Chewing lice (Phthiraptera: Amblycera, Ischnocera) from chukars (*Alectoris chukar*) from a pheasant farm in Jinacovice (Czech Republic)

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ABSTRACT: One hundred and twenty captive chukars (*Alectoris chukar*) and other hosts from a pheasant farm in Jinacovice (Czech Republic) were searched for chewing lice from July 2003 to April 2004. Seven species of chewing lice were found on chukars: *Amyrsidea perdicis*, *Menacanthus pallidulus*, *Menopon gallinae* (Amblycera); *Goniodes colchici, Lipeurus maculosus, Goniocotes microthorax* and *Cuclotogaster heterographus* (Ischnocera). Except for the last two mentioned species, the other five louse species are recorded for the first time on chukars. The prevalence, mean intensity of infestation and mean abundance of the lice from chukars were recorded. The species diversity and distribution of chewing lice from another eight species of gallinaceous birds kept in the pheasant farm were also recorded.

Keywords: chewing lice; Phthiraptera; chukar; *Alectoris chukar*; pheasant farm

Chewing lice (Phthiraptera: Amblycera, Ischnocera) are common ectoparasites of wild and domestic birds. They are particularly widespread among gallinaceous birds (Galliformes), and massive infestations of some of the species have been reported, particularly in flocks of domestic fowls (Kettle, 1990; Mullen and Durden, 2002). A total of 543 species of chewing lice parasitic on 237 species of gallinaceous bird (82.9% of total number of Galliformes) (Price et al., 2003) have been described.

Along with several other foreign gallinaceous species, chukars (*Alectoris chukar* Gray, 1830) are favourite game birds in the Czech Republic. In spite of several unsuccessful past attempts to introduce them into the open countryside, chukars reproduce very well under local conditions, and breeding of chukars in aviaries has been very successful (Hrib, 1994). Large concentrations of birds within the confined space of an aviary may facilitate, just as in any commercial domestic fowl operations, the spreading and increase of their chewing louse populations. This is manifested by extensive damage to feathers and marked irritation of the skin, which may cause overall weakening and even death of the birds infested (Porkert, 1978; Jurasek and Dubinsky, 1993).

The aim of this study was to record the incidence of chewing lice among gallinaceous birds in a pheasant farm in Jinacovice (Czech Republic), and to determine the prevalence, intensity of infestation and abundance of individual species of chewing lice on chukars.

MATERIAL AND METHODS

The Jinacovice pheasant farm is situated about 10 km west of Brno (Czech Republic – latitude 49°15'N, longitude 16°31'E). At present, there are 9 species of gallinaceous birds in the farm: about 100–200 chukars (*Alectoris chukar*), about 300 ring-necked pheasants (*Phasianus colchicus* Linnaeus, 1758), about 100 Reeves's pheasants

(*Syrmaticus reevesi* Gray, 1829), about 10 grey partridges (*Perdix perdix* Linnaeus, 1758), about 200 Japanese quails (*Coturnix japonica* Temminck & Schlegel, 1849), about 20 domestic fowl (*Gallus gallus* Linnaeus, 1758), about 10 peafowl (*Pavo cristatus* Linnaeus, 1758), about 50 Guineafowl (*Numida meleagris* Linnaeus, 1758) and about 30 wild turkeys (*Meleagris gallopavo* Linnaeus, 1758). The birds are kept in outdoor aviaries (except the Japanese quails), usually separating one species per aviary. Adjacent aviaries may, however, be occupied by different species. In some cases, the smaller species of birds are kept in mixed flocks. Young birds are kept in hatcheries, separated from adults.

Between July 2003 and April 2004, 120 chukars were examined for lice. In order to determine species diversity of the chewing lice population in the farm, another 73 birds of the remaining eight species bred there were also examined.

Ectoparasites were collected using the fumigation chamber method (Clayton and Drown, 2001) specifically adapted for gallinaceous birds. Paint plastic buckets were used and their depth was adjusted with pads to allow the bird examined to stand on the bottom (Figure 1). Lice from peafowl were collected using a large black polyethylene bag (50 cm × 100 cm). Bird was placed in this bag with a head taken out. Chewing lice were killed with chloroform. When the bird was released from the bucket, the dead chewing lice remaining on the bird were manually ruffled onto filter paper (Clayton and Walther, 1997). In the case of

Figure 1. Collecting lice from a chukar using the fumigation chamber method in paint plastic buckets

Table 1. Changes of mean intensity of seven species of chewing lice found on chukars (*Alectoris chukar*) in the July – April period (intensity range is in parentheses)

	July	August	September	October	November	December	January	February	March	April
Ape	3.7 (2–6)	1.3 (1–2)	5.0 (2–9)	– –	– –	– –	– –	– –	– –	– –
Mpa	2.0 (1–3)	1.3 (1–2)	3.6 (1–9)	–* (1)	–* (1)	– –	–* (1)	–	–* (1)	1.5 (1–2)
Mga	– –	–* (1)	– –	– –	– –	– –	– –	– –	– –	– –
Gmi	68.8 (30–98)	62.6 (26–178)	122.7 (27–314)	62.6 (40–86)	193.8 (25–416)	330.5 (27–696)	448.7 (279–752)	410.5 (332–484)	110.2 (64–172)	95.0 (61–122)
Gco	4.0 (1–8)	2.7 (1–6)	9.9 (1–30)	4.6 (2–9)	10.3 (4–24)	8.3 (3–11)	7.0 (4–9)	11.5 (7–14)	7.8 (1–14)	3.0 (2–5)
Che	39.8 (22–64)	37.6 (14–69)	33.6 (10–144)	49.2 (36–72)	31.0 (10–46)	31.5 (18–44)	41.3 (34–54)	15.3 (13–20)	7.8 (1–14)	9.0 (4–17)
Lma	2.0 (1–3)	1.0 (1)	12.6 (4–24)	1.5 (1–2)	1.7 (1–2)	20.0 (9–39)	0.5 (2)	2.0 (1–3)	–* (1)	–* (1)

Ape = Amyrsidea perdicis, Mpa = Menacanthus pallidulus, Mga = Menopon gallinae, Gmi = Goniocotes microthorax, Gco = Goniodes colchici, Che = Cuclotogaster heterographus, Lma = Lipeurus maculosus

*only one bird was infested by chewing lice

wild turkeys, lice were collected from dead birds. For proper identification, all the lice were fixed in 96% ethanol, and subsequently slide-mounted as permanent slides following the technique in Palma (1978). The prevalence, mean intensity, intensity of infestation and mean abundance were determined for all the species of lice collected (sensu Bush et al., 1997).

RESULTS

Chukars kept in the Jinacovice pheasant farm were infested with seven species of chewing lice: three amblyceran species – *Amyrsidea perdicis* (Denny, 1842), *Menacanthus pallidulus* Neumann, 1912, *Menopon gallinae* (Linnaeus, 1758) and four ischnoceran species – *Goniocotes microthorax* (Stephens, 1829), *Goniodes colchici* Denny, 1842, *Cuclotogaster heterographus* (Nitzsch [in Giebel], 1866) and *Lipeurus maculosus* Clay, 1938. Chewing lice were found on all the birds examined, with individual chukars hosting from two to six species. Most of the chukars (61%) were infested with four species of lice. Three and five species of lice were found on 20% and 15% of chukars, respectively. The least frequent were infestations of two and six species of chewing lice (2% in each case). Mean intensity and infestation intensities for individual species over the monitoring period, the total prevalence, intensity and mean abundances are given in Tables 1 and 2. A total of 14 species of chewing lice were identified from all of the species of birds bred in the Jinacovice pheasant farm. A summary of all the species of chewing lice collected and identified, with their dominance and distribution on nine species of birds examined, is given in Tables 3 and 4. The two bird species that shared a maximum number of louse species in common (4 species) were chukars and grey partridges.

DISCUSSION

The type of hatching and rearing methods used in the Jinacovice pheasant farm rules out the possibility that any of the chewing lice recorded in this study be linked to either wild chukars (the birds are hatched from eggs brought in to the farm) or to the vertical transfer of lice from adults to young (kept separately in hatcheries). The conclusion is that chukars are infested with chewing lice as a result of horizontal transfers among adult birds. Hillgarth (1996) and Darolova et al. (2001) demonstrated that horizontal transfers were the main route for the spreading of chewing lice from one adult bird to another within the same species. In facilities where birds are kept in adjacent aviaries or even in mixed flocks, that kind of transfer is also possible between birds of different species. Chewing lice may migrate and thus colonize new hosts in basically two ways: through direct contact between two or more birds, or indirectly via shared dust baths (Price et al., 2003). Direct contacts are possible among birds of the same species, especially when they are squeezed together in the winter months (McGowan, 1994). Transfers of lice between birds of different species is also possible if they are kept together in mixed flocks or if birds are moved from one aviary to another. In the lat-

Table 2. Prevalence, mean intensity (± SE), intensity range and mean abundance (± SE) of chewing lice collected from chukars

	Prevalence (%)	Mean intensity ± SE	Intensity	Mean abundance ± SE
Goniocotes microthorax	100	160.5 ± 22.3	25–752	160.5 ± 22.3
Cuclotogaster heterographus	100	31.3 ± 3.1	1–144	31.3 ± 3.1
Goniodes colchici	90.1	7.3 ± 0.8	1–30	6.6 ± 0.8
Lipeurus maculosus	50.9	8.4 ± 1.8	1–39	4.1 ± 1.0
Menacanthus pallidulus	32.7	2.2 ± 0.5	1–9	0.7 ± 0.2
Amyrsidea perdicis	16.4	3.6 ± 0.5	1–9	0.5 ± 0.2
Menopon gallinae	0.8	–	1	0.02 ± 0.02
Total	100	203.8 ± 73.1	53–792	203.8 ± 73.1

Table 3. Species of lice and their host distribution in the Jinacovice pheasant farm

	Ach	*Ppe*	*Pco*	*Sre*	*Cja*	*Pcr*	*Gga*	*Nme*	*Mga*
Amblycera									
Amyrsidea minuta	–	–	–	–	–	+[1]	–	–	–
Amyrsidea perdicis	+	–	+[1]	–	–	–	–	–	–
Menacanthus cornutus	–	–	–	–	–	–	+[1]	–	–
Menacanthus pallidulus	+[3]	+	–	+	–	–	–[3]	–	–
Menacanthus stramineus	–	–	–	–	–	–	+[1]	–	+[1]
Menopon gallinae	+	–	–	–	–	–	+[1]	+[1]	–
Ischnocera									
Chelopistes meleagridis	–	–	–	–	–	–	–	–	+[1]
Cuclotogaster heterographus	+[2]	–	–[2]	–	–	–	+[2]	–	–
Goniocotes chrysocephalus	–	–	+[1]	+	–	+	–	–	–
Goniocotes gallinae	–	–	–	–	–	–	+[1]	+	–
Goniocotes microthorax	+[1]	+[1]	–	–	–	–	+	–	–
Goniodes colchici	+	+	+[1]	+	–	–	–	–	–
Lipeurus maculosus	+	+[1]	+[1]	+	–	–	–	+	–
Lagopoecus colchicus	–	–	+[1]	–	–	–	–	–	–
Total number of species	7	4	5	4	0	2	6	3	2
New louse-host associations	5	2	0	4	0	1	1	2	0

Ach – Alectoris chukar (*n* = 120); *Ppe – Perdix perdix* (*n* = 4); *Pco – Phasianus colchicus* (*n* = 20); *Sre – Syrmaticus reevesi* (*n* = 14); *Cja – Coturnix japonica* (*n* = 12); *Pcr – Pavo cristatus* (*n* = 1); *Gga – Gallus gallus* (*n* = 10); *Nme – Numida meleagris* (*n* = 10); *Mga – Meleagris gallopavo* (*n* = 2)

[1]primary hosts (i.e. these species of lice have been described, or subsequently recorded, from these hosts)

[2]*C. heterographus* is also known from ring-necked pheasant. No specimen of *C. heterographus* was found on this bird bred in Jinacovice

[3]the primary host of *M. pallidulus* is domestic fowl. No specimen of *M. pallidulus* was found on this bird bred in Jinacovice

ter case, some species of chewing lice may be left behind and survive in aviaries for several hours or even days without their hosts (Mullen and Durden, 2002). The possibility of chewing lice being transferred on hippoboscid flies, a phenomenon know as phoresis, should also be considered (Kerains, 1975). However hippoboscid flies occur only occasionally on gallinaceous bird (Büttiger, 1994), so importance of this rout of transfer is small.

Five species of lice have been recorded from *Alectoris chukar* by Price et al. (2003) and Aksin (2003) of which *Menacanthus lyali* Rodriguesz Caabeiro et al., 1983, *Goniocotes pusillus* (Nitzsch [in Giebel], 1866) and *Goniodes dispar* Burmeister, 1838 have not been found in this study. Considering the seven species of chewing lice collected from chukars during this study, it appears that five of them have been able to colonize birds held in captivity, although the extremely low prevalence of *Menopon gallinae* would suggest that this species is only an accidental straggler rather than a colonizer. The remaining four species: *Amyrsidea perdicis*, *Menacanthus pallidulus*, *Goniodes colchici* and *Lipeurus maculosus*, are all recorded from chukars for the first time in this paper (see Table 2). These species have been found on several gallinaceous hosts elsewhere, including ring-necked pheasants, grey partridges, domestic fowl and Reeves's pheasants (Price et al., 2003). The other two species collected from chukars in

Table 4. Dominance of lice on individual Gallinaceous birds bred in in the Jinacovice pheasant farm

Birds	Lice/dominance (%)						
Alectoris chukar (*n* = 120) (lice, *n* = 11 207)	*Gmic* 75.3	*Chet* 17.2	*Lmac* 4.2	*Gcol* 2.9	*Aper* 0.2	*Mpal* 0.1	*Mgal* 0.004
Perdix perdix (*n* = 4) (lice, *n* = 440)	*Lmac* 70.9	*Mpal* 11.8	*Gcol* 10.0	*Gmic* 7.3			
Phasianus colchicus (*n* = 20) (lice, *n* = 2 740)	*Gchr* 48.2	*Aper* 19.7	*Gcol* 15.3	*Lmac* 13.1	*Lcol* 3.7		
Syrmaticus reevesi (*n* = 14) (lice, *n* = 784)	*Gcol* 56.4	*Mac* 21.8	*Gchr* 10.9	*Mpal* 10.9			
Pavo cristatus (*n* = 1) (lice, *n* = 41)	*Amin* 95.9	*Gchr* 4.1					
Gallus gallus (*n* = 10) (lice, *n* = 790)	*Mstr* 6.3	*Mgal* 32.5	*Mcor* 23.4	*Ggal* 5.2	*Gmic* 1.3	*Chet* 1.3	
Numida meleagris (*n* = 10) (lice, *n* = 650)	*Ggal* 38.5	*Lmac* 32.3	*Mgal* 29.2				
Meleagris gallopavo (*n* = 2) (lice, *n* = 80)	*Cmel* 93.3	*Mstr* 6.7					

Cmel = Chelopistes meleagridis, Chet = Cuclotogaster heterographus, Gchr = Goniocotes chrysocephalus, Ggal = Goniocotes gallinae, Gmic = Goniocotes microthorax, Gcol = Goniodes colchici, Lcol = Lagopoecus colchicus, Lmac = Lipeurus maculosus, Amin = Amyrsidea minuta, Aper = Amyrsidea perdicis, Mcor = Menacanthus cornutus, Mpal = Menacanthus pallidulus, Mstr = Menacanthus stramineus, Mgal = Menopon gallinae

Jinacovice had been previously recorded on wild living chukars (Blagoveshtchensky, 1951) as well as on chukars reared on farms and subsequently released in the wild: *Goniocotes microthorax* in the U.S.A. (Emerson, 1972) and *Cuclotogaster heterographus* in New Zealand (Pilgrim and Palma, 1982). Regular and natural hosts of these louse species are the grey partridge* (for *G. microthorax*) and the ring-necked pheasant* (for *C. heterographus*), with chukars probably being secondary hosts (*sensu* Lakshminarayana, 1971). *Goniocotes microthorax* was also collected from grey partridges, and *C. heterographus* from Guineafowl, in this study (see Table 3).

Adults, larval stages and eggs of three species of chewing lice (*Goniocotes microthorax*, *Goniodes colchici* and *Cuclotogaster heterographus*) were found on chukars over the entire monitoring period during this study (Table 1). This would indicate that they were not random stragglers but lice that have successfully adapted to chukars and established as viable, self-sustaining populations. Although the presence of the other four species may have been the result of accidental transfers – as is certainly the case of *M. gallinae* – they nevertheless corroborate the existence of transfer routes for chewing lice among different bird species. It is also support by fact, that 15 of 33 louse-host associations found on Jinacovice are recorded for the first time in this paper.

Increased incidence of the Amblycera in the summer season (July–September) was probably related to the population dynamics of those species. The maximum mean intensity levels of three chewing lice from hens were reported in the May–July period by Zlotorzycka (1981). The population size then decreases markedly, which may be connected with the spread of chewing lice to new hosts (Zechnov, 1950).

Because the population of *Goniocotes microthorax* collected in this study was sufficiently large, it is possible to follow its dynamics (Table 1). The maximum increase in the population size was achieved in the winter months (December–February), which might be due to more opportunities for the chewing lice to migrate between individual birds.

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REFERENCES

Aksin N. (2003): The presence of Mallophaga species on wild partridge in the Elazig district (in Turkish). Turkish Journal of Veterinary and Animal Sciences, 27, 559–565.

Blagoveshtchensky D.I. (1951): Mallophaga of Tadzhikistan (in Russian). Parazitologicheskij Sbornik, 13, 272–327.

Büttiger W. (1994): Die Lausfliegen der Schweiz (Diptera, Hippoboscidae) mit bestimmungsschlüssel. Documenta Fauunistica Helvetiae, 15, 117 pp.

Bush A.O., Lafferty K.D., Lotz J.M., Shostak A.W. (1997): Parasitology meets ecology on its own terms: Margolis et al. revisited. The Journal of Parasitology, 83, 575–583.

Clayton D.H., Drown D.M. (2001): Critical evaluation of five methods for quantifying chewing lice (Insecta: Phthiraptera). The Journal of Parasitology, 87, 1291–1300.

Clayton D.H., Walther B.A. (1997): Collection and quantification of arthropod parasites of birds, 419–440. In: Clayton D.H., Moore J. (eds.): Host-parasite Evolution: General Principles and Avian Models. Oxford University Press, Oxford. 473 pp.

Darolova A., Hoi H., Kristofik J., Hoi Ch. (2001): Horizontal and vertical ectoparasite transmission of three species of Mallophaga, and individual variation in European Bee-eaters (*Merops apiaster*). The Journal of Parasitology, 87, 256–262.

Emerson K.C. (1972): Checklist of the Mallophaga of North America (North of Mexico) Part I. Suborder Ischnocera. Desert Test Center, Dugway, Utah. 1–200.

Hillgarth N. (1996): Ectoparasite transfer during mating in Ring-necked Pheasants *Phasianus colchicus.* Journal of Avian Biology, 27, 260–262.

Hrib M. (1994): Opportunities of the Chukars keeping in Czechoslovakia (in Czech). [Diploma thesis.] Mendel University of Agriculture and Forestry in Brno, Faculty of Forestry and Wood Technology. 80 pp.

Jurasek V., Dubinsky P. (eds.) (1993): Veterinary Parasitology (in Slovak). Priroda, Bratislava. 382 pp.

Keirans J.E. (1975): A review of the phoretic relationship between Mallophaga (Phthiraptera: Insecta) an Hippoboscidae (Diptera: Insecta). Journal of Medical Entomology, 12, 71–76.

Kettle D.S. (ed.) (1990): Medical and Veterinary Entomology. C.A.B. International, Wallington, Oxford.

Lakshminarayana K.V. (1971): Evaluation of secondary infestations in Mallophaga. Angewandte Parasitologie, 13, 52–53.

McGowan P.J.K. (1994): Family Phasianidae (Pheasants and Partridges). In: del Hoyo J., Elliott A., Sargatal J. (eds.): Handbook of the Birds of the World. Vol. 2. New World Vultures to Guineafowl. Lynx Edicions, Barcelona. 434–554.

Mullen G., Durden L. (eds.) (2002): Medical and Veterinary Entomology. Academic Press, London. 597 pp.

Palma R.L. (1978): Slide-mounting of Lice: a detailed description of the canada balsam technique. The New Zealand Entomologist, 6, 432–436.

Pilgrim R.L.C., Palma R.L. (1982): A list of the chewing lice (Insecta, Malophaga) from birds in New Zealand. National Museum of New Zealand, Miscellaneous Series No 6, 1–32.

Porkert J. (1978): Mass occurrence of *Goniocotes megalocephalus* on one injured Hazel Grouse (in German). Angewandte Parasitologie, 19, 213–219.

Price R.D., Hellenthal R.A., Palma R.L., Johnson K.P., Clayton D.H. (2003): The chewing lice: world checklist and biological overview. Illinois Natural History Survey, Special Publication 24. 501 pp.

Zechnov M.I. (1950): Adaptation in reproduction of chewing lice from the Eurasian Jackdaw (*Coloeus monedula* L.) (in Russian). Zoologicheskii Zhurnal, 29, 478–480.

Zlotorzycka J. (1981): Influence of environment on population dynamic of chewing lice (Mallophaga) of Poultry (in Polish). Wiadomosci Parazytologiczne, 3–4, 87–92.

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