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CERATOPHYLLUS VAGABUNDUS INSULARIS ROTHSCHILD, 1906 AND C. ROSSITTENSIS DAMPF, 1913 (SIPHONAPTERA) IN CZECHOSLOVAKIA

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Abstract. The conditions for the occurrence of two flea species — *Ceratophyllus vagabundus insularis* and *C. rossittensis* — in Czechoslovakia were studied. Using as a basis the present knowledge on the occurrence of these two flea species on typical hosts (*Corvus monedula* and *C. corone*), the author presents the natural patterns which account for the occurrence of specific and nonspecific species (included in the zones of siphonapteria). This inclusion is found to be closely connected to the bionomy of the flea and that of its host (nidobiology). The ecological conditions, whether natural or modified by human activities, are considered as decisive for the occurrence of specific and nonspecific fleas.

Data about the occurrence of the two species in Czechoslovakia were published earlier (Rosický 1955, Jurík 1967, 1968, 1974, Ryba and Balát 1977, Kiefer et al. 1981). In this study, primarily some problems are dealt with which resulted from a detailed analysis of conditions under which the two above flea species occur in Czechoslovakia: 1. character of the occurrence, 2. importance of the host's bionomy and 3. conditions affecting the occurrence of specific and nonspecific flea species on hosts. Previous extensive siphonapterological studies (Rosický 1955, 1957) carried out throughout the Czechoslovak territory made it possible, by comparing earlier and recent findings as well as a detailed analysis of their occurrence, to suggest reasons for the failure to detect them earlier.

C. vagabundus was found on a number of host species, above all on members of Corvidae, Accipitres and Lari (Rothschild 1952). On the European continent, the subspecies *C. vagabundus insularis* is known only from nests of *Corvus monedula*.

A total of 16 jackdaws's nests were examined situated on buildings (*C. gallinae* 108 ex., *N. fasciatus* 1 ex.) and only one in the original nesting site, i.e. an oak tree hollow (with 11 ♂♂ and 23 ♀♀ of *C. vagabundus* — Jurík 1974).

As hosts of *C. rossittensis Covrus c. corone* and *C. c. cornix* were described. These fleas were also found on various birds of prey (Costa Lima and Hathaway 1946, Smit 1957). Skuratowicz (1967) characterized the present knowledge on this species by the following words: "It is a species with a wide but still very insufficiently studied geographic occurrence".

A total of 10 negative and 2 positive nests of *C. c. cornix* were examined (2 ♂♂ and 3 ♀♀ of *C. rossittensis* — Jurík 1968).

I. CHARACTERIZATION OF THE OCCURRENCE OF THE TWO FLEA SPECIES IN CZECHOSLOVAKIA

As suggested by the hitherto known occurrence of both above mentioned flea species and their main hosts, either should be quite common in Czechoslovakia. But what are the reasons for the very rare findings of these two species? It may be claimed that all nests of *C. monedula* investigated so far originated from secondary nesting sites situated on buildings or in nest boxes. Whenever nests from the original nesting sites, i. e. from natural tree hollows (Ferianc 1964, 1965) were collected, the specific species *C. vagabundus* was observed in them (Jurík 1967). As far as the species *C. corone* is

concerned, a number of its nests in Czechoslovakia were studied (Rosický 1957, Juríx 1967, 1968). The changed conditions did not force crows to use new types of nesting sites; the original character of their nests was preserved. The crows were considerably reduced in number by the cultivation of landscape and primarily by intensive hunting and game keeping, and the continuity of nesting was almost completely interrupted in the major part of Czechoslovak territory. Whenever we could find areas with a relatively dense population and at least partly preserved continuity of nesting, the specific species *C. rossittensis* was detected (Juríx 1968).

In this respect the findings of both species under study in Czechoslovakia have to be considered as original relict micropopulations in original habitats — microhabitats.

II. THE IMPORTANCE OF HOST BIONOMY

In Czechoslovakia, a country well studied from the siphonapterological aspect, the above mentioned fact suggests that evaluation of the occurrence of particular flea species must be based not only on a detailed knowledge of the flea itself but also on the occurrence of hosts, on a profound knowledge of their bionomy, character of their occurrence as well as on detailed studies of their ecology and primarily of nidobiology.

As seen from the present occurrence of hosts of the two flea species studied, either occurs throughout the territory of Czechoslovakia. As mentioned above, the specific flea species could find favourable conditions for their permanent occurrence (based on suitable developmental conditions) in original microhabitats only. This means that, if the host species also occupied those parts of its range where changes in the original type of nesting sites took place or where the original conditions had changed due to the cultivation of landscape, the specific flea species would dissapear although the host could develop without difficulties. The validity of this pattern was also confirmed with other species. For example, *Riparia riparia* has its specific flea (*C. styx*) which, however, is absent in the southern part of its European range (probably due to a decreased humidity? — Peus 1954). The relationship between the main host and specific parasites (fleas) within the whole area must be judged from this view point, but the problem must be further studied.

III. CONDITIONS INFLUENCING THE OCCURRENCE OF SPECIFIC AND NONSPECIFIC FLEA SPECIES ON THE HOST

Considering the occurrence of specific flea species, it is necessary to divide the range of the host species as follows:

1. The part offering optimum conditions (as considered from the developmental aspect) for the formation of relationships between the main host and the specific flea species (Fig. I : 1). In this particular part of the area, the specific flea species lives in abundance on its host and frequently infests other host species living in the common or similar biotopes (ecological relationships — Fig. I, 7). Under such conditions, they can also occur on predators (trophic relationships — Fig. I, 6).
2. The part of the area where the developmental conditions for the specific flea species are not optimal. Here, the parasites live on the main host only (Fig. I, 2).
3. The part of the area where conditions are different either due to its original ecological diversity or due to secondarily changed character of original conditions. Here, the flea species live only on their main host (Fig. I, 3); in the former case they live only in small microhabitats where they find at least minimum developmental conditions, as it is usual after the introduction of populations (Fig. I, 5), e. g. a wetted truss of the tower in Schwerin (Peus 1968) while in the latter case they occur in the original, preserved

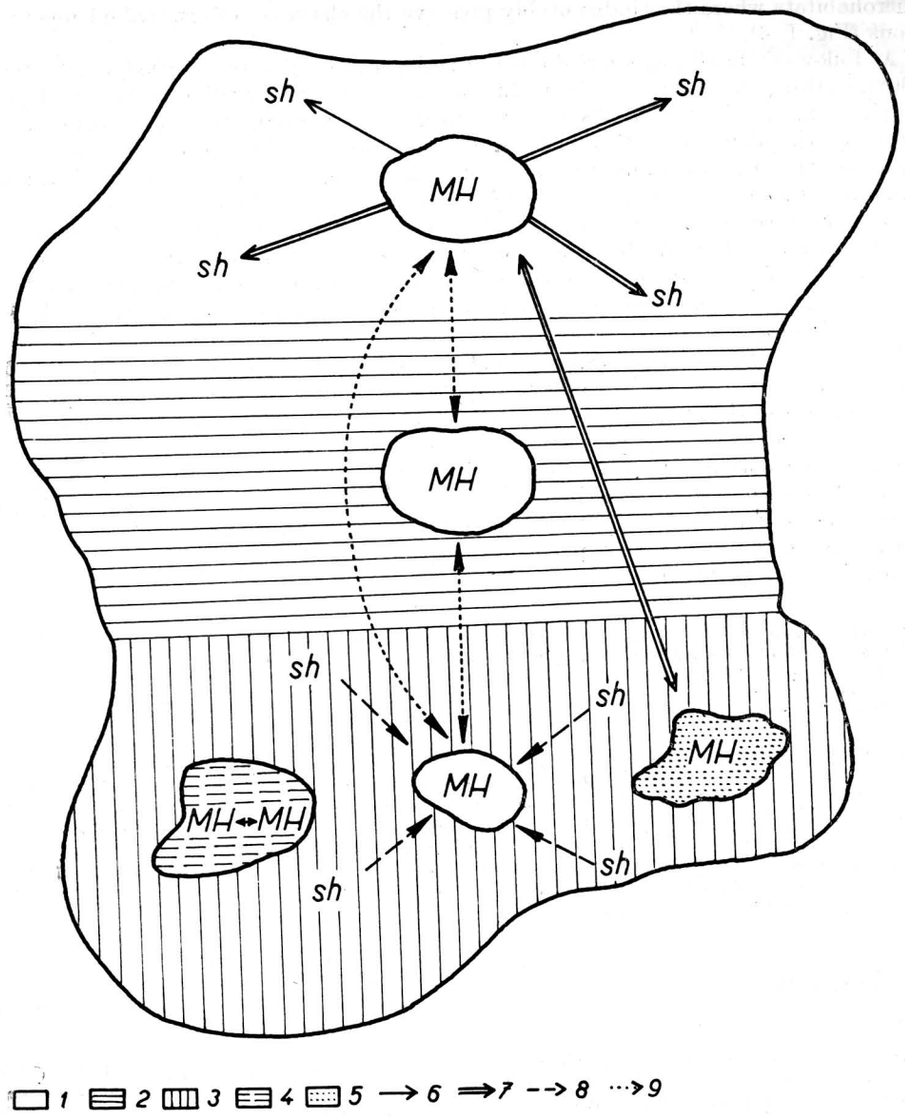

Fig. I. Schematic representation of the host and specific flea areas. **1.** The part of area with optimum conditions for the specific flea development; **2.** The part of area with at least minimum conditions for the development; **3.** The part of area where the common specific species fails to find conditions for its development; **4.** Microhabitats where the conditions for the development of original micropopulations of the specific flea species have been preserved; **5.** Microhabitats where the specific species may occur only after the introduction; 6—7. Range of specific flea species. (**6.** due to trophic relationships; **7.** due to ecological relationships); 8—9. Range of nonspecific flea species (**8.** from main hosts of nonspecific to those of specific flea species; **9.** Range into various parts of the area). MH: Main host of specific flea species. sh: Secondary host of the specific flea species.

microhabitats where they indisputably preserve the character of original micropopulations (Fig. I, 4).

As follows from studies carried out in Czechoslovakia (Rosický 1957, Jurík 1967, 1968), in this part of the area the main hosts are included according to their ecological requirements in the zones of siphonapteria (Rosický 1950, 1957) and acquire quite regularly the nonspecific flea species. *Corvus corone — Ceratophyllus gallinae*, and *C. monedula — C. gallinae* may be mentioned as examples in connection with nesting boxes and *C. monedula — Nosopsyllus fasciatus* when nesting on buildings.

It is evidently impossible to evaluate the relationships between the host and the parasite only on the basis of the occurrence of certain species on a certain host in a certain part of the host's range. On the other hand, the above mentioned patterns referring to the occurrence of specific and nonspecific flea species may be of great epizootological and epidemiological importance.

These natural patterns are schematically represented in Fig. I. It must be pointed out that the occurrence of specific flea species is limited by ecological conditions to a certain part of the area of the main host; on the other hand, when nonspecific species infest the main host, they may be introduced into those parts of the area where the specific species occurs (dotted arrows in Fig. I, 9). The importance of these changes is more pronounced in the case of flea species due to the migration of individual bird populations. These patterns might be of great importance if the specific (or nonspecific) flea species became vector of pathogenic agents out of the area of its traditional occurrence (Jurík 1972).

CERATOPHYLLUS VAGABUNDUS INSULARIS ROTHSCHILD, 1906 И *C. ROSSITTENSIS* DAMPF, 1913 (SIPHONAPTERA) В ЧЕХОСЛОВАКИИ

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Резюме. Автором рассматриваются условия наличия *Ceratophyllus vagabundus insularis* и *C. rossittensis* в ЧССР. На основании существующих знаний о наличии приведенных выше видов на типичных хозяевах (*Corvus monedula* и *C. corone*) описаны закономерности, обусловливающие наличие специфических и неспецифических видов (зачисленных в зоны siphonapteria). Такое зачисление обусловлено биономией блохи и биономией хозяина (нидобиологией). Экологические условия, как природные так измененные под влиянием деятельности человека, являются решающими для наличия специфических и неспецифических видов блох.

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