

BIOLOGY AND EPIDEMIOLOGICAL ROLE OF ARTHROPODS
IN ENVIRONMENTS AT VARIOUS STAGES
OF ANTHROPOGENIZATION

STATE OF INVESTIGATIONS ON MITES, LICE, ANTS, BRACHYCERA AND
OTHER ARTHROPODS WHICH ARE PARASITIC OR NOXIOUS TO MAN AND
DOMESTIC ANIMALS

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The password of our Symposium — “Parasitic arthropods under anthropopressure” — requires that the author brings to the fore those papers which inform about the effect of human activities on insects and arachnids or the reverse, namely the influence these arthropods have on human activities. The meetings of this Section are mainly devoted to the biology and epidemiological role of the arthropods mentioned. Further, the review of attainments covers chosen problems of the faunistics of domestic animals' parasites and work concerning the structure and functions of the arthropods of interest to us.

The fact that human activities influence the characteristic of parasitic arthropods is now an element of text-book knowledge. The culminant argument can be the body louse, which was only able to adapt itself to existence in clothing after man had reached a certain stage of material culture. Analogous conclusions can be drawn from the shaping of a separate species of louse for the domestic dog, were the initial form was the parasite of domesticated sheep. It is thus assumed that in these cases, the evolution of the louse required persistent influence of conditions created by man. Alpatov et al. (1945; 1955) alone, informed as to the ability of human lice to transform from the head to the body form in laboratory conditions, during only several score generations, which corresponds to a period of several years. In this respect, Machel's paper submitted to the Symposium, on the biological features of the human lice *Pediculus h. humanus* L. after 30 years of continuous laboratory breeding, might comprise an interesting and weighty argument. This would probably be an argument in favour of the relatively rapid bio-

logical changes in the louse. This is suggested after comparison of present results with the work of various authors from the former Department of Professor Weigl, on the biology of the human louse, published 25 years ago. The biological and morphological changes in rickettsiae bred in such louse over many years (Zatulovsky, 1974) may also indicate, indirectly, changes which take place during laboratory breeding, in the organism of the louse. It is thus a pity that Machel restricted his paper to a pure description of fertility observed in lice at present, quantity of blood samples taken and bionomical features, leaving the reader to draw his own conclusions.

Left us now go on to the consequences of anthropopressure occurring in human parasites and those of domestic animals in non-laboratory conditions. Basing on the papers submitted to the Symposium, let us first turn our attention to the prevalence and dynamics of appearance (seasonal and diurnal) of insects and arachnids in habitats at different stages of anthropogenization. The unfavourable influence of what is in fact, the artificial aggregation of host mammals and in the human host, his behaviour, habits and even fashion, on the intensification of infestation, is stressed everywhere.

The species which have accompanied man over the ages, include the itch mite *Sarcoptes scabiei* (L.) In certain periods and environments, this is also not a rarity in Poland, but this has not been reflected sufficiently in professional literature. Conditions for the conducting of epidemiological research improved in our country, when scabies was included among the infectious diseases, and full, uniform records of all cases introduced, 10 years ago. Even so, work conducted later, continued to be of a local character. Recently Żukowski submitted his paper entitled "Scabies in the population of Poland in 1966", which embraced the whole country. Apart from confirming the generally known factors (e. g. differentiation between particular centres as regards morbidity, seasonal fluctuations of epidemics etc.), it leads to concrete and important conclusions. Among other things, we learn that the highest percentage of cases was in the 5 to 19 years age groups and that losses resulting from absenteeism amounted to about 7 million zloties. It was a pity that Żukowski's work concerned the period of 1966. It should be remembered that the epidemiological situation at the time, which was 328/100,000 inhabitants, deteriorated later as the result of the scabies pandemia which spread throughout Poland and the situation at present is now much better. If we are to believe Sönnichsen (1974), scabies morbidity has a 15-year rhythm, this being the time required for scabies immunity acquired to decline in a substantial part of the human population. According to this theory, we should now be in the most favourable position in the epidemio-

logical sinusoid and it should be high time to attempt to further knowledge of the reasons for the regular increase in the number of fresh cases of scabies in the IV quarter of the year. The diagnosis of scabies comes to the fore here. It is both written and related, that there are many cases of scabies with atypical symptoms, which may give rise to doubt as to the identity of the etiological factor.

It is completely different in the case of pediculoses. As it is not obligatory to register cases, a picture of the existing state of infestation is available only from literature, or scattered materials from the sanitary-epidemiological field stations. Thus, for example, in such large urban centre as Wrocław, infestations by head lice was confirmed in 1.5% of children in elementary and secondary schools (Chylak et al., data for 1964-1965), and surveys conducted in summer camps at Gdańsk in 1970-1974 proved there to be pediculosis in 0.50-0.85% of children every year (material from the Gdańsk San. Epid. Field Station). These figures would seem to be somewhat low, however, in comparison with analogical material from Czechoslovakia, West Berlin and Great Britain, from the beginning of the seventies (indices 4.13-8.6%). The reason for the low approximate indices in Poland, probably lies in the fact that not all children take advantage of the summer camps, also careful preparation of the children prior to the holidays, as well as diverse assessment of the infestation, where there are nits but no mobile forms, etc. Apart from this, the indices do not include children of kindergarten age, or adults, nor do they cover the whole range of lice species.

Pediculosis corporis is very rare in Poland and usually only found in some decrepit individuals. In Western Europe and North America, a certain upward trend in the number of cases of pediculosis capitis and pediculosis pubis can be observed. These infestation are found in various age groups, irrespective of the material situation, thus a higher standard of living does not automatically eliminate such parasitoses. The opinion in Poland is also that only those persons unaware of the reason for the complaint seek medical aid, which again obstructs the picture. Thus information as to the dynamics of the particular pediculoses in different regions is indispensable, e. g. in the large industrial and agricultural centres which are arising. It is a pity that no material on this subject was submitted to the Symposium.

Arthropods inhabiting the same building as man are harmful to him in varying degrees. We have here in mind mainly, the Pharaoh's ant, flies and allergogenic mites.

We know *Monomorium pharaonis* L. as a synanthropic insect which is now showing signs of biological expansion, unconsciously aided by man: the great modern buildings of today, with central heating and hot

water favour the forming of habitats with microclimates similar to the subtropical conditions in the ant's country of origin. Hence the mass occurrence and thus the necessity not only to register any expansion, trace changes in range of infestation on a continental scale etc., but also conduct biological investigations on the ant which to all intents and purposes is now living in conditions foreign to it, all this to find an efficient method of eradication. The matter is the more important in that the ant may be a vector of infection. From recent Polish literature, I wish first to mention the paper by Wiśniewski (1975). One of the new factors this contains is that it draws attention to the discomfort caused by the Pharaoh's ant to vertebrates in the zoo. The publication by Styczyńska et al. (1974) on the combating of the ant, contains information on new stands in Poland. Mention must also be made of the two-day symposium on the Pharaoh's ant which took place in Warsaw in 1975, sponsored by the Polish Entomological Society. A subject of particular interest was: the rate of settlement and ways of dissemination of the ant in Poland. One paper on the occurrence of ants in flats was submitted to the Symposium. As the authors (Herczeg et al.) state, however, these were mostly species other than *M. pharaonis* and did not compose a pest. The main problem in modern dwellings built in Budapest during the past 10 years, have been the cockroaches *Blattella germanica* (L.) and *Blatta orientalis* L., followed by the bedbug *Cimex lectularius* L. and silverfish *Lepisma saccharina* L. Thus from the point of view of the sanitary entomologist, new urban building has also created ideal habitats for parasites and pests in Hungary. The paper submitted by Berndt was devoted to the reproductive biology of *M. pharaonis*. Having large colonies of ants under observation (of the order of 4,000 queens), he noted the seasonal appearance of new sexuals. Berndt tries to explain the phenomenon in the original hypothesis of suppressive pheromone, the presence of which hinders the forming of new sexuals; such a generation appears during the short period when secretion of the pheromone is inhibited. I would like to add that basing on this hypothesis, the author proposes a new method of combating the Pharaoh's ant.

The epidemiological importance of flies found in dwellings decreased substantially following the application of long — acting insecticides. The form of application is convenient (cotton cords saturated with insecticide hung inside rooms) and does not give rise to reservations as regards environmental protection, thus no immediate change in this form is to be expected. The relative control of fly pest caused a drop in interest in this group of insects on the part of biologists and epidemiologists in urban centres. Such extreme attitudes are also inexpedient. In Poland as a whole, the seasonal fluctuations in the appearance of house flies and their species

composition are known from a few papers only, from Warsaw and Gdańsk. The Polish Academy of Sciences' Institute of Zoology later took up investigations on the mutual penetration of insect fauna in towns and neighbouring, non-urbanized terrains, on the migration of synanthropic entomofauna to new recreational areas of the population etc. One of these papers on synanthropic *Diptera* — *Calyptrata* of the Pieniny Mts. (Draber-Mońko) was included in the Symposium faunistic section. We have followed similar studies conducted in suburban area by our Slovakian (e. g. Husárová, 1972; 1973) and Soviet (e. g. Petrova, 1973; 1974) colleagues, with interest.

The past 10 years have seen a tremendous rise in interest in, and as a result — knowledge of, allergogenic mites inhabiting man's immediate environment — in his home and even his mattress. The discovery of the role of house dust mites, carried out in the Netherlands, was soon confirmed in other west European countries, America, Japan and New Zealand. As far as I am aware, allergogenic mites have not yet been studied in Poland, and only May (1970) and Boczek and Dutkiewicz (1972) have published valuable survey papers. Chmielewski (paper submitted to the present Symposium) draw attention to the numerous allergogenic mites in man's environment, such as the nests of synanthropic birds, bee-hives, domestic food and herb warehouses etc., as well as in imported products. As we are aware, the list of mite species found in houses and man's immediate environment is continually increasing. This mainly follows the intensification of research, although reasons of an environmental nature cannot be excluded, to mention only mites from small domestic animals. Hewitt et al. (1971) represent the opinion that patients with allergic complaints of this etiology comprise 1/20th of all cases in dermatological wards in Cornwall. Owing to the prevalence of the sparrow in urban centres, the occurrence of *Dermatophagoides pteronyssinus* (Trouess.) and *D. chelidonis* (Hull) mites in its nests, as observed by Chmielewski, should attract the particular attention of the Sanitary Authorities. It is known that 80% of those allergic to dust are, in fact, susceptible to the allergen from *Dermatophagoides* (Penaud et al., 1972). We have thus obtained material to help us understand still another mechanism of the noxiousness of mites from birds' nests, alongside the earlier known fact that these mites alight on sleeping humans. Both types of noxiousness require such close proximity with mite foci (contact with something like a "mite island"), that — going by research conducted in Munich — there is no threat to pedestrians in urban streets (Mumcuoglu and Stix, 1974).

In their paper, Czajkowska and Boczek emphasized the ecological validity of allergogenic mites, because of which mites known to inhabit human dwellings also occur in stores of products of organic origin. It is

assumed that the authors' intention is to draw attention to the fact that the "ordinary" Polish warehouses mite should also be considered as potentially allergogenic, similar to the imported species known to cause the copra itch, for example. In the same manner we touch upon the more general problem of acariases in man, as an occupational disease. This has not yet received sufficient attention in Poland, but in Great Britain, for instance, it has a fairly long-standing tradition, and in France recently, Molina et al. (1974) discovered allergen properties in mite with which the cheese-makers are in constant contact.

Man is exposed to fortuitous attack by facultatively parasitic arthropods both at work and rest in the open air. In this field, Štys (1973) informed about *Heteroptera* of the *Anthocoridae* family in Czechoslovakia; there are also more papers on urogenital and rectal myiases (Schumann et al., 1975, Petrova, 1975); Dwyer et al. (1972) from Poland described a prolonged case of *Tyrophagus* sp. (*Sarcoptiformes*, *Acaridiae*) mites in vaginal secretion. Attacks by *Argas reflexus* (Fabr.) and *Dermanyssus gallinae* (DeGeer) (Wegner, 1973) may also cause town — dwellers some discomfort. Mention should be made here of the survey submitted to the Symposium by the oculist Dr. Kwiatkowska-Kawecka. She made a useful attempt to present the role of mites, ticks and insects as pathogenic factors of eye diseases in man. The author discussed diseases of the protective apparatus of the eye and eyeball caused by *Pthirus pubis* (L.), larvae of various *Diptera* and *Hymenoptera*, *Ixodes ricinus* (L.), *Demodex*, *Sarcoptes* and setae of the larvae of some butterflies. The locating of the pathogenic factor in the organ of vision is the result of coincidence of rather atypical circumstances and therefore infrequent, although the survey conducted by Kwiatkowska-Kawecka corresponds to the existing demands. Fairly frequent cases of phthiriasis palpebrarum in humans have been notified recently, particularly abroad; the author has enriched the casuistics by similar information from Poland (1973). Her intent to collect a bibliography of Polish papers on the subject is worth backing. She succeeded in listing 16 papers. To this should be added the case of the presence of the horse-fly (*Rhinoestrus purpureus* Br.) larva in the eye of a child in the Wrocław voivodship in 1953 (Draber-Mońko, 1974). "Mites and insects as pathogenic factors of diseases of the eyes in man" is not territorially-geographically limited, therefore the genus *Hippelates* (*Diptera*, *Chloropidae*) can also be included. In the tropical belt of America it is burdensome by the fact that, attracted by the secretions of the eye's protective apparatus, it forces its way into the eye and probably damages the mucous membrane.

The dog is man's close friend, a companion in children's games and frequently inhabits the same rooms. In spite of this we know curiously

little of the frequency and dynamics of occurrence of its parasitic arthropods. I should like to mention the papers by Amin and Madbouly (1973) from Cairo, also Ertürk and Tanzer (1973) from Ankara, from the regions nearest to Europe. The first such paper from Europe, as far as I know, has been published recently, namely one on the town dogs of Gdańsk (Piotrowski and Połomska, 1975). This covers the seasonal dynamics of *Linognathus setosus* (Olf.) lice, as well as the *Ctenocephalides canis* (Curtis) and *Pulex irritans* L. fleas. Apart from this, investigations on the prevalence of *Demodex canis* (Leydig) showed there to be asymptomatic infestation in 39% of dogs in the Three-Town complex (Piotrowski, 1974). The publication by Piotrowski and Milko (1975) contains the biological interpretation and epizootiological importance of such a rich reservoir of follicle mites. In addition, following Disney's (1972) example, we are taking up studies of insects connected with canine droppings.

In research on the biology of arthropods in rural environments, our forum represents several fields of interest in stock breeding animals. As regards flies in stables and pastures, there are only Piątkowski's papers, in Poland. The ecological approach to the problems heightens their value. Piątkowski submitted a paper on the seasonal dynamics of *Stomoxys calcitrans* (L.) in stock breeding, to the Symposium. This took into account pastures and accommodation (cow shed, shelter roof) as separate habitats between which insects circulate. As in this author's previous papers (1973, 1975), the present is a fragment of more extensive, several-year studies on biting flies in largeherd cattle breeding. Since Hammer's paper (1942), this subject has hardly been touched upon in Europe, thus Piątkowski's present studies in the Cashubian Lake District (about 70 km south-west of Gdańsk) are of particular importance.

The horse-fly *Tabanus bromius* L. is one of the species which occurs in large numbers in the European part of the mixed forest zone, this including Poland. Katelina and Myasnikov have presented the seasonal and diurnal activity of this species, based on the number of specimens taking in water and attacking a chosen head of cattle in the Tula district (south of Moscow). This is valuable supplementary information on the biology of *T. bromius* in the European part of the U.S.S.R., and in its wider aspect, is another step towards gaining further insight into one of the common European haematophagous species.

The *Przhevalskiana* (= *Crivellia*) *silenus* (Brauer) warble fly is a parasite of the goat and certain other Bovidae in the Mediterranean basin, Africa and Central Asia. As a close relative of the ox warble fly, it has a similar reproductive cycle. It should, however, be stressed that as regards bionomy, range of hosts and geographical distribution, *P. silenus* belongs to the little-studied species, hence the scientific value of Sayin's

paper. This covers the prevalence, reproductive cycle and seasonal dynamics of the species in northern Turkey. A prevalence of 94% was found in some herds of angora goats, the density frequently amounting to over 40 larvae per host, which indicates the economic extent of the problem, and also illustrates the dependence of parasitic prevalence on man's activities.

Recent years have seen a certain animation in research on the biology, seasonal dynamics and circadian activity in the horse bot fly *Gastrophilus* (in different parts of the U.S.A. — Schooley et al., 1971; in Tashkent — Salusiev, 1972; in New Zealand — Kettle, 1974). In Poland, investigations conducted by Draber-Mońko (1974), also Stypuła et al. (1974a, b), together with earlier publications, illustrate the species composition of the bot flies in different parts of the country and the seasonal fluctuations, particularly of *G. intestinalis* (DeGeer) and *G. nasalis* (L.). As yet unpublished material from the University of Gdańsk's Department of Zoology shows the occurrence of *G. nasalis* in the area of the Pomeranian Lake District and suggests the existence of seasonal differences in the dynamics of horse bot flies infestation as compared with the Warsaw voivodship.

The biology of ectoparasites of game animals is not represented in the papers submitted to the Symposium. I shall therefore restrict myself to mentioning the fact that recent Polish publications include papers by Kadulski on *Haematopinus apri* Gour., *Lipoptena cervi* L. etc. (1974a, b, 1975). Another paper, on the ecology of hare parasites, by Kadulski and Dobryńczuk, is at the publishers at present. It should be kept in mind that the biological and ecological approach to the problem of the ectoparasites of game animals, particularly deer and boar, only awoke interest in North America so far, thus Kadulski's papers in this field can be considered to be innovatory in Europe.

The problem of the role of arthropods in the spread of disease in man and animals, in our Section, is contained in the papers by Kamyszek and Deryło. In both cases this is a continuation of investigations, further parts of which appeared in print in recent years. Kamyszek's paper concerns the role of sucking and biting lice in the transmission of dermatomycosis in cattle. Such transmission was earlier proved by isolating the respective spores from the bodies of parasites taken from hosts suffering from mycosis (Hajsig and Žuković, 1961, cattle lice in Yugoslavia; Ito et al., 1959, rodent lice in Japan), and by transmission of infection by contamination with rodent lice (Köhler and Hoffman, 1966, West Berlin). Hajsig and Žuković also recommended that where mycosis is associated with lice infestation, the latter should be eliminated first and the mycosis later. It is only now, however, that Kamyszek has proved the pertinence of this opinion experimentally, which he also signaled earlier together

with R. Piotrowski (1975). The author this time had substantial research material at his disposal, this both in the sense of head of cattle, its distribution between several farms, also clinically confirmed high prevalence of pediculosis, mallophagosis and mycosis. Laboratory tests showed the presence of *Trichophyton verrucosum*, among other things, from 32 specimens of cattle ectoparasites. As mentioned, treatment with Neguvon and Dermowet gave good results on condition that the ectoparasites were first eliminated.

Deryło's paper is devoted to the role of the common poultry biting louse, *Eomenacanthus stramineus* (Nitzsch), in the spread of toxoplasmosis. According to contemporary opinions, the domestic cat is a particularly important link in the development cycle of *Toxoplasma gondii* Nic. et Manc., although the epidemiology is still somewhat obscure — hence the continuation of research on the role of poultry parasites. The author now possesses results almost exclusively uniformly negative, which maintains the hitherto doubts regarding the role of the ectoparasites mentioned in the spread of toxoplasmosis.

As regards the epidemiological role, the effect of anthropopressure may also be expressed by the function of the host link in the life cycle of a parasitic worm being taken over by a different insect from the usual one. As shown by El-Refaii et al. (1973), some store beetles of the *Curculionidae* and *Tenebrionidae* families are able to assume the role of intermediate host of the *Hymenolepis nana* Sieb. tapeworm. It is probable that the chances of this possibility being realized increase in improperly maintained food stores.

It should also be added that the insects may derive from the environment not only various kinds of biotic pathogenic factors — they also accumulate toxic substances, including heavy metals. Publications have already begun to appear which confirm e.g. the presence of mercury in flies feeding on poisoned fish waste (Nuorteva and Häsänen, 1972) and in lice taken from *Callorhinus ursinus* (Pinnipedia) near Alaska (Kim et al., 1974). Who knows, may be the insect will turn out to be a more universal bioindicator of the chemical contamination of some environments than previously assumed.

Anthropopressure may influence not only the biology, frequency and density of occurrence, as well as the epidemiological role of parasite, but also its geographical distribution. This subject clearly fits in with the problems of the wild animal parasite faunistics section, thus I will confine myself to fragmentary signalization of the aspect concerning man and domestic animals.

It is a well known fact that man influenced the spread of many parasites of domestic animals, primarily from European domestication and

breeding foci, throughout the world. This process is continuing. We can observe the expansion of the *Rhipicephalus sanguineus* (Latr.) tick to European pet dogs. The cockroach *Supella longipalpa* F. is also beginning to occupy ever new well-heated houses in western Europe. This would seem to signalize the extending of the geographic range of the arthropods mentioned, which formerly were not found in western Europe. It is different in the case of *Solenopotes capillatus* End. recently found for the first time in Yugoslavia (Piotrowski, 1974). During previous investigations there, various species of *Anoplura* and *Mallophaga* were found on cattle, but no *S. capillatus* was observed, which strengthens our conviction that this species was not present. Simultaneously, the geographic range of this sucking louse was evaluated, a priori, as very wide and corresponding to the distribution of domestic cattle, almost world-wide. In such case it will be more provident to treat the presence of *S. capillatus* in Yugoslavia as an example of filling in of the range of the lice under anthropopressure revealed in the transfer of breeding cattle from other countries. In my opinion, the same approach should be taken in respect of information as to the presence of species rarely noted in Europe, such as the mallophagan *Bovicola limbatus* (Gerv.) on the goat (Piotrowski, 1973), or as this author submitted to the Symposium, the finding, in the region of Gdańsk, of the sheep face louse *Linognathus ovillus* (Neum.). — which after Scotland and Macedonia, is the third case of this louse being found in Europe, also information on the occurrence of the mallophagan *Felicola subrostrata* (Nitzsch) in Poland. It would be good if the Veterinary Authorities turned attention to the presence of a sheep parasite so far unknown to Poland, particularly in view of the intensification of breeding facing us.

The occupying of a new, different biotope, i.e. a new species of host, may comprise an interesting example of one of the results of anthropopressure. Such matters are neither frequent nor easily confirmed, as the fact of taking up blood from a species of mammal different from the usual, does not automatically define its suitability to the life cycle of the parasitic arthropod. From this point of view, assuming correct determination, the information by Bogatko (1973) as to the numerous and long-term appearance of *Dermanyssus hirundinis* (Herm.) on a duck-breeding farm, takes on the features of a mass experiment confirming the suitability of the domestic duck as host for the mite mentioned. This would mean the danger of including the domestic duck in the epizootiological and epidemiological chain which covers the swallow, sparrow and similar synanthropic wild birds.

Our section also received information as regards the structure and physiology of the arthropods mentioned here. As opposed to what might be considered from the historical priority of morphological over physiolo-

gical sciences, the knowledge of the structure of arthropods of medical and veterinary importance, particularly from the anatomical and ontogenetic point of view, leaves much to be desired. The attractiveness of new research techniques, particularly scanning, leads to the situation in which, as in the case e.g. of *Phthiraptera*, we are beginning to become relatively well versed on the external structure of various receptors and grasping legs (Miller, 1971; Ubelaker et al., 1973; Eichler and Sixl, 1974), whereas our knowledge of the ordinary topography of the innervation of these organs, to say nothing of the function of the nervous system remains on the level of the general schematics. Thus anatomic as well as embryological investigations by means of modern methods and also light microscopy continue to be necessary. Among recent Polish publications, I wish to mention that by Żukowski (1973) on the ontogenetic development of the praetarsi in *Acarina* of the suborders *Mesostigmata* and *Ixodides*. It is probably a good thing that another centre also took up this type of work: the Symposium material includes a paper by Szczęśna on the embryonic development of the so-called "crown" in three species of *Haematopinus* sucking lice.

In the field of the physiology of the ontogenetic development of flies, Stanios submitted a paper on the comparison of exogenic and endogenic amino acid contents in the tissues of larvae, pupae and adult *Musca domestica* (L.). Not being a specialist in this field, I do not feel competent to discuss it. The subject literature is very extensive and the problem itself is not really a new one. Thus probably the difference in the level of amino acids found at different stages of ontogenesis should be considered as supplementary information on the species *M. domestica*.

Bany and Żółtowski took up the antigen analysis of particular phases of post-embryonic development of *M. domestica*. In the preliminary stage of investigations they observed the presence of an antigen system common to the III larvae, pupae and imagines. A question arises, to which it is still difficult to find an answer, concerning the properties of I stage larvae — not investigated by the authors. It can only be assumed that, in accordance with present-day genetics and biochemistry, I stage larvae are antigenically simpler, which would seem to be confirmed in the fact that they are generally tolerated by the host, in contrast to later stage larvae. We can only await further results with interest.

Investigations on carotenoids in *Acarina* comprise a particularly interesting problem in which Professor Czeżuga and his colleagues have been engaged for years. Such compounds occur in various organisms, beginning with bacteria; Czeżuga's work has enriched our knowledge of the quantitative and qualitative occurrence of a dozen or so carotenoids in 4 families of water mites (*Trombidiformes*, *Hydrachnellae*). He now presents analo-

gical investigations on the tick *Dermacentor reticulatus* (Fabr.) as compared with the previously attained results concerning water mites. It turned out that *D. reticulatus* carotenoids were completely different from those in water mites. It is difficult to reach definite conclusions from what are still in spite of everything, an insufficient number of investigations. Having in mind the parasitic mode of life of the tick in all development stages, and the conviction as to the exogenic origin of carotenoids, the question arises as to whether or not the spectrum of carotenoids would be suitable as an index of the type of food or habitat of the tick hosts.

To conclude this review of papers submitted to the Symposium against the background of present knowledge of the biology and epidemiological role of chosen groups of arthropods under anthropopressure, I would like to present one or two general comments.

The majority of papers submitted can be referred to the level of the parasite or synanthrope population. The materials collected are contemporary, as it is difficult to obtain more precise information from data collected many score years ago; the publication of the material forms a starting point for future research. The continuation of work of economic importance — on parasites in large herd breeding and on game animals — should meet with general approbation. The immediate target is most probably the parasitological problem of environment in the case of industrial stock-breeding. It would, however, be a good thing if, taking the economic categories into account in our investigations, we keep in mind man himself as a host. In this character he still gives rise to problems worth solving.

With few exceptions, the papers mentioned here have not embraced all the species harrasing given hosts. Not questioning the methodological propriety of particular papers, I should like to turn attention to the superiority of complex investigations. This has been understood by our western neighbours (Hiepe, 1961; Ribbeck et al., 1973) as regards parasites of domestic animals, and may be it will be understood here.

Preparing a review of papers, it is difficult not to be subjective both as regards assessment of achievements during the period between our II and III Symposia, and that of research requirements. The pleasant task of supplementing and correcting my assessments is now left to those who participated in the Symposium and Readers.

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BIOLOGIA I ROLA EPIDEMIOLOGICZNA STAWONOGÓW W ŚRODOWISKACH NA RÓŻNYM ETAPIE ANTROPOGENIZACJI

STAN BADAŃ W DZIEDZINIE DROBNYCH ROZTOCZY, PHTHIRAPTERA, MRÓWEK,
BRACHYCERA I INNYCH STAWONOGÓW PASOŻYTNICZYCH I SZKODLIWYCH
DLA CZŁOWIEKA I ZWIERZĄT DOMOWYCH

F. PIOTROWSKI

Problematykę podzielono na badania nad wpływem człowieka na właściwości wybranych stawonogów w warunkach laboratoryjnych i nielaboratoryjnych. W tej drugiej grupie omówiono 1° częstotliwość i dynamikę występowania stawonogów na człowieku, współbytujących z nim w mieszkaniu i przeszkadzających mu w pracy i odpoczynku na wolnym powietrzu, dalej stawonogów pasożytujących na zwierzętach domowych i gospodarskich, 2° rolę epidemiologiczną stawonogów, 3° wpływ antropopresji na rozmieszczenie geograficzne, i 4° doniesienia z zakresu budowy i fizjologii omawianych tu stawonogów.

Dorobek Sympozjum został rozpatrzony krytycznie na tle współczesnych osiągnięć naukowych. Uwypuklono przy tym potrzebę poszerzenia badań nad świerbowcami i wszami u człowieka oraz pasożytami zwierząt łownych i domowych. Zdaniem referenta, na przyszłość wylaniają się 2 szczególnie ważne dziedziny badań: parazytologiczna problematyka środowiska w chowie przemysłowym oraz sam człowiek, który jako żywiciel nadal stwarza problemy zasługujące na rozwiązanie.

LITERATURA

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