FLEA NEWS is a biannual newsletter about fleas (Siphonaptera). Recipients are urged to check any citations given here before including them in publications. Many of our sources are abstracting journals and current literature sources such as National Agricultural Library (NAL) Agricola, and National Library of Medicine (NLM) Medline, and citations have not necessarily been checked for accuracy or consistent formatting.

Recipients are urged to contribute items of interest to the profession for inclusion herein, including; Flea research citations from journals that are not indexed in Agricola or Medline databases, Announcements and Requests for material, Contact information for a Directory of Siphonapterists (name, mailing address, email address, and areas of interest - Systematics, Ecology, Control, etc.), Abstracts of research planned or in progress, Book and Literature Reviews, Biography, Hypotheses, and Anecdotes. Send to:

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Editorial

Dear Flea News Reader,

Researchers have blamed failures to control fleas on both insecticide resistance and operator non-compliance (Coles and Dryden 2014, Halos et al. 2014). Another factor, less considered, is spontaneous changes in flea susceptibility, unrelated to insecticide exposure (Bossard et al. 2000). Adding to the complexity, factors interact in unexpected ways. Operator non-compliance may help create insecticide resistance, and insecticide resistance may cause otherwise negligible non-compliance to create control failure. Detecting resistance is confounded with the bioassay used (Bossard and Broce 2002).

There is also the hazard of potentially faulty assumptions:

If a failure occurs, it must be due to insecticide resistance.
If a failure occurs, it must be due to operator non-compliance.
If the operator complied, then control will be successful.
If there is no insecticide resistance, then control will be successful.

For a particular control failure, what factors are causal is often murky. Uncertainty over what causes control failures of insects is not confined to fleas. Often, we do not know what causes failures to control crop insects either.

Distinguishing among various causes might require monitoring of flea population dynamics, including reproduction and survival of all stages in the field before, during, and after treatment, and include simultaneous monitoring of resistance mechanisms of fleas, operator non-compliance, and treatment failure. However, a study on fleas of that sort has never been attempted.

Yours in fleas,
R.L. Bossard
Editor, Flea News


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**Announcements**

The position of UK Flea Recorder (UK's Siphonaptera Recording Scheme, organized with other national schemes by the Biological Records Centre) has been vacant since the passing of Bob George (obituary, Flea News 73, December 2013). Flea News is pleased to announce that Simon Horsnall has been appointed to this position. He belongs to the DaNES (Derbyshire and Nottinghamshire Entomological Society), and is particularly interested in the neglected orders. "Everybody focused on Lepidoptera and Coleoptera as well as there being a few Dipterists and Hemipterists", he comments, "So I said I would look at the distribution of Siphonaptera in the two counties."

Simon is searching for any information on fleas parasitizing *Puffinus* spp. (shearwaters). Simon writes, "Looking through the records at areas and species I can target, 3 possibilities have arisen. The first is a species which has a very common host but a very patchy distribution: *Ceratophyllus columbae*. I feel this is a result of under recording. The second is a predominantly northern species (restricted to Scotland in the UK) but with 2 English records: *Megabothris rectangulatus* [on small mammals]. I would like to try to investigate these 2 English records as they are widely spread geographically and temporally. Both of these species have sufficient information on them to make a field recording trip relatively easy to plan. However, the third is proving more elusive."

In addition, he pointed out, "In 1966, fleas were collected from Manx Shearwaters, *Puffinus puffinus*, on the Scottish island of Rhum. They only occurred in nests above 650m altitude. The specimens were identified as new to science and named as *Ceratophyllus fionnus* Usher 1968. There have been no records since. To target this species I feel I need more information so have trawled the literature and found 2 New Zealand species which share an apparently similar ecological niche: *Parapsyllus lynnae*
alynnae and Notiopsylla corynetes. Both of these parasitise Puffinus sp. at high altitudes. I was wondering if you or anybody you know could provide any information on these species (New Zealand flea researchers maybe), so that I could use them as a possible model for C. fionnus."


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Congratulations to Dra. Ma Soledad Gomez upon her retirement from the Laboratori de Parasitologia, Facultat de Farmacia, Universitat de Barcelona! A partial listing of her publications includes:


The parasite fauna (protozoa, helminths and insects) of the two most widespread Murinae rodents in El Hierro (Canary Islands, Spain), the black rat (Rattus rattus) and the house mouse (Mus musculus domesticus) was studied. Faunistic, ecological, ecotoxicological data, as well as information on the biology of some nematode parasites of R. rattus are provided. The present work is unprecedented in the Canary Islands, and provides the first data on the parasite biodiversity in Murinae from the archipelago. Concerning to parasitofaunas stands out: a) impoverishment of biodiversity of helminths respect of which have the same hosts in other islands; b) increasing the number of species of Siphonaptera, even compared with flea species that parasitize the same hosts from continental biotopes.
First report of Siphonaptera infesting Microtus (Microtus) cabrerae (Rodentia-Muridae-Arvicolinae) in Cuenca, Spain and notes about the morphologic variability of Ctenophthalmus (Ctenophthalmus) apertus personatus (Insecta-Siphonaptera-Ctenophthalmidae).

Gómez MS, Fernández-Salvador R, Garcia R.

The fleas infesting Microtus (Microtus) cabrerae from three different areas of Cuenca province (Spain) have been studied. It is the first time that an ectoparasitological study of this badly known rodent has been done. Four Siphonaptera species have been detected: Rhadinopsylla (Actenophthalmus) pentacantha, Peromyscopsylla spectabilis spectabilis, Nosopsyllus fasciatus and Ctenophthalmus (Ctenophthalmus) apertus personatus, which was the most abundant species (26 males and 31 females of a total of 28 males and 35 females). Considering the great morphologic variability within the male processus basimerus ventralis (p.b.v.) of segment IX of C. personatus subspecies, three morphotypes have been recognised. The male polymorphism detected, would be the result of both host confinement and genetic selection acting on the parasite. It should be pointed out that C. (C.) apertus personatus is not narrowly host-specific, therefore further studies are required to clarify this taxonomic situation.

Transmission dynamics of Cryptosporidium in primates and herbivores at the Barcelona zoo: a long-term study.
Gracenea M, Gómez MS, Torres J, Carné E, Fernández-Morán J.

Factors influencing the transmission of Cryptosporidium in primates and herbivores housed at the Barcelona zoo have been analyzed. The relationship between continuous and discontinuous oocyst shedding, both animal housing conditions and abiotic factors (seasonality, humidity, temperature) was examined to explain the epizootiology of the protozoan. Thirty six fecal samples from each of 11 primates (Pongidae, Cebidae, Cercopithecidae and Lemuridae) and 22 herbivores (Elephantidae, Camelidae, Cervidae, Giraffidae and Bovidae) were examined over the period of 1 year. The parasite transmission was based on the chronic infection status of some animals serving as a source of successive reinfection for other animals. The environmental temperature and humidity (seasonality), the physical features of the facilities, the vicinity of the animals and the physiological status induced by captivity contributed to transmission. The long-term character of this study was essential for obtaining these results and interpreting the complex relationships.
The same species of sucking louse (Phthiraptera-Anoplura) from the Chilean abrocomid rodent *Abrocoma bennetti* Waterhouse, 1837 was recently described as *Eulinognathus chilensis* Gomez, 1998 and as *Abrocomaphthirus hoplai* Durden & Webb, 1999. We discuss the nomenclature of this louse and confirm that its correct name is now *Abrocomaphthirus chilensis* (Gomez, 1998). After comparing type specimens designated from each description, we also document some morphological variation within this species with respect to the paratergal plate on abdominal segment 3 in the female which usually has two relatively long apical setae, but occasionally has only one.

Five rodent and two insectivore species were investigated for *Cryptosporidium* at seven sites in north-eastern Spain. Of the 442 animals studied, 82 *Apodemus sylvaticus*, 1 *A. flavicollis*, 5 *Mus spretus*, 1 *Rattus rattus*, 8 *Clethrionomys glareolus* and 13 *Crocidura russula* were infected with only *C. parvum*. Eleven *A. sylvaticus* and 2 *C. glareolus* were infected with only *C. muris* and 16 *A. sylvaticus*, 1 *M. spretus* and 2 *C. glareolus* showed mixed infections. Both cryptosporidial species were found in most study areas. No causal relationship was found between intrinsic host factors (age and sex) and the parasitic prevalence in the most captured host species (*A. sylvaticus* and *C. russula*). Extrinsic factors such as collection site of host, seasonality and covering vegetation exerted different influence on the prevalence of *Cryptosporidium*. Small mammals could become one of the most important sources of cryptosporidial oocysts in those areas where neither farm animals nor significant human activity are present. This is the first study to report the infection of *M. spretus* and *C. russula* by *C. parvum* and the first finding of *C. muris* in *M. spretus*.

Further report on *Cryptosporidium* in Barcelona zoo mammals.
Gómez MS, Torres J, Gracenea M, Fernandez-Morán J, Gonzalez-Moreno O.
The prevalence of fecal shedding of *Cryptosporidium* in 36 primates (21 species and subspecies) and 62 herbivores (36 species and subspecies) housed at the Barcelona zoo was studied. Cryptosporidial oocysts were found in stool samples of 14 Primate, 18 Artiodactyla, 2 Perissodactyla, and 1 Proboscidea species. None of them showed symptoms related to the parasite. Neither the sex nor the group condition (alone or in a group) of the animals studied appeared to be correlated with parasitic prevalence. The results extend the host species range of the protozoan to 18 new animals (6 Primate, 10 Artiodactyla, 1 Perissodactyla, and 1 Proboscidea species) and confirm the endemic status of *Cryptosporidium* at the Barcelona zoo. We conclude that maintenance of the parasitic endemic status is probably due to the presence of animal carriers as well as to the physical features of some facilities where oocysts could remain viable and infectious.

The *Cryptosporidium* "mouse" genotype is conserved across geographic areas.
Morgan UM, Sturdee AP, Singleton G, Gomez MS, Gracenea M, Torres J, Hamilton SG, Woodside DP, Thompson RC.

A 298-bp region of the *Cryptosporidium parvum* 18S rRNA gene and a 390-bp region of the acetyl coenzyme A synthetase gene were sequenced for a range of *Cryptosporidium* isolates from wild house mice (*Mus domesticus*), a bat (*Myotus [Myotis] adversus*), and cattle from different geographical areas. Previous research has identified a distinct genotype, referred to as the "mouse"-derived *Cryptosporidium* genotype, common to isolates from Australian mice. Comparison of a wider range of Australian mouse isolates with United Kingdom and Spanish isolates from mice and cattle and also an Australian bat-derived *Cryptosporidium* isolate revealed that the "mouse" genotype is conserved across geographic areas. Mice are also susceptible to infection with the "cattle" *Cryptosporidium* genotype, which has important implications for their role as reservoirs of infection for humans and domestic animals.

Beaucournu, J.C.; Gómez, M.S.; Ménier, K. Apports de la tératologie à l'étude des Siphonaptères: discussion à propos de 3 cas de stigmates supernuméraires
Boletín de la Asociación Española de Entomología
1999; Volum 23, 249-256

[Presence in the eastern part of the Spanish Pyrenees of *Amphipsylla sibirica sepifera* Jordan and Rothschild, 1920 (Siphonaptera: Ceratophyllidae: Amphipsyllinae)].
[Article in Spanish]
Gómez MS, Beaucournu JC, Arrizabalaga A.
The detection of two males and one female of *Amphipsylla sibirica sepifera* on three *Clethrionomys glareolus* is pointed out. The rodents were taken in Alt Aneu and Espot, two towns of Lerida (a Spanish Province). The finding of this flea species on Spanish Pyrenees increases to the west its geographical distribution and adds one new species to the Iberian flea fauna.

Secnidazole vs. paromomycin: comparative antiprotozoan treatment in captive primates.
Gracenea M, Gómez MS, Fernández J, Feliu C.

The antiprotozoan activity of secnidazole was studied in *Cercocebus t. torquatus*, *Cercopithecus campbelli*, Erythrocebus patas (Cercopithecidae), and *Gorilla gorilla* (Pongidae) compared with that of paromomycin in *Cercocebus t. lunulatus* (Cercopithecidae), *E. patas*, and *G. gorilla* (Pongidae) by coprological analysis. The antiprotozoan activity of both drugs depended on the parasite species and the host species. The drugs acted in a similar way on *Entamoeba coli* parasitising *C. t. torquatus* and *E. patas*. This activity was different from that observed on *I. buestchlii* from the same host species. Nevertheless, *E. coli* parasitising cercopithecids and pongids responded to drugs differently.

Substrate and cofactor specificity and selective inhibition of lactate dehydrogenase from the malarial parasite *P. falciparum*.
Gomez MS, Piper RC, Hunsaker LA, Royer RE, Deck LM, Makler MT, Vander Jagt DL.

Lactate dehydrogenase from the malarial parasite *Plasmodium falciparum* has many amino acid residues that are unique compared to any other known lactate dehydrogenase. This includes residues that define the substrate and cofactor binding sites. Nevertheless, parasite lactate dehydrogenase exhibits high specificity for pyruvic acid, even more restricted than the specificity of human lactate dehydrogenases M4 and H4. Parasite lactate dehydrogenase exhibits high catalytic efficiency in the reduction of pyruvate, $k_{cat}/K_m = 9.0 \times 10^8 \text{min}^{-1} \text{M}^{-1}$. Parasite lactate dehydrogenase also exhibits similar cofactor specificity to the human isoforms in the oxidation of L-lactate with NAD+ and with a series of NAD+ analogs, suggesting a similar cofactor binding environment in spite of the numerous amino acid differences. Parasite lactate dehydrogenase exhibits an enhanced $k_{cat}$ with the analog 3-acetylpyridine adenine dinucleotide (APAD+) whereas the human isoforms exhibit a lower $k_{cat}$. This differential response to APAD+ provides the kinetic basis for the enzyme-based detection of malarial parasites. A series of inhibitors structurally related to the natural product gossypol were shown to be competitive inhibitors of the binding of NADH. Slight changes in structure produced marked changes in selectivity of inhibition of lactate dehydrogenase. 7-p-Trifluoromethylbenzyl-8-deoxyhemigossylic acid
inhibited parasite lactate dehydrogenase, Ki = 0.2 microM, which was 65- and 400-fold tighter binding compared to the M4 and H4 isoforms of human lactate dehydrogenase. The results suggest that the cofactor site of parasite lactate dehydrogenase may be a potential target for structure-based drug design.

A survey for Cryptosporidium spp. in mammals at the Barcelona Zoo.
Gómez MS, Vila T, Feliu C, Montoliu I, Gracenea M, Fernandez J.

Mammals housed at the Barcelona Zoo belonging to the orders Carnivora, Artiodactyla, Perissodactyla and Proboscidea were examined for Cryptosporidium infections. A total of 183 fecal samples from 17 carnivores and 34 herbivores revealed patent infections in only 6 herbivore species (5 artiodactyls of the families Bovidae and Giraffidae and 1 perissodactyl of the family Rhinocerotidae); all carnivores were negative. Intensity of infection was found to be generally low. Connochaetes taurinus taurinus, Gazella dorcas neglecta, Kobus ellipsiprymmus and Giraffa camelopardalis constitute new host species for the parasite.

Detection of oocysts of Cryptosporidium in several species of monkeys and in one prosimian species at the Barcelona Zoo.

[Presence in Barcelona of Holopleura pacifica (Anoplura, Hoplopleuridae) a parasite of Rattus norvegicus].
[Article in French]
Gomez MS.

The occurrence of the louse Hoplopleura pacifica on Rattus norvegicus from Barcelona is reported. The rats infested were caught in two different biotopes: the sewer system and the port.

[Factors influencing the house dust mite population IV. Altitude].
[Article in Spanish]
Gómez MS, Portus M, Gallego J.

A study has been carried out on house-dust mites present in the buildings of 3 towns in Catalunya (Spain), with different altitudes: Reus (altitude, 76 m); L'Ametlla (altitude, 321 m); and Puigcerdá (altitude, 1,202 m). The period studied was between October, 1975 and September 1976. From this study, a negativecorrelation has been observed between the number of mites in house dust and the
altitude of the town. This supports the results obtained by other authors. The decrease in the number of mites with increases in altitude is due to a decrease in the number of mites belonging to the Pyroglyphidae family. This family was present in all samples of house-dust studied, and generally in a greater number than other groups of mites. Of the three species of Pyroglyphidae more frequently present in house dust (\textit{Dermatophagoides pteronyssinus}, \textit{D. farinae} and \textit{Euroglyphus maynei}), \textit{D. pteronyssinus} was the most abundant as well as the most affected [by] variations of R.H and temperature resulting from the variations of the altitude. \textit{D. farinae} and \textit{E. maynei} were found in low levels suggesting inadequate conditions of temperature and R.H. in the houses studied. Even if \textit{E. maynei} was the most abundant species in Puigcerdá, this is due more to the decreased incidence of \textit{D. pteronyssinus} than to an increase in the number of \textit{E. maynei}.

Acarologia. 1980 Nov;21(3-4):477-81.

\textit{Thyreophagus callegoi} a new mite from flour and house dust in Spain (Acaridae, Sarcoptiformes).

Portus M, Gomez MS

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New Doctoral Dissertation

Student: Eads, D. A.

Title: FACTORS AFFECTING FLEA DENSITIES IN PRAIRIE DOG COLONIES: IMPLICATIONS FOR THE MAINTENANCE AND SPREAD OF PLAGUE

Institution: Colorado State University

Date: 2014

Plague is a re-emerging, rodent-associated disease caused by the primarily flea-borne bacterium \textit{Yersinia pestis}. The bacterium likely originated 1,500–20,000 years ago in Asia but has been transported by humans to multiple additional continents and islands where it degrades populations of a wide array of rodents. In the western United States, there is an urgent need to acquire a deeper understanding of plague because over half the rodent species of conservation concern occur within its introduced range. This dissertation describes research on fleas in colonies of black-tailed prairie dogs (\textit{Cynomys ludovicianus}), colonial rodents that amplify \textit{Y. pestis} in the Great Plains.

Adult fleas were combed from live-trapped prairie dogs during June–August 2010–2012 in the short-grass prairie of Vermejo Park Ranch, New Mexico, USA. We evaluated correlations between flea densities and the attributes of soils, prairie dog colonies, and weather.

Adult fleas were most abundant in portions of prairie dog colonies with coarse surface-soils and moderately textured subsurface-soils. Coarse surface-soils may allow precipitation to infiltrate to the depth of prairie dog nests, where the moisture could create humid microclimates that are preferred by fleas. Inside burrows, moderately textured
soils may hold considerable amounts of water, some of which could evaporate into prairie
dog nests, thereby creating humid microclimates. Although fleas tend to fare best under
humid conditions, they were scarce in areas with very wet subsurface-soils, presumably
because sodden soils can facilitate the accumulation of fungi and mites, some of which
are lethal to fleas.

We also studied the abundance of fleas in old colonies (initially 8-11 years-old)
and young colonies (3–6 years). Fleas were 110% more abundant in old colonies and
their abundance was positively correlated with the number of years since a colony was
established. Fleas may accumulate to high densities in old colonies because prairie dogs
have created deep burrows there, and deep burrows provide ectothermic fleas with humid
microclimates and stable temperatures. Moreover, older burrows presumably contain a
wealth of organic matter upon which flea larvae feed.

Fleas desiccate under dry conditions and, consequently, their densities are thought
to decline during droughts. At Vermejo, February–June precipitation was relatively
plentiful in 2010 and 2012 but scarce in 2011, the driest spring-summer on record for
New Mexico. Unexpectedly, fleas were 250% more abundant in 2011 than in other years.
During the dry 2011 field season, prairie dogs were in poor condition and devoted little
time to grooming. In contrast, during 2010 and 2012, prairie dogs were in 27% better
condition and, when controlling for month and observer variation, devoted 450% more
time to grooming. Prairie dogs provided with supplemental food and water during March-
May 2012 were in 18% better condition and carried 40% fewer fleas during June-August.
Increased flea densities during droughts may provide context for the maintenance and
spread of plague.

Three additional studies are presented herein. First, we developed a new method
for combing fleas from hosts. The method and resulting data can be used with occupancy
models to estimate prevalence rates for ectoparasites while accounting for imperfect
detection. Second, we used the combing new method to estimate prevalence rates for the
generalist flea *Pulex simulans* during June–August 2012. Prevalence estimates were
>30% higher than indices from studies with substantial sample sizes for prairie dogs. If
*P. simulans* can attain high prevalence on prairie dogs, the species may commonly serve
as a bridge vector between *Cynomys* and other mammalian hosts of *Y. pestis*, and even
function as a reservoir of plague. Third, a case study is presented to describe how *Y.
pestis* can transform grassland ecosystems by devastating populations of prairie dogs and,
thereby, causing (1) declines in native species abundance and diversity, including
threatened and endangered forms, (2) alterations in food web connections, (3) alterations
in the import/export of nutrients, (4) loss of ecosystem resilience to encroaching invasive
plants, and (5) modifications of prairie dog burrows.

(*Cynomys ludovicianus*) in New Mexico, USA: The Importance of Considering Imperfect
FOREST FRAGMENTATION’S EFFECTS ON HEMOPARASITES IN SMALL MAMMALIAN POPULATIONS FROM PARAGUAY

A.G. Howard, M. Lipman and A. Patel, Rhodes College; N. de la Sancha, Chicago State University; P. Pérez-Estigarribia, Centro Multidisciplinario de Investigaciones Tecnológicas; S. Boyle and L.E. Luque, Rhodes College

Ongoing deforestation in Paraguay’s understudied Interior Atlantic Forest (IAF) threatens this region’s biodiversity. Deforestation and forest fragmentation can negatively impact the health of mammalian populations through elevated stress, immunosuppression, and increased rate of infection, though the disease-inducing variables are still poorly understood. The goal of this study was to examine the extent to which small mammals living in forest fragments were infected with hemoparasites. We surveyed six forest fragments that ranged in area from 2 ha to 1200 ha in the Tapytá Private Reserve, located in the Department of Caazapá, Paraguay. Each forest fragment was sampled for small mammals using a grid system of arboreal and terrestrial snap and Sherman live traps, as well as pitfall traps. We collected blood from the sampled animals, following protocols approved by the Institutional Animal Care and Use Committee (IACUC) at Rhodes College. Samples were taken retro-orbitally or from the heart and liver tissue of terrestrial and arboreal Sigmodontine rodents and Didelphid marsupials found in each fragment. Blood smears were analyzed using standard histological techniques. Parasite infections were first characterized based on morphology and PCR. We collected blood samples from 134 individuals representing the genera *Oligoryzomys* (63.2 % of all small mammals sampled), *Akodon* (28.6 % of individuals sampled), *Gracilinanus* (6.0 % of individuals sampled), and *Marmosa* (2.2 % of individuals sampled). The majority of the small mammals (82.1 % of sampled individuals) were captured terrestrially. To date, 90 % of the sampled mammals show hemoparasitic infections, with representing parasites in the Phyla Helminth [helminths are in several phyla] and *Babesia* spp., along with bacterial infections from *Yersinia* spp. and *Bartonella* spp. Infected small mammals were not limited to the smallest forest fragments, as infected individuals were also from the largest 1200-ha fragment. Additional analyses will allow for the quantification of parasitic loads for each individual vector. Our findings indicate that many of the small mammals in these forest fragments...
are infected with a diverse array of hemoparasites. Findings from this study will help clarify the relationships between hemoparasite infection and forest fragmentation in small mammals, and allow for more-directed conservation management plans.

Abstract #125

DETECTION OF TRYPANOSOMES IN BRITISH BADGERS

E. Ideozu and G. Hide, University of Salford Manchester

The Eurasian Badger (Meles meles) is a popular animal in the UK that is statutorily protected. It has been the subject of intense public health concern resulting from its role as a wildlife reservoir for tuberculosis. Trypanosomes are blood parasites that infect a wide range of hosts, including humans, and have the potential to cause disease in mammals such as badgers perhaps resulting in declining populations. The objectives of this study were to detect trypanosomes in UK badgers using novel molecular biological diagnostic tools. A total of 82 badger blood samples were examined by ITS-PCR using a set of nested primers that targeted the ribosomal RNA gene locus. Twenty-nine of the samples were found to be positive for trypanosomes giving a prevalence of 35.4%. Analysis of ITS sequence data suggested that the badger trypanosomes are closely related to Trypanosoma (Herpetosoma) otospermophili and phylogenetic analysis from this study supports the belonging of T. otospermophili in the Herpetosoma subgenus (NJ and ML tree; 100% bootstrap support). These results show that a significant proportion of UK badgers could be infected with trypanosomes indicating they are susceptible to infection with pathogens. Trypanosome infections in badgers are mediated by transfer of blood by fleas and high prevalence indicates this may be happening frequently. The possibility exists that other important pathogenic diseases, such as tuberculosis, could be transmitted in similar ways. This study could give an insight into the general transmission of infectious diseases in this important wildlife reservoir. Future work is aimed at sequencing other ITS regions.

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The 13th International Congress of Parasitology, Aug. 10 - 15, 2014, at the Camino Real Hotel, Mexico City.

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Intensity of infestation of chewing lice (Phthiraptera) and fleas (Siphonaptera) on poultry (Gallus gallus domesticus) in a region of Southern Mexico.

Cruz-Mendoza, Irene; Figueroa-Castillo, Juan Antonio; Quintero-Martinez, Maria Teresa; Alcalá-Canto Yazmín. Departamento de Parasitología, FMVZ-UNAM04510,
Mexico City.

BACKGROUND: Chewing lice (Phthiraptera, Ischnocera) are economically important poultry ectoparasites that live mainly on the skin. Amblyceran lice may cause irritation of the skin, restlessness, overall weakening, cessation of feeding, loss of weight, reduced laying capacity and skin lesions that may become sites of secondary infection. The fleas (Siphonaptera) are obligate parasites that live, feed and shelter beneath the surface of their host’s epidermis, hair or feathers. The aim of this study was to determine the frequency of ectoparasites in poultry in Oaxaca, Mexico. METHODS: The work was carried out in Oaxaca, Mexico. A total of 45 adult hens, reared in family farms, with makeshift facilities and floor were analyzed. Ectoparasites were collected after slaughter, using a swab with alcohol on the feathers, body, head and feet. The collected parasites were placed in vials with 70% alcohol, and were identified using a progressive number. The number of ectoparasites was estimated, as not all observed parasites were collected. RESULTS: All hens tested positive for ectoparasites. In chickens, four species of chewing lice were identified: *Menopon gallinae* (86%), *Menacanthus stramineus* (88%), *Chelopistes meleagridis* (64%), *Lipeurus caponis* (33%) and three species of fleas, *Echidnophaga gallinacea* (75%), *Ctenocephalides felis* (66 %), *Ctenocephalides canis* (60%). CONCLUSIONS: This is the first study on the frequency and intensity of infestation of lice in chickens of backyard farms located in Oaxaca, Mexico. The most frequent species were *Menacanthus stramineus*, *Menopon gallinae* and *Echidnophaga gallinacea*.

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Eco-epidemiological aspects of rickettsiosis in Brazil

Mafra, Cláudio, Biochemistry and Molecular Biology Department, Federal University of Vicosa, Minas, Gerais State, Brazil. mafra@ufv.br.

In the last thirteen years the number of *Rickettsia* genus organisms described in Brazil increased from just one (*Rickettsia rickettsii*) to seven (*R. rickettsii*, *R. bellii*, *R. parkeri*, *R. amblyommii*, *R. felis*, *R. rhipicephali* and *R. monteiroi*). Others (new?) species are being reported without confirmation yet. Before that, the reports of human clinical cases were very sporadic and rare, with, in the case of Minas Gerais state, a silence period of around 40 years without any register. Actually, many groups in Brazil are investigating wild and domestic animals (potential reservoirs and amplified hosts), tick and fleas vectors, ecological and epidemiological conditions, risk factors and host-parasites interactions, among other questions. On the species reported, it has been observed different levels of pathogenesis and distinct ecological conditions involving several vertebrates (wild and domestic) and invertebrates (ticks and fleas). Anthropogenic actions are very marked and associated to the risk and/or exposure, being it the major epidemiological condition observed in urban or periurban areas in Brazil. *Amblyomma aureolatum*, *A. brasiliensis*, *A. cajennense*, *A. dubitatum*, *A. incisum*, *A. longirostre*,
A.nodosum, A. ovale, A. parkeri, A. triste, Haemaphysalis juxtakochi and Rhipicephalus sanguineus are being described parasiting/involved in sylvatic and/or domestic cycles with birds, capybaras, small rodents, marsupials, dogs and/or horses, among others. Some of these Rickettsia species are, until now, considered as apathogenic or without known pathogenicity, being reported in isolated cases parasiting tick vectors or detected by serological response circulating among vertebrates. Despite that, disregarding the pathogenicity or level of pathogenicity of Rickettsia species, from 2001 when just five states in the Southeast region of the country reported human cases of rickettsiosis, nowadays we have notifications in all geographical regions. In Brazil this event is of obligatory notification, with an integrated web of public reference laboratories giving the support to (new) focus.

Management of ectoparasites: Nature helps to control ectoparasites

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Ectoparasites are plagues for humans and their animals, since not only their bites are painful and may lead to skin irritations but since they many also act as vectors important agents of disease, which may cause lethal outcome. Therefore it is important to minimize transmission of any pathogen by avoiding bites. This can be done by use of repellents and application of safe biocides. Many companies produce pure chemicals for an ectoparasitical use. Although many actually available compounds are very efficacious and safe, they have the disadvantages that parasites may develop resistances and that there are often weeks are needed, until these compounds have left meat and/or milk of treated animals. Therefore we tested different types of plant extracts and their use as repellents against ticks, mites and different insect genera. In addition we tested plant extracts in combination with fine shampoos on their efficacy to suffocate insects and ticks, since suffocation may never lead to resistances. The presentation will show successful approaches of the use of extracts of neem seeds (after complete deoiling), of Vitex agnus castus and of other plants in the fight against head lice, ticks, mites, fleas and mosquitoes, which have been developed, produced and marketed by our university spin-off company (www.alphabiocare.de).

Meeting Announcements

Put It on Your Calendar!

Block out July 11-14, 2015 to participate in the joint meeting of the American Association of Veterinary Parasitologists, the International Symposium on Ectoparasites of Pets, and the Livestock Insect Workers Conference (LIWC-ISEP-AAVP). There is no better venue for reporting research on fleas, ticks, and other ectoparasites, or to gather with colleagues sharing research interests. The three groups will meet together in
Boston, MA, USA, holding their combined conference July 11-14, 2015. Boston’s Paul Revere Hotel will be headquarters for the joint meeting. Deadlines and additional information are posted at [http://www.aavp.org/](http://www.aavp.org/)

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The 46th Annual Conference of SOVE (Society for Vector Ecology) will be held September 27 - October 1, 2015 at the Embassy Suites in Albuquerque, New Mexico. [www sove.org](http://www.sove.org)

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New Book


"A companion to 'Urban Pest Management', this book builds on the issues of insect pests in urban settings to discuss control strategies that look beyond products. From an environmental and health perspective, it is not always practical to spray chemicals indoors or in urban settings, so this work discusses sustainable control and best practice methods for managing insects that are vectors of disease, nuisance pests and the cause of structural damage."


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Featured research


Taxonomic update and geographic distribution of fleas of the genus *Ctenophthalmus* Kolenati 1856 in the Western Palearctic Region (Insecta: Siphonaptera: Ctenophthalmidae). Among fleas (Siphonaptera), the genus *Ctenophthalmus* is the one that comprises the largest number of taxa and is also characterized by a large geographical range. Here, we present a taxonomic revision of the Western Palearctic [Palearctic] subgenera, groups, species and subspecies. We recognized a total of 143 taxa (57 species and 86 subspecies). These taxa are clustered into 23 groups of species, which fall into seven of the 16 subgenera of the genus *Ctenophthalmus*. According to Hopkins
& Rothschild (1966), the subgenus *Ctenophtalmus* would only include the agyrtes group, itself divided into subgroups. We decided to raise these subgroups to group status to clarify taxonomic relationships within the subgenus *Ctenophtalmus*. Within this subgenus, the arvernus group is renamed baeticus, the transmiti group is confirmed, and the egregius group is created. For each taxon, we provided information on geographical distribution, mammalian hosts, and host specificity.

[A new Malagasy flea species of the genus *Tsaractenus*]

A third species of the genus *Tsaractenus* Klein, 1968, endemic to Madagascar, is described: *T. clavator* n. sp. This species is mainly characterized by the chaetotaxy of the telomere and the shape of the phallosome in the male genitalia and, in female, by the presence of an additional tergite VIII’. The host of this new species is the shrew-tenrec *Microgale dobsoni* Thomas, 1884 (Tenrecidae, Oryzorictinae). The phylogenetic relationships of the genus *Tsaractenus* are discussed.


A new species of flea of the genus *Paractenopsyllus*, endemic to Madagascar (Siphonaptera, Ceratophyllidae, Leptopsyllinae). *Paractenopsyllus exspectatus* n. sp., nineteenth species in the genus *Paractenopsyllus* Wagner, 1938, is described. This flea is a parasite on a species of Tenrecidae, *Microgale cowani* Thomas, 1882, endemic to Madagascar, which is relatively small and with a broad distribution across the humid forest formations of the island.


This review defines insecticide/acaricide resistance and describes the history, evolution, types, mechanisms, and detection of resistance as it applies to chemicals currently used against fleas and ticks of dogs and cats and summarizes resistance reported to date. We introduce the concept of refugia as it applies to flea and tick resistance and discuss strategies to minimize the impact and inevitable onset of resistance to newer
classes of insecticides. Our purpose is to provide the veterinary practitioner with information needed to investigate suspected lack of efficacy, respond to lack of efficacy complaints from their clients, and evaluate the relative importance of resistance as they strive to relieve their patients and satisfy their clients when faced with flea and tick infestations that are difficult to resolve. We conclude that causality of suspected lack of insecticide/acaricide efficacy is most likely treatment deficiency, not resistance.


Our understanding of the spectrum, aetiology, diagnosis and management of parasitic diseases in companion animals has changed dramatically throughout the past two decades. Parasitic diseases are an important challenge to the health and welfare of companion animals, as well as the public health worldwide. We cannot completely eliminate the exposure of pets to parasites because parasites have been evolved to co-exist within their host animals over millennia. However, we can reduce the incidence and spread of these parasites via understanding what factors increase parasitic disease risk and via utilising and promoting effective means for treatment and control. Management of any parasitic infection in pets relies on the sensible application of chemotherapeutic drugs to alleviate disease and maintain welfare, and sound hygienic measures to reduce the transmission of parasites. The role for integrated parasite control programmes has grown and will continue to grow as rates of antiparasitic resistance are likely to rise.


Why is it that, despite the proliferation of research on their biology and control, fleas remain such a burden for companion animals and their owners? This review highlights a range of reasons for persistence and apparent treatment failures. It argues that a sustainable approach will require integrated pest management based upon a detailed understanding of the flea life cycle, targeting not only adult fleas but also the immature stages in the environment, combining several modes of control and limiting the risk of chemoresistance. Individual characteristics of the pet and its environment need to be considered. Control of fleas can be achieved, over a timescale of several months, if basic rules are respected.


We studied seven perforated bony dermal scutes of piche (Zaedyus pichiy, [Desmarest 1804]) recovered at the archaeological shell midden called Las Hormigas, on
the northern coast of the province of Santa Cruz (Patagonia, Argentina). Bony dermal scutes have perforations of conical section with an outside diameter of 2.27±0.32 mm and an inner diameter of 3.43±0.96 mm. Studies were conducted to determine if the perforations were made by humans or if instead they were generated by biological agents. An experimental program was carried out; photographs were made by scanning electron microscopy to analyze the surfaces of the holes and the presence of traces; we also compared the archaeological evidence with bony dermal scutes perforated by biological agents (fleas) and with those experimentally perforated with stone tools. We conclude that fleas of the Tunga genus, a parasite of armadillos that creates holes in the bony dermal scutes, would have generated the holes in the archaeological osteoderms, despite being similar macroscopically to others produced by humans.


A new species of Tunga (Siphonaptera: Tungidae) collected from armadillos in Argentina is described. The new species is characterized by large and pigmented eyes, the presence of two bristles on antennal segment II, two bristles at the base of the maxilla, and a discoid neosome compressed anteroposteriorly. The gravid female is located in the carapace of the host, perforating the osteoderms. The new species resembles Tunga penetrans and Tunga terasma in general appearance. However, it differs by the greater anteroposterior compression of the neosome, a more angular head, and a manubrium with a pointed proximal end and convex ventral margin (the proximal end of the manubrium is rounded or slightly pointed in T. terasma, and the ventral margin is straight in both T. penetrans and T. terasma). In addition, specimens of T. penetrans have more bristles in antennal segments II and III, and lack bristles in the posterior tibia. This is the first report of a species of Tunga perforating the osteoderms of its host and thereby showing a high degree of specialization. Tunga terasma is recorded for the first time in Argentina; the male is described again and the characteristics of the species amended. This information may be useful in epidemiological studies of diseases caused by species of Tunga.


The results of the study of fleas (Siphonaptera) collected off small mammals (insectivores and rodents) in the Russian Far East (Magadan Province and Khabarovsk and Kamchatka Territories) are presented. Fourteen flea species were found on 17 species of small mammals.


A two-year study of the diversity and ecology of the macro-invertebrate fauna (Nemata and Arthropoda) of Kartchner Caverns, near Benson, Arizona, USA, was conducted between September 2009 and September 2011. The study expands on the baseline study conducted twenty years earlier, from 1989-1991, which was one of several resource analyses conducted prior to development of Kartchner Caverns as an Arizona State Park. The recent study makes a significant contribution to the understanding of the invertebrate fauna and ecology of Kartchner Caverns and cave macro-invertebrates in the desert region of the southwestern United States and Northern Mexico. The initial study identified 39 macro-invertebrate species associated with the ecology of the cave. The recent study increased this number to 98 species, including 16 species new to science, seven of which are troglobites. Kartchner Caverns is now known to support the most species-rich macro-invertebrate ecology of any cave in Arizona.

"Order Siphonaptera"
Family Ischnopsyllidae  
**Myodopsylla collinsi**?

Larvae of a species of bat flea were found on the Maternity Roost guano pile in August of both 2010 and 2011. No adults were found, and the larvae have not been positively identified to species. However, of the 11 species of bat fleas recorded from North America, only *Myodopsylla collinsi* has been recorded from the cave myotis, including several records from Arizona (Jameson 1959; Bradshaw and Ross 1961; Ubelaker 1966; Whitaker and Easterla 1975; Reisen et al. 1976; Lewis and Lewis 1994). We suspect that the larvae are probably this species.

"Family Pulicidae  
Undet. genus and sp.

A variety of species of fleas are common in caves, typically near entrances, where they are associated with mammals that inhabit these areas. This species was observed only once as a couple of individuals that climbed onto two of us in the Crinoid Room. Only one individual was captured. We assume that it is a parasite on one or more of the mammals that are present in the entrance area of the cave. Potential hosts include ringtail, rock squirrel, white-throated wood rat, kangaroo rat (*Dipodomys* sp.), mice, and gray fox (*Urocyon cinereoargenteus* Schreber, 1775)."


An ecological study of the microarthropod communities from Las Sardinas cave was undertaken. Four different biotopes were studied over the course of a year: bat guano, litter, soil under the chemosynthetic bacteria colonies and as a control, plain soil without litter or guano. A total of 27,913 specimens of a total of 169 species were collected. Analysis of Variance (ANOVA) showed that there is a significant effect of biotope on the recorded density, and the post hoc Tukey’s test showed that guano is the most different biotope with the highest value of density recorded. The interaction between season and biotope variables was not significant. In the most extreme case, 99 percent of the microarthropods in soil under chemosynthetic bacteria were mites, mainly in the family Histiostomidae.

[A bat cave with no bat fleas. Why? -Editor]


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Ellis Parker Butler, American short-story writer (1869 – 1937), is best known for his story, "Pigs is Pigs", about the troubles a certain Mike Flannery had with pigs. The story is thought to have influenced the episode "The Trouble with Tribbles" (David Gerrold, 1967) in the science-fiction television-series "Star Trek". Our story (1909), which is Chapter 3 of "Mike Flannery On Duty and Off" (New York Doubleday, Page & Company, MCMIX), and which also features the redoubtable Flannery and Mrs. Muldoon, involves as well, we are happy to point out, fleas. - The Editors

FLEAS WILL BE FLEAS
by Ellis Parker Butler

Mike Flannery was the star boarder at Mrs. Muldoon's, and he deserved to be so considered, for he had boarded with Mrs. Muldoon for years, and was the agent of the Interurban Express Company at Westcote, while Mrs. Muldoon's other boarders were largely transient.

"Mike," said Mrs. Muldoon, one noon, when Mike came for his lunch, "I know th' opinion ye have of Dagos, and niver a-one have I took into me house, and I think the same of thim meself—dirthy things, an' takin' the bread away from th' honest American laborin' man—and I would not be thinkin' of takin' one t' board at this day, but would ye tell me this:—is a Frinchmin a Dago?"

Flannery raised his knife and laid down the law with it.

"Mrs. Muldoon, mam," he said, "there be two kinds of Frinchmin. There be the respictible Frinchmin, and there be th' unrespictible Frinchmin. They both be furriners, but they be classed different. Th' respictible Frinchmin is no worse than th' Dutch, and is classed as Dutch, but th' other kind is Dagos. There is no harm in th' Dutch Frinchmin, for thim is such as Napoleon Bonnypart and the like of him, but ye want t' have nawthin' t' do with th' Dago Frinch. They be a bad lot."

"There was a Frinchmin askin' would I give him a room and board, this mornin'," said Mrs. Muldoon.

Flannery nodded knowingly.

"I knowed it!" he cried. "T was apparent t' me th' minute ye spoke, mam. And agin th' Dutch Frinch I have nawthin' t' say. If he be a Dutch Frinchmin let him come."
Was he that?"

"Sure, I don't know," said Mrs. Muldoon, perplexed. "He was a pleasant-spoken man, enough. 'T is a professor he is."

"There be many kinds of professors," said Mike.

"Sure!" agreed Mrs. Muldoon. "This wan is a professor of fleas."

Mike Flannery grinned silently at his plate.

"I have heard of thim, too!" he said. "But 'tis of insects they be professors, and not of one kind of insects alone, Mrs. Muldoon, mam. Ye have mistook th' understandin' of what he was sayin'."

"I beg pardon to ye, Mr. Flannery," said Mrs. Muldoon, with some spirit, "but 'tis not mistook I am. Fleas th' professor said, and no mistake at all."

"Yis?" inquired Flannery. "Well, mebby 'tis so. He would be what ye call one of thim specialists. They do be doin' that now, I hear, and 'tis probable th' Frinchmin has fleas for his specialty. 'Tis like this, mam:—all professors is professors; then a bunch of professors separate off from the rest and be professors of insects; and then the professors of insects separate up, and one is professor of flies, and another one is professor of pinch-bugs, and another is professor of toads, and another is professor of lobsters, and so on until all the kinds of insects has each a professor to itself. And thim they call specialists, and each one knows more about his own kind of insect than any other man in th' world knows. So mebbe the Frinchmin is professor of fleas, as ye say."

"I should think a grown man would want to be professor of something bigger than that," said Mrs. Muldoon, "but there's no accountin' for tastes."

"If ye understood, mam," said Mike Flannery, "ye would not say that same, for to the flea professor th' flea is as big as a house. He studies him throo a telescope, Mrs. Muldoon, that magnifies th' flea a million times. Th' flea professor will take a dog with a flea on him, mam, and look at th' same with his telescope, and th' flea will be ten times th' size of th' dog."

"'Tis wonderful!" exclaimed Mrs. Muldoon.

"It is so!" agreed Mike Flannery. "But 't is by magnifyin' th' flea that th' professor is able t' study so small an insect for years and years, discoverin' new beauties every day. One day he will be studyin' th' small toe of th' flea's left hind foot, and th' next day he will be makin' a map of it, and th' next he will be takin' a statute of it in plaster, an th' next he will be photygraftin it, and th' next he will be writin' out all he has learned of it, and then
he will be weeks and months correspondin' with other flea professors in all parts of th' worrld, seein' how what he has learned about th' little toe of th' flea's left hind foot agrees with what they have learned about it, and if they don't all agree, he goes at it agin, and does it all over agin, and mebby he dies when he is ninety years old and has only got one leg of th' flea studied out. And then some other professor goes on where he left off, and takes up the next leg."

"And do they get paid for it?" asked Mrs. Muldoon, with surprise.

"Sure, they do!" said Flannery. "Good money, too. A good specialist professor gits more than an ixpriss agent. And 't is right they sh'u'd," he added generously, "for 't is by studyin' th' feet of fleas, and such, they learn about germs, and how t' take out your appendix, and 'Is marriage a failure?' and all that."

"Ye dumbfounder me, Mike Flannery," said Mrs. Muldoon. "Ye should have been one of them professors yourself, what with all the knowledge ye have. And ye think 't would be a good thing t' let th' little Frinchmin come and take a room?"

"'T would be an honour to shake him by th' hand," said Mike Flannery, and so the professor was admitted to the board and lodging of Mrs. Muldoon.

The name of the professor who, after a short and unfruitful season at Coney Island, took lodging with Mrs. Muldoon, was Jocolino. He had shown his educated fleas in all the provinces of France, and in Paris itself, but he made a mistake when he brought them to America.

The professor was a small man, and not talkative. He was, if anything, inclined to be silently moody, for luck was against him. He put his baggage in the small bedroom that Mrs. Muldoon allotted to him, and much of the time he spent in New York. He had fellow countrymen there, and he was trying to raise a loan, with which to buy a canvas booth in which to show his educated insects. He received the friendly advances of Flannery and the other boarders rather coldly. He refused to discuss his specialty, or show Mike the toe of the left hind foot of a flea through a telescope. When he remained at home after dinner he did not sit with the other boarders on the porch, but walked up and down the walk, smoking innumerable cigarettes, and thinking, and waving his hands in mute conversations with himself.

"I dunno what ails th' professor," said Mrs. Muldoon, one evening when she and Flannery sat at the table after the rest had left it.

Flannery hesitated.

"I would not like to say for sure, mam," he said, slowly, "but I'm thinkin' 't is a loss he has had, maybe, that's preyin' on his mind. Ever since ye told me, Missus
Muldoon, that he was a professor of th' educated fleas, I have had doubts of th' state of th' mind of th' professor. Th' sense of studyin' th' flea, mam, I can understand, that bein' th' way all professors does these days, but 't is not human t' spend time givin' a flea a college education. Th' man that descinds t' be tutor t' a flea, and t' teach it all th' accomplishments, from readin' and writin' arithmetic and football, mebby, is peculiar. I will say he is dang peculiar, Missus Muldoon, beggin' your pardon. Is there any coffee left in the pot, mam?"

"A bit, Mr. Flannery, an' you 're welcome t' it."

"I understand th' feelin' that makes a man educate a horse, like that Dutchman I was readin' about in th' Sunday paper th' other day," said Mike, "and teachin' it t' read an' figger, an' all that. An' I can see th' sinse of educatin' a pig, as has been done, as you well know, mam, for there be no doubt a man can love a horse or a pig as well as he can love his own wife—"

"An' why not a flea?" asked Mrs. Muldoon. "It is natural for an Irishman t' love a pig, if 't is a pig worth lovin', and 't is natural, I make no doubt, for a Dutchman t' love a horse th' same way, and each t' his own, as th' sayin' is. Mebby th' Frinch can learn t' love th' flea in th' same way, Mr. Flannery."

"I say th' same, Missus Muldoon," said Flannery, "an' I say th' professor has done that same, too. I say he has educated th' flea, an' mebby raised it from a baby, and brung it from his native land, mam, an' taught it, an' learned t' love it. Yes, Missus Muldoon! But if th' educated horse or th' educated pig got loose would they be easy t' find agin, or would they not, mam? And if th' professor come t' have a grand love for th' flea he has raised by hand, an' taught like his own son, an' th' flea run off from him, would th' educated flea be easy t' find? Th' horse an' th' pig is animals that is not easy t' conceal themselves, Missus Muldoon, but th' flea is harrd t' find, an' when ye have found him he is harrd t' put your thumb on. I'm thinkin' th' reason th' professor is so down is that he has lost th' flea of his heart."

"Poor man!" said Mrs. Muldoon.

"An' th' reason I'm thinkin' so," said Flannery slowly, and leaning toward Mrs. Muldoon across the table, "is that, if I be not mistaken, Missus Muldoon, th' professor's educated flea spent last night with Mike Flannery!"

Mrs. Muldoon raised her hands with a gesture of wonderment.

"And listen to that, now!" she cried, in astonishment. "Mike Flannery, do you be thinkin' th' professor has two of them? Sure, and he must have two of them, for was it not mesilf was thinkin' all last night I had th' same educated flea for a bed-felly? I would have caught him," she added, sadly, "but he was too brisk for me."
"There was forty-sivin times I thought I had mine," admitted Flannery, "but every time whin I took up me thumb he had gone some other place. But I will have him to-night!"

"But mebby he has gone by now," said Mrs. Muldoon.

"Never fear, mam," said Flannery. "He's not gone, mam, for he has been close to me every minute of th' day. I could put me thumb on him this minute, if he would but wait 'till I did it."

"Well, as for that, Mike Flannery," said Mrs. Muldoon, mischievously, as she arose from the table, "go on along with ye, and don't be bringin' th' blush t' me face, but whin I want t' find th' one I was speakin' of, I won't have t' walk away from meself t' find him this minute!"

The trained flea is one of nature's marvels. Everyone says so. A Bobby Burns might well write a poem on this "wee, timorous, cowerin' beastie," except that the flea is not, strictly speaking, timorous or cowering. A flea, when it is in good health and spirits, will not cower worth a cent. It has ten times the bravery of a lion—in fact, one single little flea, alone and unaided, will step right up and attack the noisiest lion, and never brag about it. A lion is a rank coward in comparison with a flea, for a lion will not attack anything that it has not a good chance of killing, while the humble but daring flea will boldly attack animals it cannot kill, and that it knows it cannot kill. David had at least a chance to kill Goliath, but what chance has a flea to kill a camel? None at all unless the camel commits suicide. And dogs! A flea will attack the most ferocious dog and think nothing of it at all. I have seen it myself. That is true bravery. And not only that—not only will one flea attack a dog—but hundreds of fleas will attack the same dog at the same time. I have seen that myself, too. And that multiplies the bravery of the flea just that much. One flea attacking a dog is brave; one hundred fleas attacking the same dog are therefore one hundred times as brave. We really had to give the dog away, he was carrying so much bravery around with him all the time.

Think of educating an animal with a brain about the size of the point of a fine needle! And that was what Professor Jocolino had done. The flea is really one of nature's wonders, like Niagara Falls, and Jojo the dog-faced man, and the Cañon of the Colorado. Pull? For its size the educated flea can pull ten times as much as the strongest horse. Jump? For its size the flea can jump forty times as far as the most agile jack-rabbit. Its hide is tougher than the hide of a rhinoceros, too. Imagine a rhinoceros standing in Madison Square, in the City of New York, and suppose you have crept up to it, and are going to pat it, and your hand is within one foot of the rhinoceros. And before you can bring your hand to touch the beast suppose it makes a leap, and goes darting through the air so rapidly that you can't see it go, and that before your hand has fallen to where the rhinoceros was, the rhinoceros has alighted gently on top of the City Hall at Philadelphia. That will give you some idea of the magnificent qualities of the flea. If we only knew
more of these ordinary facts about things we would love things more.

At the breakfast table the next morning Professor Jocolino sat silent and moody in his place, his head, bent over his breakfast, but the nine other men at the table eyed him suspiciously. So did Mrs. Muldoon. There was no question now that Professor Jocolino had lost his educated flea. There was, in fact, ground for the belief that the professor had had more than one educated flea, and that he had lost all of them. There was also a belief that, however well trained the lost might be in some ways, their manners had not been carefully attended to, and that they had not been trained to be well behaved when making visits to utter strangers. A beast or bird that will force itself upon the hospitality of an utter stranger unasked, and then bite its host, may be well educated, but it is not polite. The boarders looked at Professor Jocolino and frowned. The professor looked stolidly at his plate, and ate hurriedly, and left the table before the others had finished.

"'T is in me mind," said Flannery, when the professor had left, "that th' professor has a whole college of thim educated insects, an' that he do be lettin' thim have a vacation. Or mebby th' class of 1907 is graduated an' turned loose from th' university. I had th' base-ball team an' th' football gang spendin' th' night with me."

"Ho!" said Hogan, gruffly, "'t was th' fellys that does th' high jump an' th' long jump an' th' wide jump was havin' a meet on Hogan. An' I will be one of any ten of us t' tell th' professor t' call th' scholards back t' school agin. I be but a plain uneducated man, Missus Muldoon, an' I have no wish t' speak disrespect of thim as is educated, but th' conversation of a gang of Frinch educated fleas is annoyin' t' a man that wants t' sleep."

"I will speak t' th' professor, gentlemin," said Mrs. Muldoon, "an' remonstrate with him. Mary, me girrl," she added, to the maid, who was passing her chair, "would ye mind givin' me th' least bit of a rub between me shoulders like? I will speak t' th' professor, for I have no doubt he has but t' say th' worrd t' his scholards, an' they will all run back where they belong."

But the professor did not come back that day. He must have had urgent business in New York, for he remained there all night, and all the next day, too, and if he had not paid his bill in advance, Mrs. Muldoon would have suspected that he had run away. But his bill was paid, and his luggage was still in the room, and the educated fleas, or their numerous offspring, explored the boarding-house at will, and romped through all the rooms as if they owned them. If Professor Jocolino had been there he would have had to listen to some forcible remonstrances. It was Flannery who at length took the law into his own hands.

It was late Sunday evening. The upper hall was dark, and Flannery stole softly down the hall in his socks and pushed open the professor's door. The room was quite dark, and Flannery stole into it and closed the door behind himself. He drew from his pocket an insect-powder gun, and fired it. It was an instrument something like a bellows,
and it fired by a simple squeeze, sending a shower of powder that fell in all directions. It was a light, yellow powder, and Flannery deluged the room with it. He stole stealthily about, shooting the curtains, shooting the bed, shooting the picture of the late Mr. Timothy Muldoon, shooting the floor. He bent down and shot under the bed, and under the washstand, until a film of yellow dust lay over the whole room, and then he turned to the closet and opened that. There hung Professor Jocolino's other clothes, and Flannery jerked them from the hooks and carried them at arm's length to the bed, and shot them.

As he was shooting into the pocket of a pair of striped trousers the door opened and Professor Jocolino stood on the threshold. There was no doubt in the professor's mind. He was being robbed! He drew a pistol from his pocket and fired. The bullet whizzed over the bending Flannery's head, and before the professor could fire a second time Flannery rose and turned and, with a true aim, shot the professor!

Shot him full in the face with the insect powder, and before the blinded man could recover his breath or spit out the bitter dose, or wipe his eyes, Flannery had him by the collar and had jerked him to the head of the stairs. It is true; he kicked him downstairs. Not insultingly, or with bad feeling, but in a moment of emotional insanity, as the defense would say. This was an extenuating circumstance, and excuses Flannery, but the professor, being a foreigner, could not see the fine point of the distinction, and was angry.

That night the professor did not sleep in Westcote, but the next afternoon he appeared at Mrs. Muldoon's, supported by Monsieur Jules, the well-known Seventh Avenue restaurateur, and Monsieur Renaud, who occupies an important post as garçon in Monsieur Jules' establishment.

"For the keek," said the professor, "I care not. I have been keek before. The keek by one gentleman, him I resent, him I revenge; the keek by the base, him I scorn! I let the keek go, Madame Muldoon. Of the keek I say not at all, but the flea! Ah, the poor flea! Excuse the weep, Madame Muldoon!"

The professor wept into his handkerchief, and the two men looked seriously solemn, and patted the professor on the back.

"Ah, my Alphonse, the flea! The poor leettle flea!" they cried.

"For the flea I have the revenge!" cried the professor, fiercely. "How you say it? I will be to have the revenge. I would to be the revenge having. The revenge to having will I be. Him will I have, that revenge business! For why I bring the educate flea to those States United? Is it that they should be deathed? Is it that a Flannery should make them dead with a—with such a thing like a pop-gun? Is it for these things I educate, I teach, I culture, I love, I cherish those flea? Is it for these things I give up wife, and patrie, and immigrate myself out of dear France? No, my Jules! No, my Jacques! No, my madame! Ah, I am one heart-busted!"
"Ah, now, professor," said Mrs. Muldoon, soothingly, "don't bawl anymore. There is sure no use bawlin' over spilt milk. If they be dead, they be dead. I wouldn't cry over a million dead fleas."

"The American flea—no!" said the professor, haughtily. "The Irish flea—no! The flea au naturel—no! But the educate flea of la belle France? The flea I have love, and teach, and make like a sister, a sweetheart to me? The flea that have act up in front of the crowned heads of Spain; that have travel on the ocean; that travel on the land? Ah, Madame Muldoon, it is no common bunch of flea! Of my busted feelings what will I say? Nothings! Of my banged-up heart, what will I say? Nothings! But for those dead flea, those poor dead flea, so innocents, so harmless, so much money worth—for those must Monsieur Flannery compensate."

As the professor's meaning dawned on Mrs. Muldoon a look of amazement spread over her face.

"And would ye be makin' poor Mike Flannery pay good money for thim rascal fleas he kilt, and him with his ankles so bit up they look like the small-pox, to say nothin' of other folks which is th' same?" she cried. "'Tis ashamed ye should be, Mister Professor, bringin' fleas into America and lettin' them run loose! Ye should muzzle thim, Mister Professor, if ye would turn thim out to pasture in the boardin'-house of a poor widdy woman, and no end of trouble, and worry, and every one sayin', 'Why did ye let th' Dago come for, anyhow?''

The professor and his friends sat silent under this attack, and when it was finished they arose.

"Be so kind," said the professor, politely, "to tell the Flannery the ultimatum of Monsieur the Professor Jocolino. One hundred educate French flea have I bring to the States United. Of the progeny I do not say. One milliard, two milliard, how many is those progeny I do not know, but of him I speak not. Let him go. I make the Flannery a present of those progeny. But for those one hundred fine educate French flea must he pay. One dollar per each educate flea must he pay, that Flannery! It is the ultimatum! I come Sunday at past-half one on the clock. That Flannery will the money ready have, or the law will be on him. It is sufficient!"

The three compatriots bowed low, and went away. For fully five minutes Mrs. Muldoon sat in a sort of stupor, and then she arose and went about her work. After all it was Flannery's business, and none of hers, but she wished the men had gone to Flannery, instead of delegating her to tell him.

"Thief of th' worrld!" exclaimed Flannery, when she told him the demand the professor had made. "Sure, I have put me foot in it this time, Missus Muldoon, for kill
thim I did, and pay for thim I must, I dare say, but 't will be no fun t' do it! One hundred dollars for fleas, mam! Did ever an Irishman pay the like before? One week ago Mike Flannery would not have give one dollar for all the fleas in th' worl'd. But 'Have to' is a horse a man must ride, whether he wants to or no."

But the more Flannery thought about having to pay out one hundred dollars for one hundred dead insects the less he liked it and the more angry he became. It could not be denied that one dollar was a reasonable price for a flea that had had a good education. A man could hardly be expected to take a raw country flea, as you might say, and educate it, and give it graces and teach it dancing and all the accomplishments for less than a dollar. But one hundred dollars was a lot of money, too. If it had been a matter of one flea Flannery would not have worried, but to pay out one hundred dollars in a lump for flea-slaughter, hurt his feelings. He did not believe the fleas were worth the price, and he inquired diligently, seeking to learn the market value of educated fleas. There did not seem to be any market value. One thing only he learned, and that was that the government of the United States, in Congress assembled, had recognized that insects have a value, for he found in the list of customs duties this:—"Insects, not crude, 1/4 cent per pound and 10 per cent. ad valorem."

As Flannery leaned over his counter at the office of the Interurban Express Company and spelled this out in the book of customs duties he frowned, but as he looked at it his frown changed to a smile, and from a smile to a grin, and he shut the book, and put it in his pocket. He was ready to meet the professor.

"Good day to yez," he said, cheerfully, when he went into the little parlor on Sunday afternoon, and found the professor sitting there, flanked by his two fellow countrymen. "I have come t' pay ye th' hunderd dollars Missus Muldoon was tellin' me about."

The professor bowed and said nothing. The two gentlemen from Seventh Avenue also bowed, and they, too, said nothing.

"I'm glad ye spoke about it," said Flannery, good-naturedly, "for 'tis always a pleasure to Mike Flannery to pay his honest debts, and I might not have thought of it if ye had not mentioned it. I was thinkin' them was nawthin' but common, ignorant fleas, professor."

"Ah, no!" cried the professor. "The very educate flea! The flea of wisdom! The very teached flea!"

"Hear that, now!" said Flannery, "and did they really come all th' way from France, professor? Or is this a joke ye are playin' on me?"

"The truly French flea!" explained the professor. "From Paris herselfs. The
"And to think ye brought thim all th' way yerself, professor! For ye did, I believe?"

"Certain!" cried all three.

"An' t' think of a flea bein' worth a dollar!" said Flannery. "Thim can't be crude fleas at such a price, professor."

"No! Certain, no!" cried the three men again.

"Not crude," said Flannery, "and imported by th' professor! 'T is odd I should have seen a reference t' them very things this very day, professor. 'T is in this book here." He took the list of customs duties from his pocket and leaned his elbows on his knees, and ran his hand down the pages.

"Cattle, if less than one year old, per head, two dollars. All other, if valued less than $14 per head, $3.75; if valued more than $14 per head, twenty-five and one half per cent.," read Flannery. "Sure, fleas does not count as cattle, professor. Nor does they come in as swine, th' duty on which is one dollar an' fifty cints per head. I know th' pig, an' I am acquainted with th' flea, an' there is a difference between them that anybody would recognize. Nor do they be 'Horses an' Mules' nor yet 'Sheep,' Some might count them in as 'All other live animals not otherwise specified, twenty per cent.,' but 't was not there I saw reference t' thim. 'Fish,'" he read, "'th' flea is no more fish than I am—" He turned the pages, and continued down through that wonderful list that embraces everything known to man. The three Frenchmen sat on the edges of their chairs, watching him eagerly.

"Ho, ho!" Flannery sang out at length. "Here it is! 'Insects, not crude, one quarter cent per pound and tin per cint. ad valorum.' What is ad valorum, I dunno, but 't is a wonderful thing th' tariff is. Who would be thinkin' tin years ago that Professor Jocolino would be comin' t' Ameriky with one hundred fleas, not crude, in his dress-suit portmanteau? But th' Congress was th' boy t' think of everything. 'No free fleas!' says they. 'Look at th' poor American flea, crude an' uneducated, an' see th' struggle it has, competin' with th' flea of Europe, Asia, an' Africa. Down with th' furrin flea,' says Congress, 'protect th' poor American insect. One quarter cent per pound an' tin per cint. ad valorum for th' flea of Europe!"

Mike Flannery brought his hand down on the book he held, and the three men, who had been watching him with a fascinated stare, jumped nervously.

"That's what Congress says," said Flannery, glaring at the professor, "but up jumps th' Senator from Californy. 'Stop!' he says, 'wait! 'T is all right enough for th' East t' rule out th' flea, but th' Californian loves th' flea like a brother. We want free fleas.' Then
up jumps th' Senator from New York. 'I don't object t' th' plain or crude flea comin' in free,' says he, 'for there be need of thim, as me frind from th' West says. What amusement would th' dogs of th' nation have but for th' flea?' says he. 'But I am thinkin' of th' sivinty-three theaters on an' off Broadway,' says he. 'Shall th' amusement industry of th' metropolis suffer from th' incoming of th' millions of educated an' trained fleas of Europe? Shall Shakespere an' Belasco an' Shaw be put out of business by th' pauper flea theaters of Europe? No!' says he. 'I move t' amend th' tariff of th' United States t' read that th' duty on insects, not crude, be one fourth of a cent per pound an' tin per cint. ad valorum,' he says, 'which will give th' dog all th' crude fleas he wants, an' yit shut out th' educated flea from compytition with grand opera an' Barnum's circus.' An' so 'twas voted," concluded Mike Flannery.

Monsieur Jules fidgeted and looked at his watch.

"Be easy," said Flannery. "There's no hurry. I'm waitin' for a frind of mine, an' 't is fine t' talk over th' tariff with educated min once in a while. Th' frind I'm lookin' for anny minute now is a fine expert on th' subject of th' tariff himself. O'Halloran is th' name of him. Him as is th' second deputy assistant collector of evidence of fraud an' smugglin' in th' revenue service of th' United States. 'T was a mere matter of doubt in me mind," said Flannery, easily, "regardin' th' proper valuation of th' professor's fleas. I was thinkin' mebby one dollar was not enough t' pay for a flea, not crude, so I asks O'Halloran. 'T will be easy t' settle that,' says O'Halloran, 'for th' value of thim will be set down in th' books of th' United States, at th' time whin th' professor paid th' duty on thim. I'll just look an' see how much th' duty was paid on,' says he. 'But mebby th' professor paid no duty on thim,' I says. 'Make no doubt of that,' says O'Halloran, 'for unless th' professor was a fool he would pay th' duty like a man, for th' penalty is fine an' imprisonmint,' says O'Halloran, 'an' I make no doubt he paid it. I will be out Sunday at four,' says O'Halloran, 'an' give ye th' facts, an' I hope th' duty is paid as it should be, for if 't is not paid 't will be me duty t' arrest th' professor an'—""

Flannery stopped and listened.

"Is that th' train from th' city I hear?" he said. "O'Halloran will sure be on it."

The professor arose, and so did the two friends who had come with him to help him carry home the one hundred dollars. The professor slapped himself on the pockets, looked in his hat, and slapped himself on the pockets again.

"Mon Dieu!" he exclaimed, and in an instant he and his friends were in an excited conversation that went at the rate of three hundred words a minute. Then the professor turned to Flannery.

"I return," he said. "I have lost the most valued thing, the picture of the dear mamma. It is lost! It is picked of the pocket! Villains! I go to the police. I return."
He did not wait for permission, but went, and that was the last Mike Flannery or Mrs. Muldoon ever saw of him.

"An' t' think of me a free trader every day of me born life," said Mike Flannery that evening to Mrs. Muldoon, "but I be so no more. I see th' protection there is in th' protective tariff, Missus Muldoon, mam."

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On the next page

"The Five Senses: Touch" (1636), by Dirck Hals (1591-1656, Haarlem and Leiden, The Netherlands), 12x12cm, oil on panel, Mauritshuis, The Hague. In his series of oil paintings portraying the five senses.
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(Continued from Flea News 74)


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