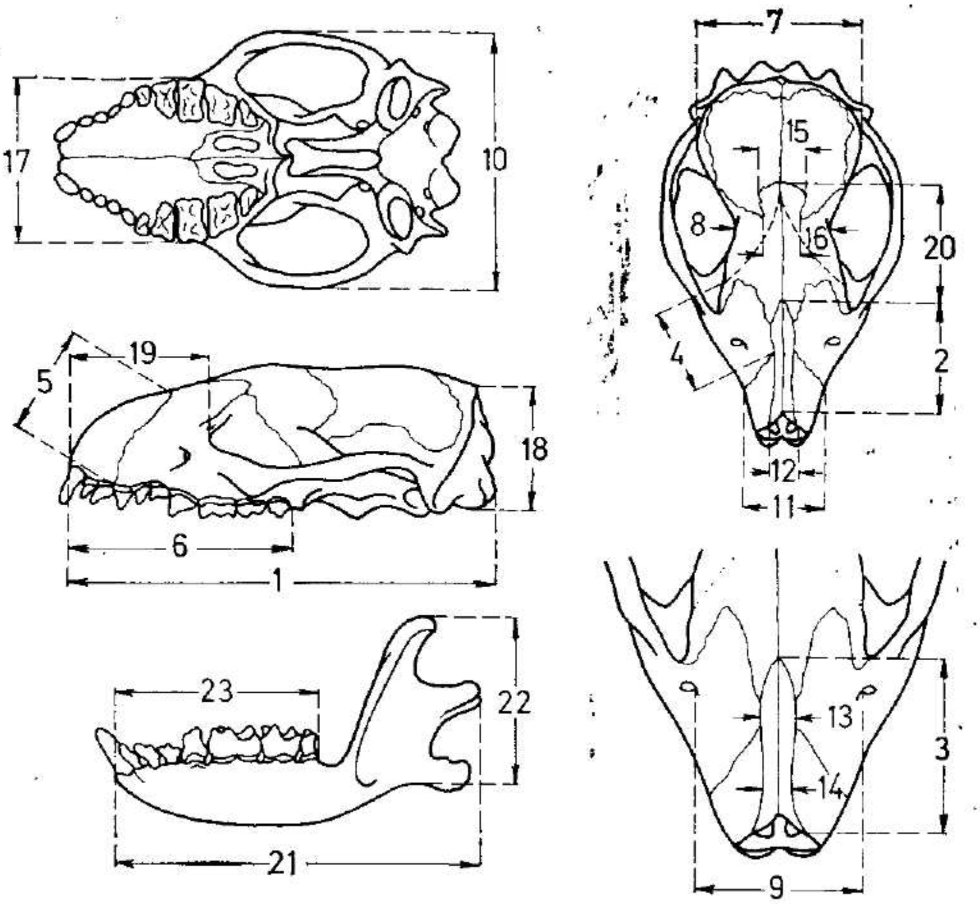

Fig. 1. Mode of measuring 23 cranial dimensions (see Table 1).

MATERIALS AND METHODS

We examined a total of 207 skulls of adult *E. concolor*, i. e. 137 skulls from Bohemian and Moravian specimens, 70 skulls of Polish specimens deposited in the collection of the Institute of Mammalian Research, Polish Academy of Sciences, Bialowieża, mainly animals from eastern and northeastern Poland. A major part of the collection consisted of animals trapped in the vicinity of Bialowieża and in the surroundings of Mokuszyn located in western White Russia. In view of the closeness of this locality to Poland and of similar climatic conditions (Walter and Leith 1960), the latter group was evaluated together with the Polish material, and will be referred to in the text under "Polish population". The age of the animals was estimated by means of the degree of tooth abrasion (after a method used by Škoudlín 1976). We measured for each skull 23 dimensions (accuracy 0.1 mm) surveyed in Table 1 (for the mode of measuring see Fig. 1), and calculated these indexes: Ni-nasal index/(2):(14)/(Rödl 1966), Pi-parietal index/(1):(16)/(Rödl 1966), Mi-maxillary index/(4):(5)/(Stein 1929/30), Fi-frontal index/(3):(20)/(Škoudlín 1978). The capacity of the neurocranium (CN) was measured by means of the methods suggested by Kratochvíl and Mrázová (1976).

Table 1. Values of cranial measurements of ***Erinaceus***
(for each measurement — first line-age

	Czechoslovakia				
	n	min—max	$\bar{x}$	s	C. v. %
1. Condylobasal length	133	50.8—59.4	55.40	1.53	2.76
	91	51.7—59.4	56.26	1.56	2.78
2. Length of sutura internasalis	134	10.9—18.4	13.72	1.23	8.96
	93	11.5—18.4	13.99	1.20	8.56
3. Total length of nasalia	135	14.6—19.7	16.87	0.94	5.57
	94	14.8—19.7	17.05	0.93	5.44
4. Length of proc. front. o. incisivi	136	10.0—16.4	12.76	1.06	8.31
	93	10.2—16.4	12.85	1.08	8.39
5. Ant. alv. margin P^1 — proc. front. o. incisivi	136	9.6—12.8	10.96	0.57	5.20
	93	10.0—12.8	11.10	0.61	5.45
6. Maxillary tooth-row length	136	25.3—30.4	28.15	0.88	3.13
	93	26.4—30.4	28.56	0.84	2.95
7. Greatest breadth of neurocranium	133	21.3—25.6	23.75	0.80	3.37
	90	22.5—25.6	24.08	0.70	2.92
8. Postorbital breadth	137	13.2—15.9	14.52	0.46	3.17
	94	13.2—15.9	14.60	0.43	2.95
9. Infraorbital breadth	137	12.0—16.6	14.31	0.61	4.26
	94	12.7—16.6	14.54	0.64	4.39
10. Zygomatic breadth	133	29.1—36.3	32.40	1.05	3.24
	90	30.7—36.3	32.94	1.06	3.21
11. Rostral breadth	134	10.0—13.6	11.87	0.52	4.38
	92	10.9—13.6	12.10	0.53	4.40
12. Rostral breadth of nasalia	135	2.9— 5.4	4.07	0.42	10.32
	94	2.9— 5.4	4.13	0.44	10.71
13. Greatest breadth of nasalia	136	2.5— 4.6	3.49	0.47	13.47
	93	2.4— 4.6	3.50	0.48	13.65
14. Least breadth of nasalia	136	1.6— 3.6	2.64	0.42	15.91
	94	1.6— 3.6	2.71	0.43	15.81
15. Greatest breadth of proc. parietalis o. frontalis	135	3.6—11.2	7.34	1.23	16.76
	92	3.6—10.2	7.30	1.18	16.19
16. Least breadth of proc. parietalis o. frontalis	135	3.2— 8.3	5.66	1.11	19.61
	92	3.2— 8.3	5.64	1.16	20.62
17. Greatest breadth of upper jaw	136	19.6—24.2	21.19	0.70	3.30
	93	19.7—24.2	21.43	0.74	3.43
18. Occipital height	134	13.1—17.2	15.76	0.64	4.06
	92	13.9—17.2	15.95	0.60	3.76
19. Rostral length	134	18.0—22.2	19.97	0.69	3.46
	92	18.1—22.2	20.26	0.74	3.64
20. Length of sutura interfrontalis	136	12.8—21.2	17.83	1.14	6.39
	93	16.0—21.2	18.02	1.10	6.09
21. Mandible length	136	36.0—43.8	39.97	1.32	3.30
	93	38.0—43.8	40.61	1.33	3.28
22. Height of ramus mandibulae	135	15.6—20.8	18.04	0.88	4.88
	92	16.3—20.8	18.33	0.93	5.06
23. Mandibular tooth-row length	136	19.7—23.8	21.51	0.72	3.35
	93	20.2—23.8	21.71	0.70	3.21

*) significant difference ($P \leq 0.05$)
**) highly significant difference ($P \leq 0.01$)

RESULTS

Having found some slight differences in the age composition of the two populations (31.4 % of the total number for age group 1 of the Czechoslovak population, 22.5 % for the Polish population) we did not evaluate the first age

concolor from Czechoslovakia and Poland
group 1 – 5, second line-age group 2 – 5)

			Poland			
t	CD	n	min – max	$\bar{x}$	s	C. v. %
7.93**	0.61	62	52.8 – 61.7	57.29	1.59	2.78
5.16**	0.45	51	54.5 – 61.7	57.73	1.74	3.01
6.16**	0.46	65	11.3 – 18.4	14 89	1.31	8.80
5.29**	0.45	52	12.6 – 18.4	15.13	1.33	8.77
9.00**	0.66	66	15.0 – 21.5	18.22	1.11	6.09
7.87**	0.66	53	16.2 – 21.5	18.40	1.11	6.06
4.35**	0 33	69	11.2 – 15.6	13.42	0.95	7.08
3.78**	0.33	55	11.2 – 15.6	13.52	0.98	7 21
6.96**	0.51	70	9.8 – 13.0	11.54	0.56	4.85
5.81**	0.50	55	10.6 – 13.0	11.69	0.58	5.00
8.27**	0.61	67	27 2 – 31.6	29.27	0.96	3.28
5.48**	0.46	52	27.3 – 31.6	29.43	1.04	3.52
6.66**	0.51	67	22.3 – 26.8	24.52	0.71	2.90
4.95**	0.43	54	22.3 – 26.8	24.69	0.74	2.98
1.30	0.09	70	13.4 – 15.7	14.61	0.49	3.35
1.15	0.10	54	13.5 – 15.7	14.69	0.50	3.40
4.75**	0.36	69	13.4 – 15.9	14.72	0.53	3.60
2.97**	0.27	54	13.4 – 15.9	14.85	0.56	3.77
12.06**	0.96	61	31.7 – 36.5	34.28	0.91	2.65
8.95**	0.81	51	31.9 – 36.5	34.51	0.89	2.58
5.81**	0.45	67	11.1 – 13.5	12.30	0.44	3.58
3.60**	0.32	52	11.4 – 13.5	12.42	0 48	3.82
1.36	0.10	61	2.9 – 5.0	4.16	0.45	10.82
0.53	0.05	50	2.7 – 4.9	4.17	0.41	9.85
0.89	0.07	70	2.5 – 4.3	3.43	0.43	12.54
0.13	0.01	55	2.5 – 4.3	3.49	0.44	12.70
0.62	0.05	68	1.7 – 3.6	2.68	0.46	17.16
0.53	0.05	54	1.7 – 3.6	2.67	0.45	17.01
6.21**	0.48	70	4.0 – 8.4	6.29	0.97	15.42
5.16**	0.45	54	4 0 – 8.4	6.30	1.04	16.44
6.29**	0.47	70	2.2 – 6.6	4.66	1.02	21.89
5.45**	0.52	54	2.2 – 6.4	4.49	1 03	22.87
5.05**	0.40	69	20.5 – 22.8	21.67	0.51	2.35
3.30**	0.30	54	20.6 – 22.8	21.81	0.54	2.45
5.51**	0.42	63	14.8 – 17.9	16.31	0.68	4.17
4.65**	0.40	52	14.9 – 17.9	16.47	0.72	4.36
7.92**	0 60	67	19.2 – 22.8	20.78	0.67	3.22
5.38**	0.47	52	19.4 – 22.8	20.94	0.71	3.40
8.84**	0.62	70	16.1 – 23.7	19.62	1.75	8.92
8.31**	0.69	54	16.1 – 23.7	19.98	1 76	8.83
13.68**	10.3	68	38.7 – 45.5	42.60	1.24	2.91
10.68**	0.92	53	40.2 – 45.5	43.04	1.30	3.03
8.22**	0.62	68	17.1 – 21.1	19.10	0.84	4.40
6.18**	0.55	52	17.4 – 21.1	19.27	0.78	4.05
16.78**	1.22	68	22.1 – 24.9	23.38	0.81	3.46
14.18**	1.21	53	22.1 – 24.9	23.45	0.74	3.16

group, but compared only two- and more year-old animals, i. e., fully grown specimens. However, for reasons of a comparability of our results, this principle could not be followed up in the Discussion and we had to include all animals in the set under evaluation (Table 1); yet, as evident from the table, the slightly different age structure influenced minimally the t-test values and coefficients of difference (CD).

Table 2. Values of maxillary (M_I), nasal (N_I), parietal (P_I) and frontal (F_I) indexes for populations of ***Erinaceus concolor*** from Czechoslovakia — 1st row) and Poland (— 2nd row)

Index (I)	n	min — max	$\bar{x}$	s	C. v. %	I > Cr. v.	I = Cr. v.	I < Cr. v.	Cr. v.*
Mi	135 69	0.92— 1.41 0.96— 1.43	1.16 1.16	0.14 0.12	12.07 10.34	96.30% 97.10%	1.48% 1.45%	2.22% 1.45%	**1.00**
Ni	135 65	4.06—11.06 4.41—12.64	6.59 7.11	1.35 1.69	20.49 23.77	28.89% 44.61%	1.48% 1.54%	69.63% 53.85%	**7.00**
Pi	133 62	5.88 -16.65 8.19—17.81	10.70 12.82	3.07 3.49	28.69 27.22	6.02% 43.55%	0.00% 0.00%	93.98% 56.45%	14.00
Fi	134 65	0.77— 1.39 0.68— 1.17	0.95 0.94	0.12 0.12	12.63 12.77	8.96% 26.15%	8.96% 4.62%	82.08% 69.23%	**1.00**

*) Critical value

According to our skull measurements, skulls of members of the Polish population were on the average bigger than those of the specimens from Czechoslovakia, and the difference, using the t-test, was highly significant ($P \leq 0.001$) for all dimensions except the postorbital width and width measurements of nasals. This accounted for certain differences in the shape of the skull evidencing themselves primarily in the nasals which on the average were longer in the Polish specimens (by 8.1 % for the sutura internasalis, 7.9 % for total length of nasals) and, simultaneously less wide than those of the Czechoslovak members, and that relatively less wide as regards the rostral width of nasal, and absolutely as regards their greatest and least width. Even if we considered a considerable dispersion of values particularly in width measurements of nasals, there could be not doubt that these differences in proportions reduced the taxonomic value of the nasal index (Table 2). Similarly, the value of the parietal index was reduced by differences in the shape of the processus parietalis ossis frontalis which in most members of the Polish population was found to be longer (up to 11.2 mm in length) and more narrow than in the Czechoslovak specimens as this was confirmed indirectly by the high average value for the length of the sutura interfrontalis. However, an increase in the value of this character due to the fact that the proc. parietalis o. frontalis was more deeply wedged between parietal bones, compensated simultaneously an increase in values of the frontal index occurring in specimens of the Polish population as a result of higher values for the length of nasal (Table 2).

Apart from these differences influencing the taxonomic value of the above indices, it can be stated that the skull of the Polish specimens is relatively more narrow in the rostral area and mainly in the area of the interorbital attenuation (a difference of 0.6 % in average values for postorbital width in both populations). Marked differences were found in the size of the mandible in that values for the three dimensions measured were higher in the Polish population, but their ration differed in both populations: the Polish specimens have an absolutely longer mandible bearing a longer row of teeth, and possess a relatively lower ramus mandibulae.

DISCUSSION

The fact that skulls of members of Polish populations are generally bigger than those of members of Czechoslovak populations has been implicated by Hrabě (1976b) in a comparison of his values obtained for Czechoslovak populations with literary data on Polish populations, in which he found statistically highly significant differences in condylobasal length, zygomatic width, length of maxillary tooth row, mandibular length and height of the ramus mandibulae. As regards the two latter measurements, Hrabě's values for the Czechoslovak population are in support of our finding of a remarkable difference in mandibular length and a relatively low average value for the height of the ramus mandibulae in the Polish population. Also for the rostral angle which Hrabě (1976 a, b) used in his characteristics of rostral parts of the skull, his values were significantly higher in the Polish population. Although we did not measure the rostral angle, it can be derived from the mode of measuring that the zygomatic width is wider in members of the Polish population, and that the rostrum is relatively more narrow at least in the area of the sutura maxilloincisiva than in the Czechoslovak population. This finding is in complete agreeement with our results.

The Polish population of *E. concolor* is a perfect example of how small size differences in two populations living close to each other can be responsible for a considerable reduction of the diagnostic value of several indexes. E. g., the mean value of the nasal index (Ni) becomes shifted to above the critical value 7.00 given by Rödl (1966) for distinguishing between *E. concolor* and *E. europaeus*. Therefore, basing on its values, we could not have identified more than 46 % of the Polish population. The same goes for the parietal index (Pi), and partly for the frontal index (Fi) for which values Fi > 1.00 were obtained with an increasing frequency although, in a comparison with the Czechoslovak population, average Fi values did not change. The only index whose high dianostic value was not changed by these small size differences was that of Mi.

Among the earlier authors concerned with these problems it was Stein (1929/30) who found that hedgehogs from East- and West Prussia differed from those from Upper Silesia (he regarded the latter as a typical *E. r. roumanicus*). Basing on a different colour of spines of the Prussian specimens he discribed for this area the new subspecies *E. r. dissimilis*. Unfortunately, he paid little attention to differences in the structure of the skull remarking only that "... bei *E. r. dissimilis* die Nasalia weiter und spitzer in die Frontalia hineinreichen". How much this influences higher average values for the length of nasals observed in the Polish population would be extremely difficult to determine. It seems more likely that the longer length of nasals is associated with the generally bigger skulls of members of the Polish population. In our total comparison (Table 3) we used values given by Stein (1929/30) for cranial measurements of *E. concolor* from former Prussia together with those recorded by Ruprecht (1972), Hrabě (1976b) and Markov (1957).

In spite of certain differences among the two populations, neither the results reported here nor literary data lend support to the view that these differences are on a subspecific level. Although there exist differences in skull measurements among the two populations which are of statistical significance as disclosed by results of the t-test, we had to consider a considerable transgression and the fact that the coefficient of difference never attained the value of 1.28 (Table 3) at which 90 % of one population differ from 90 % of the other population and the assumption of an existence of two subspecies differing in the evaluated character is justified (Hubbs and Hubbs 1953; Mayr et al. 1956; Mayr 1971).

If we had used criteria employed, e. g., by Krüger (1969) for *E. europeaus* (an identification of subspecies based on t-test values) in our evaluation of differences among the two populations, we would necessarily have come to the conclusion that there exist two different subspecies, one living in the Czech lands, the other in NE-Poland and in western areas of White Russia.

In the past, an evaluation of similar small differences, e. g., in colour, bodily measurements and in the shape of the skull, have been responsible for a quantity of descriptions of forms on the subspecific level and below it. The inadequacy of these criteria has been pointed out, e. g., by Andrejev and Rešetnikov (1977) whose results indicate quite clearly that the taxonomic position of a population cannot be assessed individually but in connection with all other populations. We compared our values obtained for skull measurements of members of the Czechoslovak and the Polish populations also with literary data on several other European populations of *E. concolor* using the coeffi-

Table 3. Coefficients of difference among some European populations of *Erinaceus concolor* in condylobasal lenght, zygomatic breadth, maxillary tooth-row length, mandible length, mandibular tooth-row length and rostral breadth
(index values for each pair of localities read from top left to bottom right)

	Number of localities													
	(1)		(2)		(3)		(4)		(5)		(6)		(7)	
(1) Kirov Palatinate Ruprecht (1972)	—		0		0		0		0		0		0	
(2) former Prussia Stein (1929/30)	0.13 0.10 —	0.47 0.21 —	—		0		0		0		0		0 (1)	
(3) Bialowieza Primeval Forest Ruprecht (1972)	0.12 0.09 —	0.41 0.22 —	0.04 0.01 —	0.19 0.01 —	—		0		0		0		0	
(4) Brest Palatinate Ruprecht (1972)	0.35 0.53 —	0.45 0.35 —	0.16 0.35 —	0.12 0.12 —	0.25 0.40 —	0.08 0.14 —	—		0		0		0	
(5) Poland present study	0.31 0.62 —	0.65 0.33 —	0.11 0.42 0.12	0.07 0.06 —	0.19 0.49 —	0.20 0.08 —	0.10 0.11 —	0.09 0.08 —	—		0		0 (2)	
(6) Other parts of Poland Ruprecht (1972)	0.34 0.41 —	0.62 0.36 —	0.15 0.25 —	0.08 0.11 —	0.25 0.29 —	0.17 0.14 —	0.02 0.11 —	0.05 0.01 —	0.08 0.21 —	0.03 0.07 —	—		0	
(7) Czechoslovakia present study	0.19 0.04 —	0.14 0.60 —	0.31 0.07 1.17	0.63 0.73 —	0.35 0.06 —	0.63 0.83 —	0.60 0.52 —	0.65 0.93 —	0.61 0.61 1.22	0.96 1.03 0.45	0.60 0.39 —	0.74 0.98 —	—	
(8) Czechoslovakia Hrabě (1976)	0.22 0.28 —	0.04 0.86 —	0.31 0.33 —	0.52 0.94 —	0.35 0.36 —	0.47 1.05 —	0.56 0.80 —	0.50 1.13 —	0.56 0.88 —	0.73 1.25 0.22	0.56 0.67 —	0.58 1.18 —	0.07 0.33 —	0.10 0.37 0.18
(9) Crimea Ruprecht (1972)	0.68 0.66 —	1.00 0.68 —	0.41 0.43 —	0.25 0.35 —	0.59 0.51 —	0.63 0.42 —	0.27 0.05 —	0.49 0.24 —	0.45 0.08 —	0.52 0.39 —	0.30 0.28 —	0.45 0.27 —	1.04 0.65 —	1.32 0.87 —

Table 3. Continued. Numerals below nos. of localities indicate cases with CD ≧ 1.28, those in parentheses with CD ≧ 1.00

	Numbers of localities						
	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1)	0	0 (1)	0	0	0	1 (4)	2 (4)
(2)	0	0	0	0	0	0	0 (1)
(3)	0 (1)	0	0	0	0	0 (1)	1 (2)
(4)	0 (1)	0	0	0	0	0	0 (1)
(5)	0 (1)	0	0	0	0	0 (1)	2 (2)
(6)	0 (1)	0	0	0	0	0	0 (1)
(7)	0	1 (2)	0	2 (5)	1 (2)	5 (6)	6 (6)
(8)	—	0 (2)	0 (1)	1 (4)	1 (2)	3 (5)	4 (5)
(9) Crimea Ruprecht (1972)	0.92 1.08 0.96 1.03 — —	—	0	0	0	0	0
(10) Groznyj Palatinate Ruprecht (1972)	0.33 0.44 0.49 1.03 — —	0.67 0.59 0.52 0.56 — —	—	0	0	0 (1)	1 (2)
(11) Bulgaria E. r. roumanicus Markov (1957)	0.90 1.03 1.04 1.59 — 1.00	0.13 0.04 0.09 0.04 — —	0.63 0.55 0.60 0.60 — —	—	0	0	0 (1)
(12) Caucasus Mts. Ruprecht (1972)	0.66 1.03 0.62 1.45 — —	0.21 0.08 0.29 0.02 — —	0.40 0.60 0.18 0.50 — —	0.12 0.12 0.37 0.06 — —	—	0	0 (2)
(13) Bulgaria E. r. bolkayi	1.30 1.39 1.23 1.70 — 1.06	0.49 0.40 0.65 0.50 — —	1.12 0.93 0.96 0.92 — —	0.66 0.43 0.59 0.47 0.26 0.06	0.64 0.27 0.79 0.49 — —	—	0
(14) Bulgaria E. r. drozdovskii Markov (1957)	1.96 1.24 1.51 1.73 — 1.45	0.89 0.46 0.87 0.50 — —	1.53 0.88 1.23 0.93 — —	1.12 0.48 0.79 0.47 0.21 0.19	1.01 0.35 1.00 0.49 — —	0.39 0.14 0.04 0.02 0.08 0.30	—

Table 3. Continued

	Numbers of localities													
	(1)		(2)		(3)		(4)		(5)		(6)		(7)	
(10) Groznyj Palatinate	0.09	0.38	0.07	0.18	0.04	0.00	0.30	0.08	0.25	0.19	0.30	0.13	0.33	0.59
Ruprecht (1972)	0.19	0.14	0.05	0.09	0.08	0.09	0.40	0.24	0.50	0.19	0.26	0.24	0.16	0.79
	—	—	—	—	—	—	—	—	—	—	—	—	—	—
(11) Bulgaria	0.83	0.95	0.36	0.22	0.75	0.59	0.39	0.45	0.37	0.47	0.22	0.41	1.04	1.27
E. r. roumanicus	0.74	0.71	0.49	0.38	0.58	0.45	0.12	0.26	0.01	0.42	0.25	0.30	0.73	1.43
Markov (1957)	—	—	0.76	—	—	—	—	—	0.63	0.94	—	—	1.66	1.20
(12) Caucasus Mts.	0.44	0.96	0.23	0.28	0.34	0.64	0.06	0.51	0.19	0.55	0.08	0.48	0.72	1.24
Ruprecht (1972)	0.34	0.61	0.18	0.32	0.22	0.38	0.21	0.20	0.31	0.34	0.09	0.23	0.31	1.28
	—	—	—	—	—	—	—	—	—	—	—	—	—	—
(13) Bulgaria	1.20	1.30	0.74	0.51	1.16	0.98	0.79	0.82	0.92	0.93	0.72	0.80	1.51	1.66
E. r. bolkayi	1.03	1.03	0.80	0.69	0.90	0.79	0.61	0.61	0.50	0.80	0.69	0.66	1.03	1.59
Markov (1957)	—	—	0.95	—	—	—	—	—	0.84	1.00	—	—	1.70	1.30
(14) Bulgaria	1.58	1.18	1.04	0.54	1.57	0.92	1.16	0.79	1.35	0.87	1.08	0.77	1.67	1.43
E. r. drozdovskii	1.28	1.01	0.97	0.70	1.11	0.80	0.78	0.62	0.65	0.81	0.87	0.67	1.30	1.63
Markov (1957)	—	—	0.98	—	—	—	—	—	0.85	1.44	—	—	1.84	1.72

cient of difference (CD) for this purpose. The results of this comparison are shown in Table 3. In addition, we determined the number of cases, for the which the CD value for 6 cranial dimensions was CD ≧ 1.00 and CD ≧ 1.28 (Table 3).

If we were to take CD ≧ 1.28 as a criterion suggesting a marked difference among the two populations, and the existence of two subspecies, we would find that the Polish population differs in this point solely from the Bulgarian population, and that only in two out of the 6 characters evaluated, i. e., in condylobasal length CD = 1.35, and in rostral width CD = 1.44, while members of the population from Bohemia and Moravia differ greatly from those of Crimean and Caucasian populations (Ruprecht 1972) and from the three subspecies described by Markov (1957) for Bulgaria; they differ from Crimean and Caucasian specimens in one out of the four possible characters, from *E. r. roumanicus* in 2 out of the 6 characters measured, from *E. r. bolkayi* in 5 out of the 6 characters, and from *E. r. drozdovskii* in all 6 characters. Another point worth of emphysis is the bigger difference in cranial measurements among the Polish and the Czechoslovak population which occupy sites close to one another but separated by the Sudeten- and Carpathian mountains, than are differences between the Polish and remote populations from the Kirov Palatinate, the Groznyj Palatinate, the Caucasus (Ruprecht 1972) or the Bulgarian population of *E. r. roumanicus* (Markov 1957) (Table 3).

Therefore, one should not speculate on certain resemblances of two populations living at a far distance from one another without considering neighbouring populations and particularly those inhabiting intervening areas. If one failed to do so, one might easily come to the conclusion that populations from marginal areas of the range of distribution of the species, e. g., from the Kirov Palatinate or from Czechoslovakia on the one hand, and from Bulgaria or the Crimea on the other hand, differ so much from one another that the assumption of the existence of two subspecies is justified.

Although Markov (1957) postulated the existence of three different subspecies in Bulgaria distributed in a mosaic-like pattern in this area, differences in average values of their cranial measurements are much smaller than those between the Bulgarian population of *E. r. roumanicus* (Markov 1957) and the Czechoslovak population which Kratochvíl (1974, 1980) determined to be *E. concolor roumanicus*. For *E. r. bolkayi* and *E. r. drozdovskii*, living in Bulgaria, part of Yugoslavia (Dulič and Tortič 1960; Dulič and Mirič 1967) and Greece (Ondrias 1965; Giagia and Ondrias 1980), Markov (1957) maintained that in addition to higher values for bodily and cranial measurements also their spines were bigger. There might be a direct relationship between the size of the animal and the length of its spines as this has been confirmed for members of the genus *Hemiechinus* (Niethammer 1969). Wettstein (1942) maintains that the form "*drozdovskii*" is a relict from the period preceding the time of distribution of the form "*roumanicus*", and places it close to the race "*transcaucasicus*" living in the Caucasus. Also the caryotypes of *E. c. drozdovskii* and *E. c. nesiotes* from Crete island are identical (Giagia and Ondrias 1980). Ognev (1928) places the subspecies *E. r. transcaucasicus* close to the typical *E. roumanicus* reporting, simultaneously, on its incidence in the pre-Caucasian (Kuban) area. He also confirms the presence of the subspecies *E. c. abascicus*, which is similar to the typical *E. concolor* from Asia Minor, in Abkhasia (Georgia).

These literary data together with our finding of small size differences in cranial measurements lend support to the view that all mentioned forms are closely related. However, differences among remote populations of the same subspecies have frequently shown to be much bigger than those among neighbouring populations which some authors have regarded as different subspecies. For the four characters available for all populations compared, i. e., condylobasal length, zygomatic width, length of upper tooth row and length of mandible, the probability of $CD \geq 1.28$ is 6.6 % for one character and one pair of localities. This brings forth the question whether there exist sufficiently significant differences justifying the establishment of different subspecies at least for the area under study. As regards cranial measurements it appears that such differences should hardly be found. Similarly, differences in the colour of spines and the coat have frequently shown to be insignificant in view of the fact that numerous authors (Herter 1938; Bauer 1960; Kratochvíl 1974) have drawn attention to a considerable variability within a population, and Wettstein (1942) has found melanic specimens, similar in colour to hedgehogs from Asia Minor and the Caucasus, in moutain areas of Austria. Therefore, differences in skull measurements disclosed in the present study do not appear to be significant enough to allow for a distinction of different subspecies on this evidence.

A point of interest is the way used by Kratochvíl (1980) for a distinction of *E. c. roumanicus* and *E. c. drozdovskii* from steppe areas in planes of the Balkan Peninsula, i. e., by the relative weight of their brains. In this, he has solved the question raised by Holz (1976, 1978) of the systematic position of populations from Roumania and Bulgaria. Having regard to the fact that, e. g., Wettstein (1942) has put the form "*drozdovskii*" close to the form "*transcaucasicus*", the index $CB/\sqrt[3]{CN}$ has been calculated for three adults caught in 1979 in the Caucasus Mts. (Kirovka, Azerbaidzhan). Although the resulting values, i. e., 37.467, 38.571, 37.566, are slightly higher than those commonly obtained for central European populations, they are far below those characteristic of ssp. *drozdovskii* which means that in general they are in good fit with findings based on cranial measurements. Therefore, this index appears to be dependent on a certain gradient which, at least, impedes a separation of subspecies.

Acknowledgements

I am greatly indebted to Professor Dr. Z. Pucek, Director of the Mammalian Research Institute, Polish Academy of Sciences, Bialowieża, for permitting to examine specimens from the collection of this institute. I have benefited particularly from the valuable advice and remarks of Dr. A. Ruprecht from the same institute during my stay here.

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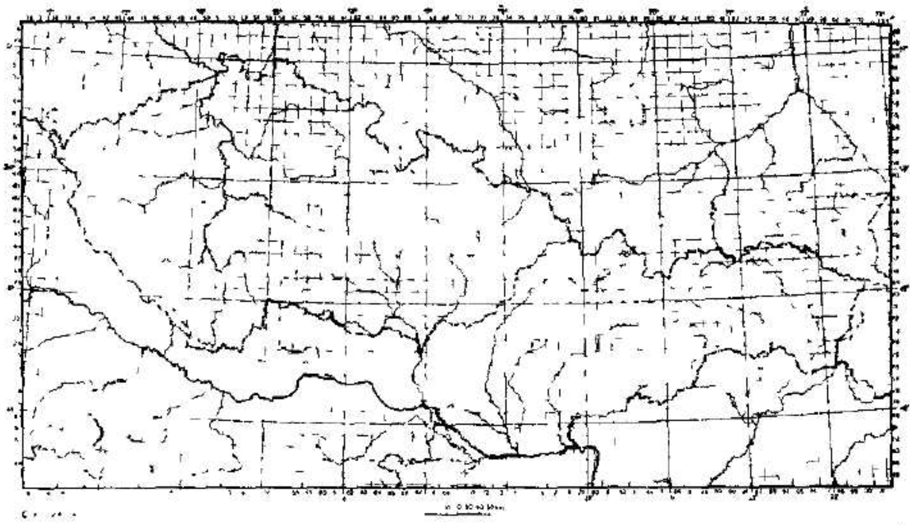
Věst. čs. Společ., zool., **46:** *317—318, 1982*

ZPŮSOB PUBLIKACE LOKALIT ŽIVOČICHŮ Z ÚZEMÍ ČESKOSLOVENSKA

Публикация фаунистических данный из территории ЧССР

PUBLICATION OF FAUNISTIC DATA FROM CZECHOSLOVAKIA

Na výroční členské schůzi Československé společnosti zoologické, konané dne 4. března 1982 bylo usneseno, aby při publikování všech faunistických údajů z území ČSSR bylo ve všech případech uvedeno spolu s názvem lokality i příslušné kódove označení čtverce, na němž se lokalita nachází Tento požadavek vyplynul z postupného zřizování databanky údajů o fauně ČSSR, která již zahajila svoji činnost na území Slovenska.



Mapa ČSSR sloužící k mapování výskytu organizmu se zakreslenou sítí čtverců a systémem dvoučíslí, z nichž lze sestavit čtyřciferný kód každeho čtverce (předlohu poskytl Dr. B. Slavík, CSc., Botanický ústav ČSAV, Průhonice).
Карта ЧССР применяемая для картографирования наличия организмов с подбитой сетью квадратов и с системой двузначных цифр для составления четырехцифрового кода данного квадрата (по оригиналу д-ра Б. Славика, Ин-т Ботаники ЧСАН, Прухонице)
A map of Czechoslovakia for recording of the occurrence of organisms, with a square grid and a system of two-digit numbers for four digit coding of individual quadrangles (after Dr. B. Slavík, CSc., Institute of Botany, Czechoslovak Academy of Sciences, Pruhonice).

Příslušnost lokality k jednomu ze sítě čtverců lze stanovit za pomoci účelové mapy ČSSR (1:500 000), kterou vydal výbor Československé zoologické společnosti. Mapu si může každý autor vypůjčit přímo na sekretariátu společnosti (Praha 2, Viničná 7) nebo v institucích, které se zabývají mapováním výskytu organismů (výbory sekcí zoologické společnosti, muzea, krajská střediska ochrany přírody a památkové péče atp.).

Každý čtverec je označen čtyřciferným kódem, který se odečítá ze stupnice na okraji mapy. Kód je tvořen dvěma dvouciferným čísly. První označuje vodorovnou řadu čtverců, druhé pořadí svislého sloupce čtverců. Např. kód soutoku Vltavy s Labem je podle připojené mapy vyjádřen číslem 5652.

V některých případech, např. když leží maloplošné stanoviště (lokalita) na rozhraní dvou nebo dokonce čtyř čtverců, může být autor na pochybách, který z kódů použít. U vzácných druhů, sbíraných ve velice malém počtu jedinců (zvláště při jediném exempláři), je zapotřebí uvést jen kód jediného čtverce, toho, na jehož přírodní poměry navazuje charakter stanoviště druhu.

Od 1. čísla 47. ročníku Věst. čs. Společ. zool., bude příslušný kód uváděn v každé práci alespoň za každým poprvé uvedeným názvem lokality (nebo v té části textu, kde jsou všechny lokality uvedeny současně). Zřejmě pouze při velikém množství druhů nalezených na různých místech ČSSR, by bylo záhodno uvádět kódy za každým názvem lokality. Ve všech případech by mělo být číslo kódu uvedeno v závorce. Např.: *Baetis fuscatus* (L.), adult: Czechoslovakia, South Bohemia, Lužnice riv., Bechyně (6752), 4. VIII. 1973 leg. T. Soldán (No. 5).

Doc. Dr. J. Buchar, CSc., vědecký tajemník

На состоявшемся 4 марта 1982 г. отчетном годовом собрании Чехословацкого Зоологического Общества ЧСАН решено, что при публикации всех фаунистических данных из территории ЧССР необходимо совместно с названием местности приводить также и соответствующее обозначение квадрата, в котором расположена указанная местность. Применяемая сеть квадратов поднята на приложенной карте. Каждый из квадратов *отмечается с помощью четырехзначного кода, вычитанного из шкалы на полях карты.* Код состоится из двух двузначных цифр, первая из которых обозначает горизонтальный порядок квадратов, вторая вертикальную очередность в столбце квадратов.

В Вестнике Чехосл. Зоол. Об-ства вышеупомянутое решение используется с № 1 47 тома. Надлежащий код приводится в скобках за названием местности.

At the annual meeting of the Czechoslovak Zoological Society, Czechoslovak Academy of Sciences held on 4 March 1982 it was decided that publication of any faunistic data from Czechoslovakia should include respective quadrangles with names of localities. The square grid used is indicated in the enclosed map. Each quadrangle is identified by a four-digit code read from a scale at the margin of the map. The code consists of two two-digit numbers, the first indicating the horizontal line of quadrangles, the second their vertical column.

This decision will be applied beginning with No. 1 of Volume 47 of Věst. čs. Společ. zool.; code numbers will be given in parentheses after the names of localities.

Věst. čs. Společ., zool., 46: 319—320, 1982

THIRTY YEARS OF THE CZECHOSLOVAK ACADEMY OF SCIENCES

Vladimír J. A. NOVÁK

This autumn the thirtieth anniversary of the foundation of the Czechoslovak Academy of Sciences will be commemorated. On 29th October 1952 the Czechoslovak National Assembly passed the bill by which the Czechoslovak Academy of Sciences (ČSAV) was established as the highest scientific institution in the country. Profesor Zdeněk Nejedlý, at that time the vice-president of the government, played a decisive role in the creation of ČSAV and became its first president. The foundation of the Academy of Sciences, following the example of Soviet Union and other socialist countries, changed profoundly the status of science in this country, as it corresponds to its significance in a society ruled on scientific basis. This was in agreement with the principle expressed by Klement Gottwald in 1948: „Socialism requires science more rich and more developed than did capitalism."

In fifties the newly founded Academy of Sciences achieved an impressive development, although the economical situation in the postwar period of the country was difficult. Dozens of new institutes were founded and well equipped personally as well as with instruments and other materials, hundreds of new scientific workers were brought up and the new scientific institution soon took a respectable and reputable position, as testified by publications of its workers abroad, their participation in international scientific meetings (congresses, conferences, and symposia) as well as the participation of prominent foreign specialists in meetings organized in the country.

Further development, however, especially later in sixties, was not straightforward and withaut scientific as well as political problems. Firstly, the majority workers in the Academy were young people, who came mostly directly from Universities with little experience in scientific, organizational and political work. This resulted, among other things, in a formalism in their own work as well as in their attitude to other scientific workers in the same field, where often various forms of institutional egoism, mutual competition and a tendency to limit others prevailed, rather than a fruiful socialistic cooperation and common efforts.

This situation was further complicated by the fact that by far not all leading workers were conscious citizens of the socialist state. Still worse, many of them pretended a socialistic consciousness and, at the same time, by their formalism, insensitiveness and fals radicalism discouraged especially young people, as shown later by the hard experience of the crisis period 1968—69. Some of them did this on purpose and as a matter of fact, the whole selection of scientific staffs was influenced in this way.

This became apparent in the failure of a considerable part of the leaders of the Academy in the year 1968. Even if one can' not say that the situation in the Academy was in this respect worse than at Universities and other institutions, the failure of the highest scientific institution, obliged for its existence to the socialist régime, resulted in a greater disappointment than in other cases. This was obviously the main reason of unfavourable consequences, brought about by the attitude of its leading representatives in the year 1968, results, manifesting themselves especially in actions of lower authorities towards the needs and justified demands of the Academy. Its position thus became considerably worse when compared with the initial period after its foundation, both in the possibillity of a further development and in the material equipment as well as in the accessibility of the foreign literature.

In spite of all these errors and shortcomings it can be said that the main task was fulfilled. The Czechoslovak Academy of Sciences became during a relatively short time of thirty years a supreme scientific institution, the achievement of which are positively accepted and acknowledged not only in this country but in the whole scientific world, in Soviet Union and other socialist countries as well as in western countries. It has reached many important results both theoretical and practical. In a number of fields formerly not treated in this country it now keeps a respectable place in the world science. Its results are also reflected in the number of state and other prizes and distinctions awarded to its workers.

At present the new presidium of the Academy follow with maximal attentiveness to the application of scientific results in the practice of the whole society with the aim of assisting economic welfare of the country. This certainly is one of the prerequisities for achieving a higher evaluation of science and scientific institutions by the society, as it has received in the Soviet Union and other socialist countries since the beginning. At the same time it is a way for each scientific worker to recognize the identity of his real long-term interests with the interests of the socialist society and hence to strive for a maximal usefulness of his scientific branch for the benefit of the country. Only in this way he can fully realize that the main and most important contribution of science for the socialism does not consist in mere assistence to the immediate practical production, but much more in creation of scientific basis for long-term prognosis and overcoming of problems and in an operative ruling of the whole evolution of the socialist society on all levels. This will also be a prerequisite for a necessary activation of the applied research, the optimal exploitation of its capacity and its full participation in the efforts of the whole society. Only in this way will the Academy reach a natural authority and understanding for its needs, which do not serve only to its own interests, and an evaluation of its work belonging to it in socialist society.

Thus even when the development of the Czechoslovak Academy of Sciences has been positive and respectable in spite of all problems and shortcomings so far, it can be assumed that in next years, with the further development of the socialism in this country will be still more farreaching and impressive, as it corresponds to the ever increasing significance of science for all aspects of further evolution of the society heading for communism and for welfare of the mankind as a whole.

Fig. 1

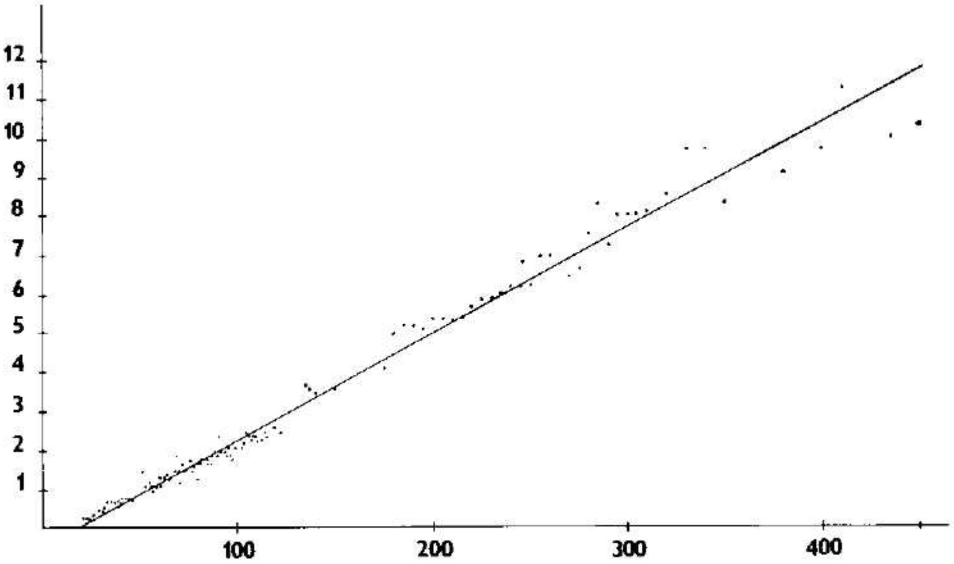
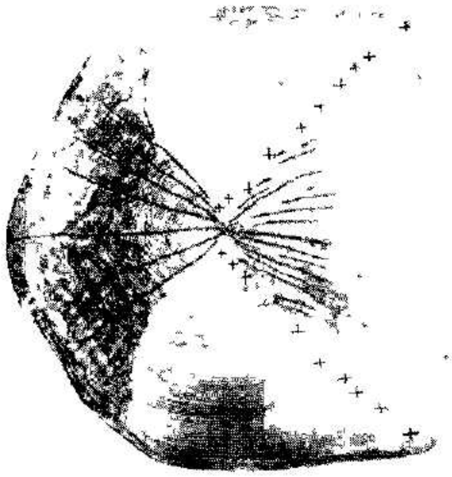


Fig. 1. — Relationship between body length and ventro-diagonal scale radius in the chub from the Klíčava reservoir. Body length (in mm) along abscissa, ventro-diagonal scale radius (in mm) along ordinate.

2



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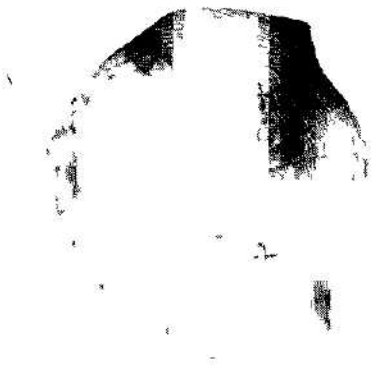

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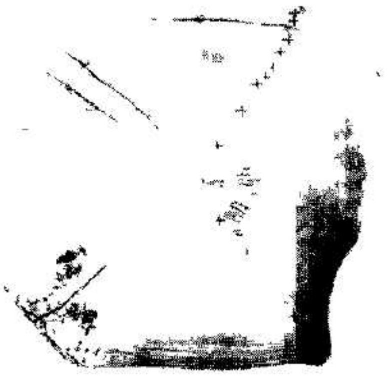
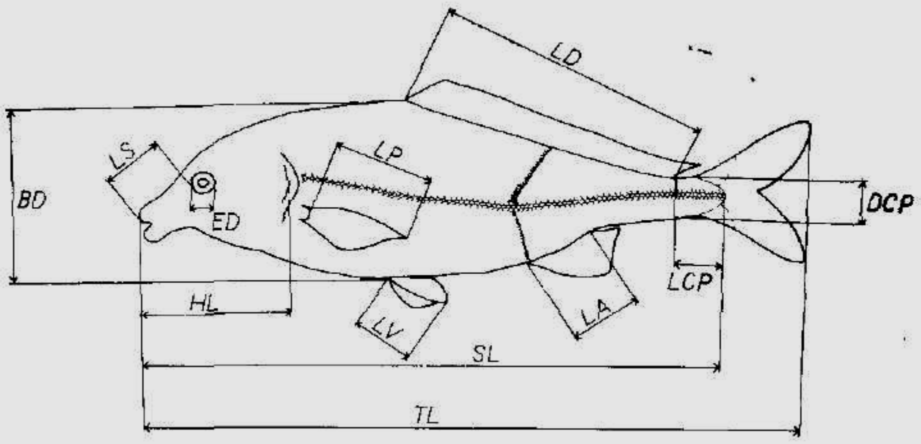


Fig. 2. — The scale of the chub, body length 350 mm, weight 920 g, caught in the reservoir Klíčava 3. 5 1978, number of annuli 10, age class XI, ventro-diagonal radius of the scale 8.34 mm.

Fig. 3 .— The scale of the chub, body length 137 mm, weight 80 g, caught in the Klíčava reservoir 7 8. 1978, number of annuli 3, age class III, ventro-diagonal radius of the scale 3.20 mm.

Fig. 4. — The scale of the chub, body length 78 mm, weight 10 g, caugth in the Klíčava reservoir 21. 10 1980, number of annuli 1, age class I, ventro-diagonal radius of the scale 1 37 mm

Fig. 5. — The scale of the chub, body length 300 mm, weight 245 g, caught in the river Berounka 5. 8. 1976, number of annuli 9, age class IX, ventro-diagonal radius of the scale 6.57 mm.



1

Fig. 1. Schematic drawing of mormyrid measurements. TL — total length, SL — standard length, BD — body depth, HL — head length, LS — snout length, ED— eye diameter, LP — length of pectoral fin, LV — length of ventral fin, LA — length of anal fin, LD — length of dorsal fin, LCP — length of caudal peduncle, DCP — depth of caudal peduncle.

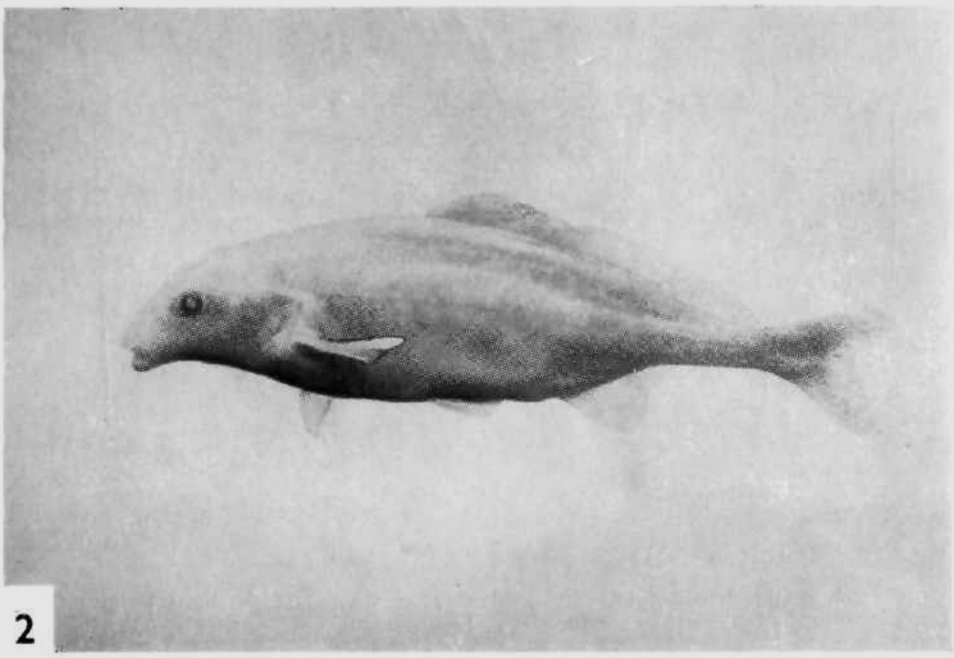


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Fig. 2. *Mormyrus kannume*, 127 mm of body length from the river Uaso Nyiro, caught above small falls.

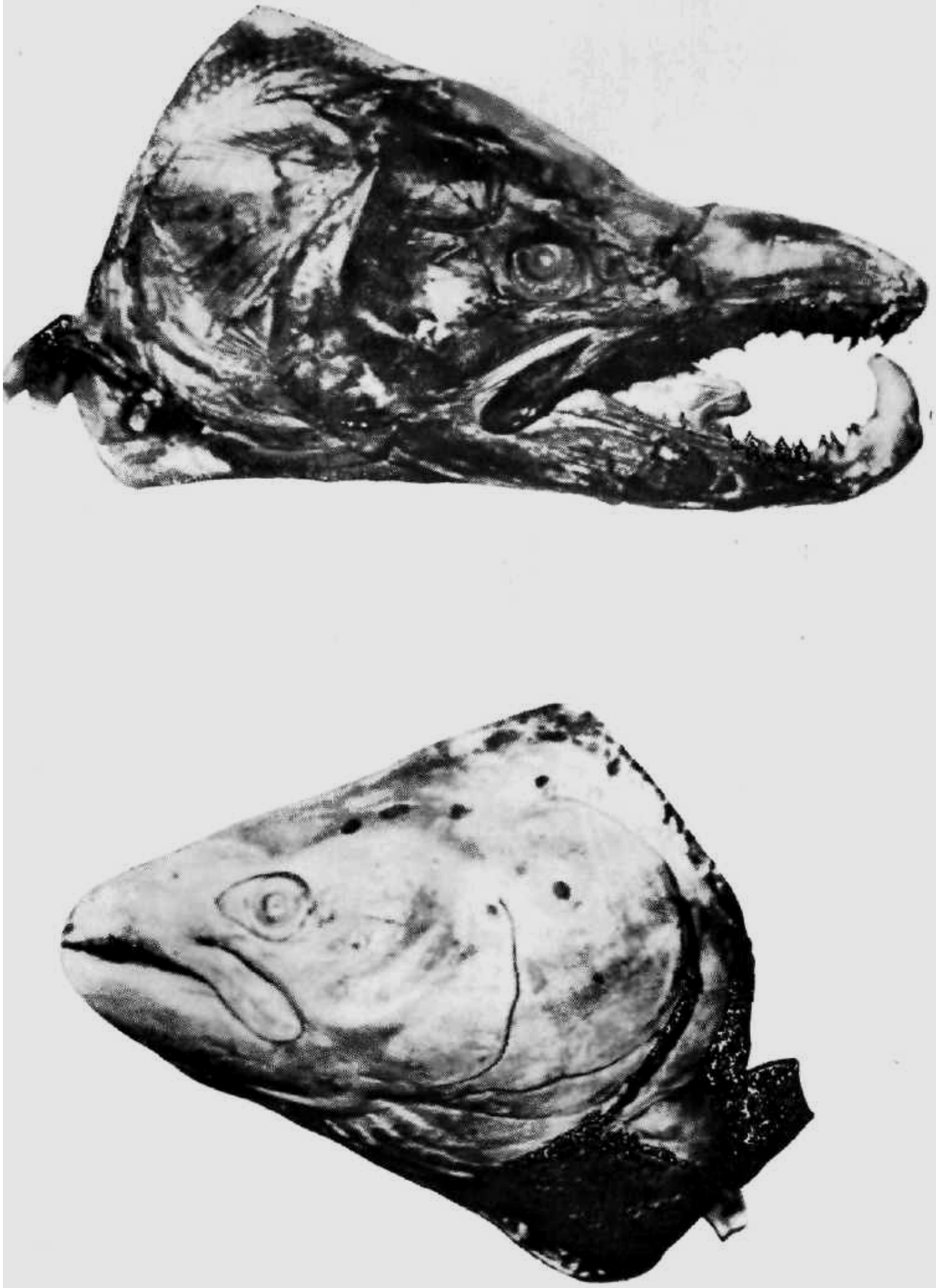

Plate 1.
Above: head of salmon male, actual length 210 mm, No 10 in our paper, No 172 in Frič (1894), with a typical mandibulary hook. Below: head of female salmon, actual length 157 mm, No 6, in our paper, No 111 in Frič (1894).
Collection of Professor A. Frič, now in the Department of Zoology, National Museum, Prague. Photos by Dr. E. Opatrný.

Ramana D. V., Sood, M. L.: Food and feeding of the lesser bandicoot rat Bandicota bengalensis

Plate I. Maize (Fig. 4) and wheat (Fig. 5) food residues left by Indian mole rats containing germ eaten grains and cellulose coats.

Ramana D. V., Sood, M. L.: Food and feeding of the lesser bandicoot rat Bandicota bengalensis

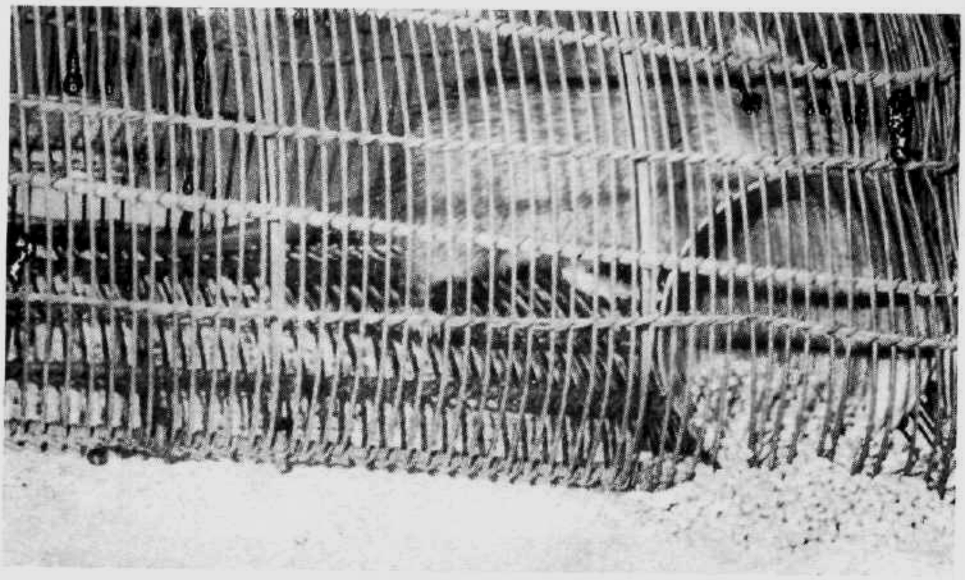

Plate II. Fig. 6. Displays 'tilting' of the food cup by *B. bengalensis.*

POKYNY PRO AUTORY

Vestnik Československe společnosti zoologické uveřejňuje původní vědecké prace členů spolecnosti v rozsahu nejvyše 30 stran rukopisu, napsane v některé z kongresovych řeci, a dale clanky, hodnotici zivotni dilo našich zoologů, vyžádané redakci Prace autoru, kteri nejsou cleny společnosti, budou přijimány jen výjimečně

Formalni uprava prací

Rukopis (original a 1 kopie) musi byt psan na stroji s většimi typy obřadek, na strance 30 řadek, řadky po 60 uhozech, bez vetšich oprav Rukopisy, ktere by neodpovidaly temto formalnim pozadavkum, budou vraceny k prepsani.

Hlavicka prace 1 Nazev pracoviště 2 Nazev prace (u praci taxonomickych v zavorce za nazvem systematicke zařazeni druhu nebo skupiny – např. Ostracoda. Cyprinidae), oboji v řeči, v niz je prace psana 3 Jmeno a přijmeni autora

Vlastni prace 1 Velmi strucny abstrakt, v rozsahu nejvyse 15 řadek, v angličtině 2 Úvod do problematiky (strucně) 3 Material a metodika (u znamých metod pouze odkaz) 4 Vlastni cast experimentalni nebo popisna 5 Diskuse 6 Zavěr. 7 Seznam citovane literatury (nikoliv bibliografie!) 8 Adresa autora 9 Tabulky, texty k obrazkům a grafům Cely rukopis je prubezně strankovan

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