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Fleas (Siphonaptera) from Nests and Burrows of the Bank Swallow (*Riparia riparia*) in Alaska

Abstract

Fleas collected from 36 vacated nests and 18 active and inactive burrows of the Bank Swallow in Alaska south of the Yukon River and west of the Yukon Territory totaled 1503 (57 percent females) *Ceratophyllus styx riparius* Jordan and Rothschild and 62 (66 percent females) *C. c. celsus* Jordan. The two taxa were collected from 19 and 9 localities, respectively. *C. c. celsus* outnumbered *C. s. riparius* only at the southernmost locality. The ranges of *C. styx riparius* and *C. c. celsus* were extended 465 and 700 km southwestward, respectively. Females of both taxa have a rather variable posterior margin of sternum VII.

Introduction

This report is the second concerning our survey of ectoparasites of swallows in Alaska. In concurrence with results of the only other study of fleas of Bank Swallow (*Riparia riparia* (Linnaeus)) nests and burrows in Alaska (Hopla, 1965), we collected large numbers of *Ceratophyllus styx riparius* Jordan and Rothschild and small numbers of *Ceratophyllus celsus celsus* Jordan. We extended the ranges of *C. styx riparius* 465 km and *C. c. celsus* 700 km from southcentral Alaska southwest to the Alaska Peninsula, the only locality where *C. c. celsus* outnumbered *C. s. riparius*. Females of both taxa have a rather variable posterior margin of sternum VII.

Procedures

Bank swallow nest sites were sought south of the Yukon River and west of the Yukon Territory from 1973 to 1978. Vacated nests were removed from burrows with a trench shovel and longhandled forceps during April-May and July-October. Nests from the same colony were pooled in one bag, carried to the laboratory, and carefully broken apart in a pan. Fleas were captured with a light-weight forceps. Selected individuals were cleared and permanently mounted in Canada balsam, others were preserved in 70 percent ethanol, and all were identified, sexed, counted, and labelled. Specimens were deposited in the Agriculture Canada Biosystematics Research Institute, Ottawa, and in the authors' collections.

Supplementary collections of fleas were made from burrow entrances, particularly

in June when birds were nesting. Fleas that aggregated at burrow entrances were captured using forceps, a piece of white flannel cloth, and a dish pan. Some fleas were so stimulated by shadows and breath of the collectors that they jumped or crawled out of burrows and were captured from some projection below.

Infested nests and burrows were pooled separately except at collection locality I (see list below), where they were pooled together (Table 1). Uninfested burrows and nests were observed in most colonies but were not routinely counted and recorded as occupancy histories were unknown.

For brevity in presentation of results (Table 1), collection localities were alphabetically assigned the following code letters:

- A. Anchorage, 30 km SE: mound between Seward Hwy and Turnagain Arm;
- B. Brushkana Cr., 4.8 km W: road cut along Denali Hwy;
- C. Cohoe, 8 km S: gravel pit along Cohoe Rd;
- D. Eagle: bluff along Yukon R;
- E. Ernestine: gravel pit along Richardson Hwy;
- F. Fairbanks, 48 km WSW: road cut along Parks Hwy;
- G. Houston: gravel pit near Parks Hwy;
- H. Kasilof, 1.6 km S: road cut along Sterling Hwy;
- I. King Salmon, 9.3 km SE: bluff on point in bend of Naknek R;
- J. Knik, 1.6 km N: gravel pit near Knik Rd;
- K. Lower Tonsina, 0.5 km N: road cut along Edgerton Hwy;
- L. Palmer, 7.1 km W: road cut along Bogard Rd;
- M. Palmer, 9.6 km N: road cut along Buffalo Mine Rd;
- N. Paxson, 1.6 km N: gravel pit along Richardson Hwy;
- O. Soldotna, 16.4 km E: road cut along Sterling Hwy;
- P. Soldotna, 29 km E: road cut along Sterling Hwy;

TABLE 1. Fleas (*Ceratophyllus*) from Bank Swallow nests and burrows in Alaska, 1973-1978.

| Nest (Burrow) Number | Local- ity | Date | <i>C. styx riparius</i> | | | Total | <i>C. c. celsus</i> | | |
|----------------------------|---------------|------------|-------------------------|-----|-----------------------|-------|---------------------|-----|-------|
| | | | ♂ ♂ | ♀ ♀ | Total | | ♂ ♂ | ♀ ♀ | Total |
| | | | sternum VII narrow | | ventral lobe broad | | | | |
| (1-4) | M | 16.IX.73 | 12 | 14 | 0 | 26 | 0 | 0 | 0 |
| (6-9) | M | 20.VI.74 | 3 | 10 | 0 | 13 | 0 | 1 | 1 |
| 1-3 | G | 21.IV.74 | 42 | 27 | 2 | 71 | 0 | 0 | 0 |
| 5 | G | 26.VII.74 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| 6-8 | G | 31.VII.74 | 1 | 4 | 3 | 8 | 0 | 0 | 0 |
| 4 | K | 25.V.74 | 4 | 18 | 0 | 22 | 1 | 2 | 3 |
| 13-15 | K | 10.VIII.74 | 27 | 42 | 0 | 69 | 0 | 4 | 4 |
| (5) | H | 10.VI.74 | 1 | 4 | 0 | 5 | 1 | 3 | 4 |
| (10-15) | A | 22.VI.74 | 30 | 62 | 5 | 97 | 1 | 7 | 8 |
| 9-10 | R | 31.VII.74 | 6 | 2 | 1 | 9 | 0 | 0 | 0 |
| 11-12 | E | 10.VIII.74 | 5 | 9 | 0 | 14 | 0 | 0 | 0 |
| 16 | N | 17.VIII.74 | 40 | 22 | 0 | 62 | 1 | 3 | 4 |
| 17-19 | B | 18.VIII.74 | 1 | 2 | 0 | 3 | 0 | 0 | 0 |
| 20* | Q | 19.VIII.74 | 18 | 36 | 0 | 54 | 0 | 0 | 0 |
| 21 | J | 23.VIII.74 | 80 | 96 | 5 | 181 | 3 | 2 | 5 |
| 22-25* | F | 6.IX.74 | 76** | 87 | 0 | 163 | 6 | 9 | 15 |
| 26 | L | 12.IX.74 | 264 | 304 | 15*** | 583 | 0 | 0 | 0 |
| 27 | P | 14.IX.74 | 5 | 3 | 1 | 9 | 1 | 0 | 1 |
| 28* | O | do | 5 | 11 | 7 | 23 | 0 | 0 | 0 |
| 29 | C | 15.IX.74 | 8 | 7 | 0 | 15 | 0 | 0 | 0 |
| 30-31 | D | 11.VIII.75 | 5 | 37 | 0 | 42 | 0 | 0 | 0 |
| 32-34 + (16-18) | I | 4.X.77 | 2 | 2 | 0 | 4 | 7 | 10 | 17 |
| 35-36 | S | 31.VIII.78 | 15 | 14 | 0 | 29 | 0 | 0 | 0 |
| TOTALS | | | 650 | 814 | 39 | 1,503 | 21 | 41 | 62 |

*Only sample of fleas collected.

**Includes 1 intersex (see Haas, 1980).

***Includes 1 intergrade.

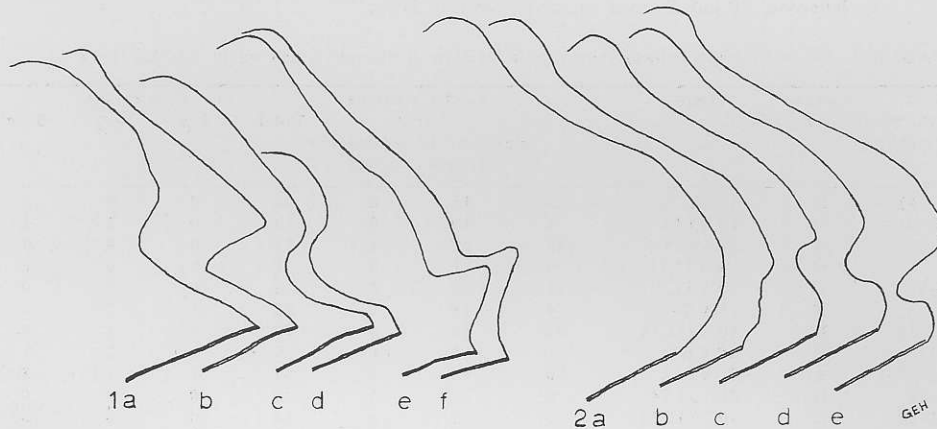
Q. Wasilla, 4 km S: gravel pit along Fairview Lp;
 R. Willow: gravel pit near Hatcher Pass Rd; and
 S. Yukon R. Bridge of Yukon-Prudhoe Hwy, 1.6 km E: road cut along Hwy.
 Collection data are presented in Table 1 chronologically.

Results

Two taxa were collected: *Ceratophyllus styx riparius* Jordan and Rothschild and *C. celsus celsus* Jordan (Table 1). The first occurred in all 19 localities surveyed, predominated in 18 of them, and represented over 96 percent of the total collection with 1503 specimens. The second occurred in nine localities, predominated in one, and represented less than 4 percent of the total collection with 62 specimens.

Collections near King Salmon, Alaska Peninsula (locality I), extended the range of *C. styx riparius* 465 km southwest from Potter, Turnagain Arm (Hopla, 1965), and the range of *C. c. celsus* 700 km southwest from the Susitna River, Denali Highway (Haas and Wilson, 1980).

Table 1 lists counts of *C. styx riparius* females by 2 sternum VII morphological types. One of the 39 specimens tabulated under broad ventral lobe actually is an intergrade (Fig. 1 c & d). Therefore, 38 of 853 females (4.4 percent) are truly in the broad lobe group. Morphological variations in *C. c. celsus* females were not tabulated. The shape of the posterior margin of sternum VII intergrades from a single well-rounded lateral lobe to a moderately deep lateral sinus (Fig. 2 a-e).



Figures 1 and 2. Variations in outline of sternum VII of females of (1) *Ceratophyllus styx riparius* Jordan and Rothschild (a from locality M, b from loc R, c and d left and respective right side of specimen from loc L, e and f from loc L); (2) *Ceratophyllus celsus celsus* Jordan (a from loc A, b from loc F, c and d from loc J, e from loc K).

Discussion

Riparia riparia, the Bank Swallow, breeds widely in the Northern Hemisphere and winters in South America, Africa, and southern Asia (Peterson, 1961). Gabrielson and Lincoln (1959) and Kessel and Gibson (1978) described this colonial swallow as a common and locally abundant breeder throughout central Alaska from mid-to late May to mid-August, and indicated that there are peripheral breeding records for western, southwestern, the north Gulf Coast-Prince William Sound region, and southeastern Alaska. The birds winter in South America.

Breeding habits of these swallows are especially favorable for high infestation of nests by arthropods. Burrowing and nesting are described by Gabrielson and Lincoln (1959) and Harrison (1975). Colonial habits; long, narrow burrows in the earth; nests of organic matter; and reuse of burrows in successive years are ecological factors favorable for nest-fleas. Many studies of fleas in *R. riparia* nests in Europe, Asia, and North America have been published (see Hicks, 1959, 1962, 1971). Several species of bird fleas and even mammal fleas were recorded, but the only true *R. riparia* nest-fleas are *Ceratophyllus styx* Rothschild, *C. celsus celsus* Jordan, and *Frontopsylla lapponica* (Nordberg). They are Holarctic, Nearctic, and Palaearctic, respectively.

Ceratophyllus styx has four recognized subspecies: *C. s. styx* ranges through most of the European Subregion of the Palaearctic Region and Kazakhstan, and *C. s. jordani* Smit ranges through the British Isles except in areas in the south, southeast and east of England where it is replaced by the nominate subspecies (Smit, 1955; Rothschild and Smit, 1955; Smit, 1969). *Ceratophyllus s. freyi* Nordberg replaces *C. s. styx* in northern Scandinavia and Finland (Smit, 1969; Brinck-Lindroth and Smit, 1971). *Ceratophyllus styx riparius* Jordan and Rothschild ranges from Trans-Baykalia, Mongolia, and Japan to North America (Smit, 1967; Lewis, 1975; Ono, 1964).

Ceratophyllus c. celsus has a broad transcontinental range in North America occurring in nests of Bank Swallows and Cliff Swallows (*Petrochelidon pyrrhonota* (Vieillot)) depending on geographic location (Benton and Shatrau, 1965; Hicks, *loc. cit.*; Nelson, 1972). *Frontopsylla lapponica* is known from northern Sweden and Finland and also from Trans-Baykalia and Mongolia (Smit, 1967; Brinck-Lindroth and Smit, 1971).

The first study of fleas in nests and burrows of Bank Swallows in Alaska was by Hopla (1965), who reported on one small collection (1 male, 1 female *C. s. riparius*) at Potter, Turnagain Arm, and on many large collections in central Alaska. His total collections were 13,940 *C. s. riparius* from 80 nests and 47 *C. c. celsus* from seven nests. One *C. idius* Jordan and Rothschild, usually found in nests of Tree Swallows (*Iridoprocne bicolor* (Vieillot)), and two *C. scopulorum* Holland, a nest-flea of the Cliff Swallow, were also found.

We found only *C. s. riparius* and *C. c. celsus* in nests and burrows of Bank Swallows, and as usual for bird fleas (Rothschild, 1952), females predominated in both taxa. The 1503 *C. s. riparius* recorded in Table 1 consisted of 56.8 percent females. This figure is rather close to 55.9 percent calculated from Hopla's (1965) data (7800 females). In contrast, his *C. c. celsus* data were remarkably close to equality (23 males and 24 females; i.e., 51 percent females). Our larger collection of 62 individuals (Table 1) consisted of 66 percent females, and when data from both studies were combined (44 males, 65 females), females were still highly predominant at 60 percent. This figure suggests that, with an exception discussed below, conditions in Bank Swallow nests and burrows in Alaska are not as favorable for this taxon as for *C. s. riparius*. Less than 4 percent of our total collection was *C. c. celsus*; only 0.003 percent of Hopla's (1965) collection was *C. c. celsus*.

While extending ranges of *C. s. riparius* and *C. c. celsus* southwestward, we detected a trend for the second taxon to increase in number relative to the first. Hopla (1965) anticipated this sort of shift when he wrote that it would be interesting to see if *C. c. celsus* is prominent in Bank Swallow nests in southeastern Alaska. From data in

Table 1, it can be calculated that if fleas from only single and pooled nests infested with *C. c. celsus* are totaled, this taxon increases from less than 4 percent to 6 percent (32 of 537 fleas). As these localities were widely scattered, a southward weighting is necessary. Thus, if the same calculations are applied to burrow collections near Cook Inlet in June, when no nests were collected, we note *C. c. celsus* increases to 10 percent (13 of 128 fleas). If all burrow collections including the burrow and nest pool near King Salmon (locality I) are used in the calculations, *C. c. celsus* increases to 17 percent (30 of 175 fleas). Furthermore, as shown in Table 1, *C. c. celsus* predominated at locality I with 17 of 21 fleas (80 percent).

Females of both *C. s. riparius* and *C. c. celsus* have a rather variable posterior margin of sternum VII. The first taxon is almost dimorphic, there being but a single intergrade (tabulated under broad lobe) (Fig. 1 c & d). Most specimens are of the usual type, i.e., with a narrow ventral lobe below a deep sinus (Fig. 1 a & b), but 38 specimens from seven localities near Cook Inlet (Table 1) have a broad ventral lobe without the sinus above (Fig. 1 e & f). This form was reported from New Brunswick and illustrated by Benton and Shatrau (1962; Fig. 1). They reported this dimorphism (there were no intergrades) occurred in 15.5 percent of 135 specimens. We recorded 5.8 percent (38 of 658) of *C. s. riparius* collected from localities near Cook Inlet with the broad lobe. Broad-lobed specimens of *C. s. riparius* are known also from Japan. Ono (1964) reported 73 (12.4 percent) of 590 females from Hokkaido with the same form of lobe as certain specimens of *C. s. freyi* in Finland (cf. Fig. 3 g & h, Ono; Fig. 16 c-g, Smit, 1956). Smit (1955) noted in his description of *C. s. jordani* that a population from one locality in Britain had a wide range of variation from the broad ventral lobe to the narrow *C. r. riparius* (= *C. s. riparius*) type. Our intergrade (Fig. 1 c & d) from near Palmer (locality L) falls within the range of variation as illustrated in his Fig. 79. We cannot explain why the broad-lobed form of *C. s. riparius* appeared in our collections only from near Cook Inlet, but its presence in Alaska strengthens the concept of a Holarctic *C. styx*.

The posterior margin of sternum VII of *C. c. celsus* varies continuously from a single, well-rounded lateral lobe to a lateral sinus (Fig. 2). In three specimens the sinus is shallow (e.g., Fig. 2 c). In two other specimens, the lateral sinus is deeper (Fig. 2 d & e). Keys to North American bird fleas in the genus *Ceratophyllus* should indicate that *C. s. celsus* females, as well as those of *C. niger* Fox and *C. petrochelidoni* Wagner (see Holland, 1951), may have a sinus in the posterior margin of sternum VII.

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